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ARGININE/CITRULLINE CYCLE CHANGES IN DIET-INDUCED RAT MODEL OF NON-ALCOHOLIC FATTY LIVER DISEASE

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ABSTRACT

The aim: to study the Arginine / Citrulline-cycle features on a diet-induced rat model of non-alcoholic fatty liver disease (NAFLD).

Materials and methods: The studies were carried out on 20 white non-linear adult rats, including 10 (50%) males, 10 (50%) females, weighing 160-220 g. NAFLD was modeled by a 9-week fast food diet. The level of arginine and citrulline, and the arginase activity were investigated in the animals' liver homogenates and in the blood. The morphological analysis of liver tissues changes was done.

Results: NAFLD modeling using a 9-week fast food diet resulted in maximum weight gain in male rats ($p < 0.05$). Female rats had 3 times more accumulation of intra-abdominal fat than male rats in the main group ($p < 0.05$). Histopathologic liver examination confirmed NAFLD development in rats on a fast food diet during 9 weeks ($p < 0.05$). NAFLD led to an increment of arginine level in the blood and liver homogenate in the main group compared to controls ($p < 0.05$). NAFLD development was accompanied by a decrease in arginase activity and citrulline level in the blood and liver homogenate compared to control ($p < 0.05$).

Conclusions: The experimental rat model of NAFLD showed the Arginine / Citrulline cycle disorders, that were characterized by an increased arginine level, a decreased arginase activity and citrulline concentration in the blood and liver tissues.

KEY WORDS: non-alcoholic fatty liver disease, arginine, arginase, citrulline

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INTRODUCTION

Non-alcoholic fatty liver disease (NAFLD) is one of the most pressing medical and social problems, due to its high prevalence worldwide, especially in economically developed countries [1, 2]. NAFLD includes a range of diseases from liver steatosis and non-alcoholic steatohepatitis (NASH) to cirrhosis and hepatocellular carcinoma. Nowadays, the leading mechanisms of lipid accumulation in hepatocytes, the role of oxidative stress and mitochondrial dysfunction in the NASH progression, the development of liver fibrosis and cirrhosis have been identified [1, 3, 4].

The arginine amino acid has a variety of biosynthetic functions due to its participation in protein synthesis, urea cycle, synthesis of polyamines, creatine and nitric oxide (NO) [5, 6, 7, 8]. In terms of the pathogenesis of obesity, metabolic syndrome, as well as the mechanisms of NASH development, the reaction of arginine conversion to NO and citrulline catalyzed by the NO-synthase (NOS) system, and the reaction of arginine metabolism into ornithine with the arginase participation, are of particular importance [9]. Citrulline is an amino acid precursor to arginine. At the same time, the citrulline can itself be converted to arginine, closing the Citrulline / NO-cycle or Arginine / Citrulline-cycle. The processes of arginine conversion are competitively affected by NOS and arginase systems [5, 7, 10, 11, 12, 13]. Arginase is a regulatory enzyme that determines the arginine bioavailability for NO, polyamines,

agmatine, proline, and glutamate synthesis [7, 14, 15]. Experimental studies have shown that arginase deficiency contributes to the NASH development against a high-calorie diet [15]. From this point of view, the Arginine / Citrulline cycle may be very important in the study of the main mechanisms of NAFLD.

THE AIM

The aim – to study the Arginine / Citrulline-cycle features on a diet-induced rat model of NAFLD.

MATERIALS AND METHODS

The studies were carried out on 20 white non-linear adult rats, including 10 (50%) males, 10 (50%) females, weighing 160-220 g. All experimental animals were divided into two series of experiments. The first series of experiments included 10 rats (5 males and 5 females) with NAFLD modeling. The second series – included 10 intact animals (5 males and 5 females) that made up the control group. The experimental animals were divided into two groups:

I (n=10) – main group, with NAFLD modeling;

II (n=10) – control group, fed with a standard vivarium diet;

Additionally, experimental animals were divided into subgroups according to gender: subgroup A – males; subgroup B – females.

Table I. Anthropometric indices of rats after 9 week NAFLD modeling, (M±m)

Studied groups	Weight, g	Height, cm	BMI, kg/m ²	VF, g
I-A (n=5)	275.2±3.86	22.9±0.36	5.38±0.15	3.07±0.02
p	p ₁ =0.0003 p ₃ =0.0001	p ₁ >0.05 p ₃ >0.05	p ₁ =0.0004 p ₃ >0.05	p ₃ =0.0095
I-B (n=5)	217.8±6.86	21.1±0.29	5.03±0.11	9.25±1.32
p	p ₂ =0.01	p ₂ >0.05	p ₂ =0.0002	-
II-A (n=5)	216.6±6.82	22.8±0.37	4.1±0.09	-
p	p ₂ >0.05 p ₄ =0.01	p ₂ >0.05 p ₄ >0.05	p ₂ >0.05 p ₄ >0.05	-
II-B (n=5)	186.2±5.93	21.3±0.37	4.08±0.09	-

Notes: VF –visceral fat,

p₁ – significant difference between indicators in I-A and II-A subgroups;

p₂ – significant difference between I-B and II-B subgroups;

p₃ – significant difference between I-A and I-B subgroups;

p₄ – significant difference between II-A and II-B subgroups.

The experiment lasted for 9 weeks. The control group rats received the standard vivarium diet throughout the observation period, which included the following components based on 1 animal per day: granulated feed concentrate 0.04 kg, fat-free cheese 0.006 kg, carrots 0.02 kg, cabbage 0.015 kg. The energy value of the standard diet was 93.1 kcal.

NAFLD was modeled in rats by fast food, using a high-fat diet and 4% aqueous fructose solution. Vegetables were excluded from the standard diet. A high-calorie diet was used, which, per animal, included a granulated feed concentrate 0.04 kg (calorie content 19.6 kcal per 0.01 kg), butter 72.5% 0.01 kg (calorie content 66.2 kcal per 0.01 kg), refined sunflower oil 0.01 kg (calorie content 89.9 kcal per 0.01 kg), palm oil 0.01 kg (calorie content 89.9 kcal per 0.01 kg). The energy value of the diet for NAFLD modeling was 324.4 kcal. A 4% aqueous fructose solution was used as the sole source of fluid for rats. The experimental animals were weighed 10 times: before being included in the experiment and once a week (every Tuesday) throughout the observation period. Weight and height of the animals were measured, and the body mass index (BMI) was calculated using the following formula: BMI = weight (kg) / height (m²).

Decapitation of rats was performed under thiopental anesthesia after 9 weeks of observation. The visceral fat mass was evaluated. These indicators were compared between the main and control groups regarding to gender characteristics. 10% liver homogenate was prepared. The blood sampling was performed. The levels of arginine, citrulline, and arginase activity in the liver homogenate and blood were determined in tested animals. Liver morphological changes were examined by light microscopy by analyzing paraffin blocks sections stained with hematoxylin-eosin.

Statistical processing of research results was conducted using statistical software GraphPad Prism version 5.00 (GraphPad Software, Inc., San Diego, CA, USA), which allows parametric and non-parametric statistical analysis. With the normal data distribution, the results were presented as arithmetic means (M) and their errors (m).

The significance was determined by Student's t-test. Non normal distributions, paired nonparametric Wilcoxon and Mann-Whitney rank tests were used. The correlation was evaluated using the Spearman's correlation coefficient. P<0.05 was considered significant.

RESULTS

At baseline the weight in the comparison groups of males and females did not differ significantly (p>0.05). Rats' weight in subgroup I-A was 212.8±8.5 g, in subgroup I-B – 183.1±6.7 g, in subgroup II-A – 193.8±7.2 g, in subgroup II-B – 170.8±2.5 g. After NAFLD modeling using fast food diet in males in subgroup I-A weight gain was 62.3±5.4 g, in females in subgroup I-B – 29.3±5.9 g. In rats of the control group, fed with standard vivarium diet, in subgroup II-A weight gain was 19.2±7.1 g, in subgroup II-B – 14.8±4.7 g. Thus, in subgroup I-A weight gain 3.2 times exceeded this indicator in subgroup II-A (p<0.05). The weight of rats in subgroup I-A was 1.3 times greater than in subgroup II-A (p<0.05) (Tab. I).

Weight gain in subgroup I-B was 2 times greater than in subgroup II-B (p<0.05). There was no significant difference between the weight ratios of female rats in subgroups I-B and II-B (p>0.05) (Tab. I). Significant differences were found in terms of weight between male and female rats of the main group. The weight in subgroup I-A was 1.26 times higher than the weight in subgroup I-B (p<0.05) (Tab. I). Thus, maximum weight gain and weight were observed in male rats receiving 9-week fast food diet.

BMI of male rats in subgroup I-A was 1.3 times higher than in subgroup II-A (p<0.05) (Tab. I). BMI of female rats in subgroup I-B exceeded 1.2 times (p<0.05) the subgroup II-B indicator (Tab. I). Visceral fat was only found in group I animals. In female rats, visceral fat weight was 3 times higher than in male rats (p<0.05) (Tab. I).

Morphologically NAFLD development was confirmed in rats of the main group, fed with 9-week fast food diet (Fig. 1).

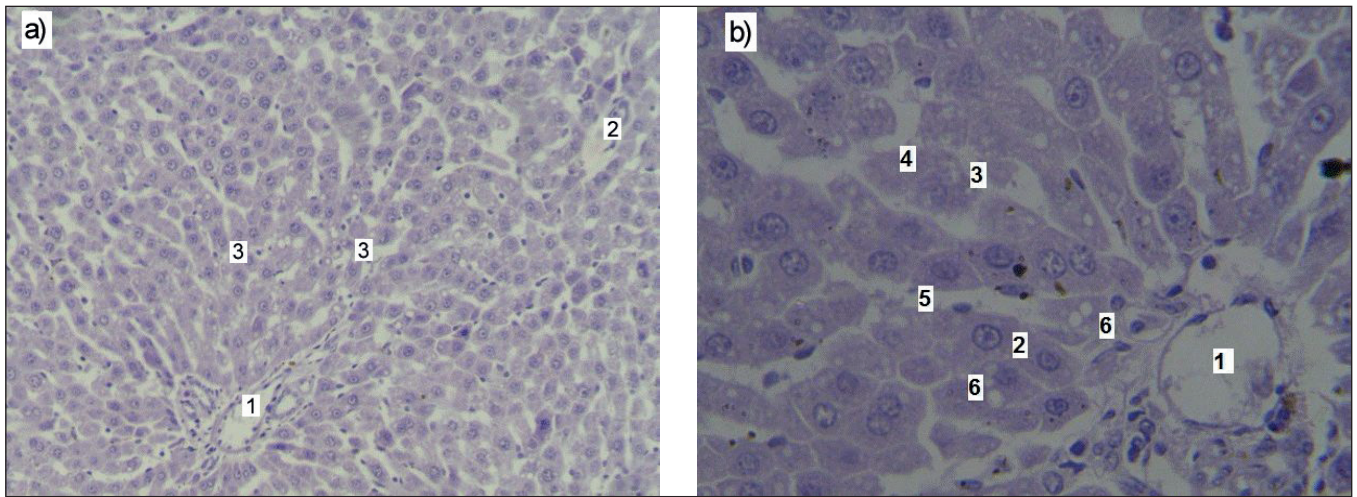


Fig. 1. a) General view of hepatic lobule structure in rats with liver steatosis model. Stained with hematoxylin-eosin, x 200 (1 – portal triad; 2 – central vein; 3 – lipid inclusions); b) Periportal hepatic lobule part in rats with liver steatosis model. Stained with hematoxylin-eosin, x 600 (1 – portal vein, 2 – hepatocyte with karyolysis and large, optically empty, vacuoles (lipid droplets); 3 – decomposition of hepatic cords due to hepatocytes destruction; 4 – hepatocyte nucleus in the karyolysis phase; 5 – constricted sinusoidal capillaries; 6 – numerous large optically empty vacuoles (lipid droplets).

Changes in periportal and pericentral areas of the acinus, characterized by the presence of hepatocyte karyolysis, decomposition of the hepatic cords due to hepatocytes' destruction, numerous large, optically dense vacuoles (lipid droplets) were revealed during the liver morphological analysis in rats with NAFLD model (Fig. 1a, 1b). In the acinus periportal areas, there were constricted sinusoidal capillaries due to hepatocyte cytoplasm swelling. There is a dramatic sinusoidal dilatation in the acinus pericentral areas (Fig. 1a, 1b).

There was an increased arginine level in the blood of the main group of rats with NAFLD model compared with the control group. In subgroup I-A male rats, arginine level in the blood increased 2-fold compared with subgroup II-A (0.13 ± 0.015 vs 0.064 ± 0.005) mmol/l ($p < 0.05$) (Fig. 2c). In subgroup I-B female rats, arginine in the blood increased 2.6-fold times compared to subgroup II-B (0.136 ± 0.014 vs 0.052 ± 0.012) mmol/l ($p < 0.05$) (Fig. 2c). There was a tendency to increase the arginine level in rat liver homogenate in the main group compared to the control ($p > 0.05$). Thus, in subgroups I-A and I-B the arginine level in liver homogenate was $0,371 \pm 0,041$ and $0,413 \pm 0,021$ mmol/g, and in subgroups II-A and II-B – $0,27 \pm 0,054$ and $0,27 \pm 0,023$ mmol/g, respectively (Fig. 2a).

Arginase activity in the blood of main group rats in subgroup I-A decreased 2.4-fold compared with subgroup II-A (21.00 ± 3.65 vs 51.40 ± 10.86) $\mu\text{mol/ml}$ ($p < 0.05$), in subgroup I-B – 2.1-fold compared to subgroup II-B (14.67 ± 0.66 vs 31.08 ± 4.59) $\mu\text{mol/ml}$ ($p < 0.05$) (Fig. 2d).

Arginase activity in liver homogenate decreased 3.4-fold in male rats of subgroup I-A compared to subgroup II-A (0.866 ± 0.041 vs 2.986 ± 0.227) $\mu\text{mol/g}$ ($p < 0.05$) (Fig. 2a). In female rats of subgroup I-B arginase activity in liver homogenate decreased 2.9-fold compared with subgroup II-B (0.747 ± 0.183 vs $2.235 \pm 0,303$) $\mu\text{mol/g}$ ($p < 0.05$) (Fig. 2a).

A direct correlation was found between serum and liver tissue arginine in male rats of subgroup I-A with NAFLD modeling ($r = +0.8$; $p < 0.05$) (Fig. 3a).

Against the background of NAFLD in the blood of subgroup I-A rats, citrulline level decreased 2.4-fold compared to subgroup II-A (241.8 ± 11.61 vs 585.7 ± 9.53) $\mu\text{mol/ml}$ ($p < 0.05$) (Fig. 2e), and in the blood of subgroup I-B rats – 1.7-fold compared to subgroup II-B (397.9 ± 8.64 vs 669.9 ± 69.48) $\mu\text{mol/ml}$ ($p < 0.05$) (Fig. 2e). Simultaneously, citrulline content in the liver homogenate of subgroup I-A was 1.8-fold lower than in subgroup II-A (31.64 ± 3.82 vs 57.26 ± 1.92) $\mu\text{mol/g}$ ($p < 0.05$) (Fig. 2f) and in rats of subgroup I-B – was 1.6-fold compared subgroup II-B (33.49 ± 2.81 vs 54.07 ± 1.36) $\mu\text{mol/g}$ ($p < 0.05$) (Fig. 2f). The NAFLD development was accompanied by a decreased level of citrulline in the blood and liver tissues compared with the control group. The competitive interaction of arginase and NOS is confirmed by the presence of an inverse correlation between blood arginase activity and citrulline content in liver tissues of male rats with NAFLD ($r = -0.98$; $p < 0.05$) (Fig. 3b), as well as a direct correlation between levels of arginine in blood and citrulline in liver tissues ($r = +0.98$; $p < 0.05$) (Fig. 3c) and inverse correlation between arginase activity and citrulline content in liver tissues of control subgroup II-A male rats ($r = -0.94$; $p < 0.05$) (Fig. 3d).

DISCUSSION

Modeling of NAFLD using a 9-week fast food diet resulted in maximum weight gain of male rats, accompanied by significant BMI growth compared to the control group. However, the mass of intra-abdominal fat increased maximally in female rats of the main group with NAFLD model. This fact may indicate a higher risk of diseases development associated with abdominal obesity in females [4].

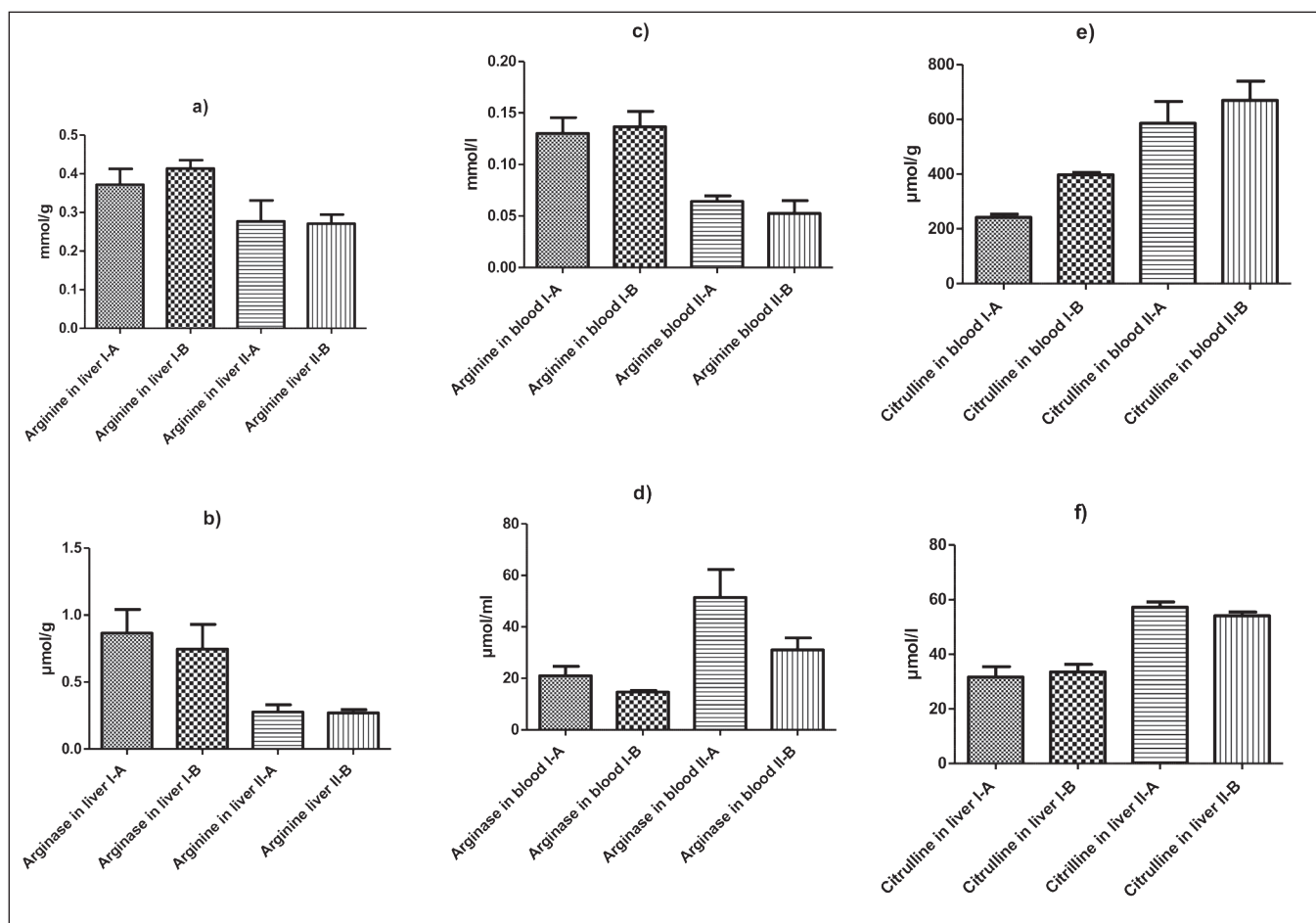


Fig. 2. Arginine/Citrulline-cycle. a) Arginine in liver. b) Arginase in liver. c) Arginine in blood. d) Arginase in blood. e) Citrulline in blood. f) Citrulline in liver. * $p < 0.05$ relative to control (group II).

The use of fast food diet for 9 weeks led to NAFLD histological liver structure transformation, namely, karyolysis of hepatocytes, decomposition of liver cords due to hepatocytes destruction, the presence of numerous large, optically dense vacuoles (lipid droplets), constricted sinusoidal capillaries in the periportal acinus areas due to hepatocyte cytoplasm swelling and sinusoidal dilatation in the pericentral acinus areas. According to the study [1], the use of a high-calorie diet allows to simulate NAFLD in experimental animals with histopathological changes that are similar to humans.

There was an increased arginine content in the blood and liver tissues of experimental animals with NAFLD model. The maximum arginine substrate accumulation in the liver was noted. At the same time, the arginase activity in the blood and liver tissues, which is produced mainly by hepatocytes, was reduced in rats with NAFLD model [5]. Reduced arginase activity in the liver homogenate may indicate impaired liver functionality. The increase in arginine content against the background of NAFLD may be associated with a shift in protein metabolism toward catabolic processes. Reduced arginase activity in liver tissues leads to impaired detoxification of protein catabolism products, as well as reduced ornithine formation. Ornithine is a substrate for polyamines and characterizes the protein-synthesis liver function. That is, NAFLD rat model showed an

impaired protein-synthesis and detoxification liver function. It is known that arginine is also a substrate for NO. Reduction of arginine biotransformation with arginase participation leads to metabolic shift to NOS-stimulated citrulline formation. Citrulline may partially replace arginine as a NO substrate donor [5].

Our study results showed the arginase and NO-synthase pathways disruption of arginine metabolism. This fact may be related to the violation of the arginine availability for arginase and NOS [1, 6, 14]. This substrate availability is regulated by transport systems, which provide its recapture. The arginine reuptake is inhibited by L-ornithine, N-aminoethyl-L-ornithine, N-methyl-L-arginine and others [1, 6]. Decreased citrulline is an additional factor that potentiates the progression of liver steatosis [10, 15]. In addition, impaired citrulline formation during the NOS-dependent arginine metabolism reaction can be considered a sign of reduced NO production and endothelial dysfunction.

CONCLUSIONS

The experimental NAFLD model showed an increased arginine level in the blood and liver tissues. The reason for the arginine concentration growth may be a violation of arginine metabolism in the Arginine / Citrulline cycle. This opinion is confirmed

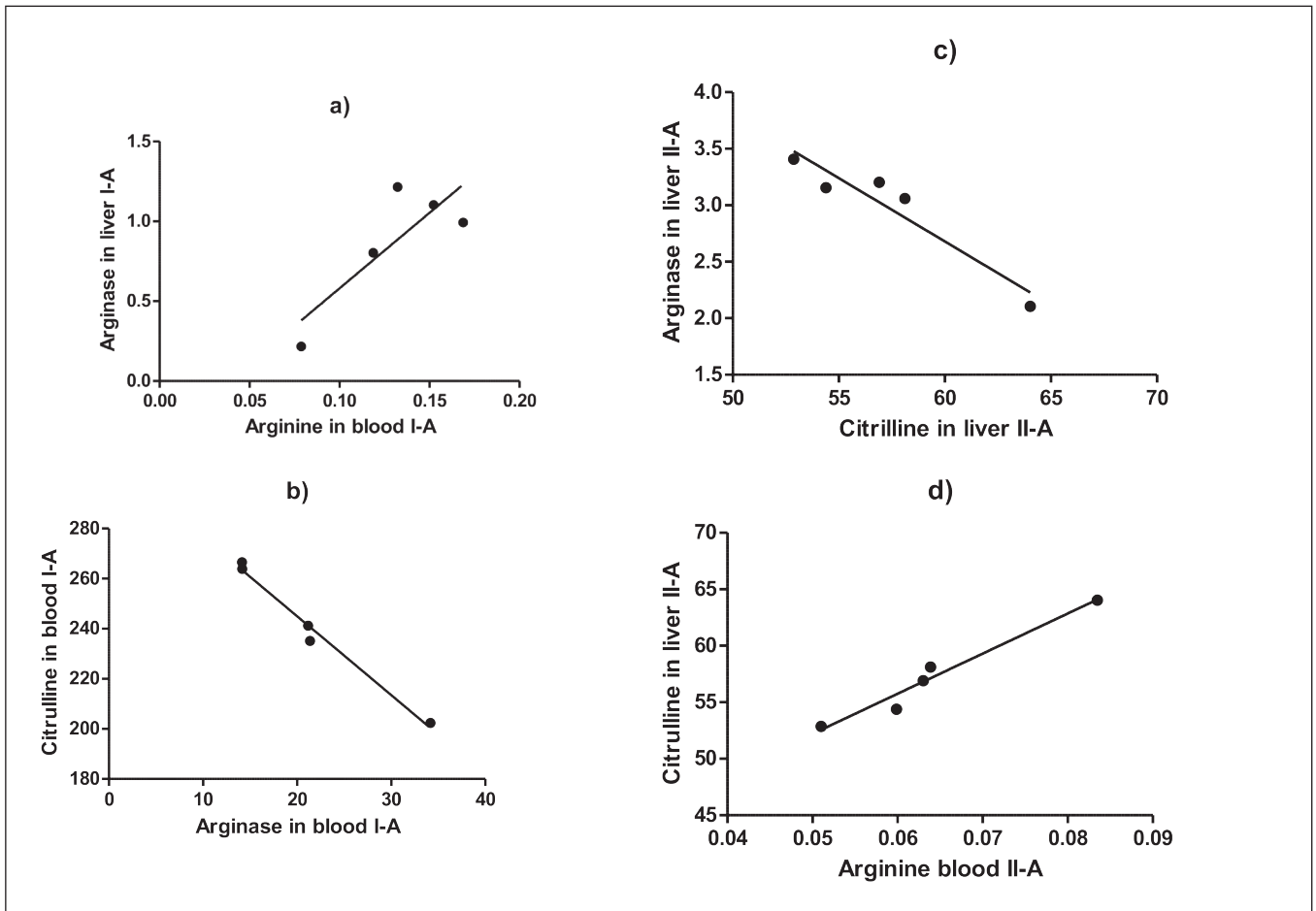


Fig. 3. Arginine/Citrulline-cycle. a) Arginase in liver. b) Arginase in liver. c) Arginine in liver. d) Arginase in blood. e) Citrulline in blood. f) Citrulline in liver. * $p < 0.05$ relative to control (group II).

by decreased arginase activity of in the blood and liver homogenate. At the same time, disorders of arginine metabolism under the influence of NOS system were detected. Citrulline content was decreased in blood and liver tissues in rats with NAFLD model. Thus, it can be considered that Arginine / Citrulline cycle disturbance in rats with NAFLD model was characterized by decreased production of arginase by hepatocytes, as well as low availability of NOS arginine substrate.

REFERENCES

- Bival'kevich N.V., Denisenko Yu.K., Novgorodczeva T.P. Metodicheskie podkhody k e'ksperimental'nomu modelirovaniyu nealkogol'noj zhirovoj bolezni pečeni [Methodical approaches in experimental modelling of non-alcoholic fatty liver disease]. RZhGGK. 2015;4:39-45. (In Russian).
- Hebbard L., George J. Animal models of nonalcoholic fatty liver disease. *Nat Rev Gastroenterol Hepatol.* 2011;8(1):35-44. doi: 10.1038/nrgastro.2010.191.
- Skrypnyk I.M., Dubrovinska T.V. Optyimizatsiia dovhotryvaloho likuvannia rozuvastatynom u khvorykh na infarkt miokarda u poiednanni z nealkoholnym steatohepatytom [Optimization of long-term treatment with rosuvastatin of patients with myocardial infarction in combination with non-alcoholic steatohepatitis]. *Likarska sprava* 2014; 5-6:113-21. (In Ukrainian).
- Singh S., Allen A.M., Wang Z. et al. Fibrosis progression in nonalcoholic fatty liver vs nonalcoholic steatohepatitis: a systematic review and meta-analysis of paired-biopsy studies. *Clin Gastroenterol Hepatol.* 2015;13(4):643-54. doi: 10.1016/j.cgh.2014.04.014.
- Granik V.G. Metabolizm L-arginina (obzor) [The metabolism of L-arginine (review)]. *Khimiko-farmaceuticheskij zhurnal.* 2003;37(3):3-20. (In Russian).
- Maksymchuk N.O., Konovchuk V.M. Metabolizm arhininu: perspektyvy klinichnoho vykorystannia (ohliad literatury) [Arginine metabolism: prospects for clinical use (review of literature)]. *Bukovynskiy medychny visnyk.* 2017;21(vyp.1(81)):205-10. (In Ukrainian).
- Scheja L., Kluwe J. Arginine and NASH – Do macrophages deliver the first hit?. *Journal of Hepatol.* 2015;62(2):260-1. doi: 10.1016/j.jhep.2014.11.001
- Thomas T., Thomas T.J. Polyamine metabolism and cancer. *J Cell Mol Med.* 2003;7(2):113-126. doi: 10.1111/j.1582-4934.2003.tb00210.x
- Skrypnyk I., Maslova G., Lymanets T. et al. L-arginine is an effective medication for prevention of endothelial dysfunction, a predictor of anthracycline cardiotoxicity in patients with acute leukemia. *Experimental Oncology.* 2017;39(4):308-11.
- Charbonneau A., Marette A. Inducible nitric oxide synthase induction underlies lipid-induced hepatic insulin resistance in mice: potential role of tyrosine nitration of insulin signaling proteins. *Diabetes.* 2010;59(4):861-71. doi: 10.2337/db09-1238.

11. Dou L., Shi X., He X. et al. Macrophage phenotype and function in liver disorder. *Front Immunol.* 2020;10:3112. doi: 10.3389/fimmu.2019.03112.
12. Khallou-Laschet J., Varthaman A., Fornasa G. et al. Macrophage plasticity in experimental atherosclerosis. *PLoS One.* 2010;5(1):e8852. doi: 10.1371/journal.pone.0008852.
13. Munder M. Arginase: an emerging key player in the mammalian immune system. *Br J Pharmacol.* 2009; 158(3): 638–51. doi: 10.1111/j.1476-5381.2009.00291.x.
14. Ming X.F., Rajapakse A.G., Yepuri G. et al. Arginase II promotes macrophage inflammatory responses through mitochondrial reactive oxygen species, contributing to insulin resistance and atherogenesis. *J Am Heart Assoc.* 2012; 1(4): e000992. doi: 10.1161/JAHA.112.000992.
15. Navarro L.A., Wree A., Povero D. et al. Arginase 2 deficiency results in spontaneous steatohepatitis: a novel link between innate immune activation and hepatic de novo lipogenesis. *J Hepatol.* 2015; 62(2): 412–20. doi: 10.1016/j.jhep.2014.09.015

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The Authors declare no conflict of interest.

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EXTRAPERITONEOSCOPIC RADICAL PROSTATECTOMY AFTER PELVIC SURGERY PROCEDURES

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ABSTRACT

The aim of study is to evaluate the results of extraperitoneoscopic radical prostatectomy performed in the presence of various complicating factors.

Materials and methods: This prospective study included 7 patients with a diagnosis of prostate cancer (T1-T2b, No, Mo) who underwent extraperitoneoscopic radical prostatectomy (ERPE).

Results: Among all ERPEs performed on seven patients, the maximum duration of the surgery was 6 hours 30 minutes, and the minimum one was 3 hours 40 minutes. The average volume of blood loss did not exceed 350 ± 20 ml; decline in hemoglobin level was in the range of 10-12 g/l. The urethral catheter was removed no earlier than 7 days after the surgery. Drainage from the space of Retzius was removed on the 3rd day. Postoperative complications occurred in 2 patients (28.57%). The maximum period of postoperative outpatient follow-up was 22 months. In 6 patients (85.71%), complete urinary retention up to 3 months was noted. One patient (14.29%) had mild urinary incontinence (PAD-test – no more than one pad per day). In these cases, sexual potency was absent in 100% of patients. The maximum postoperative PSA level in the group reached 0.13 ng/ml.

Conclusions: Own experience of ERPE in patients on the background of previous transurethral resections and vaporization of the prostate demonstrated the effectiveness and safety of the method. More extensive studies with a larger number of cases are needed.

KEY WORDS: localized prostate cancer, radical prostatectomy, urinary retention, transurethral resection

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INTRODUCTION

Benign prostatic hyperplasia (BPH) is one of the most common diseases in elderly men. Despite the preoperative screening of patients to exclude prostate cancer, the latter is often a histological finding after TURP for BPH [1].

Radical prostatectomy (RPE) in clinically localized prostate cancer is a safe procedure and successfully reduces the risk of death from cancer [2]. Many factors, including the previous surgery on organs of the lower part of the abdominal cavity, pelvis or prostate gland, as well as radiation therapy, change the anatomy of the para-prostatic space, which, together with the experience of the surgeon, determine the possibility of successful RPE. In particular, the previous surgery or radiation therapy in this area can lead to the formation of connective tissue fibrosis that drastically changes the anatomy of interfascial spaces and the ratio of tissue layers, which complicates the performance of RPE to a great extent [3].

Some researchers state that the previous extensive transabdominal or pelvic surgery is a contraindication for laparoscopic RPE [4]. However, other studies have shown that RPE can be safely performed after prostate surgery [5], even if extensive fibrosis is observed and interfascial dissection planes are absent. Many studies have shown that the retropubic RPE and laparoscopic RPE are difficult to

perform after TURP, because perforation of the prostatic capsule during TURP with extravasation of blood and irrigation fluid can result in periprostatic fibrosis, sclerotic changes in the capsule of the prostate and distortion of the surgical planes [6].

Thus, in the modern literature there is a lot of conflicting information about the results of laparoscopic and open RPE in patients who have previously undergone pelvic surgery. This fact encouraged us to describe our experience in performing extraperitoneoscopic radical prostatectomy (ERPE) after various surgical procedures on the lower abdominal and pelvic organs.

THE AIM

The aim of the study is to evaluate the results of extraperitoneoscopic radical prostatectomy performed in the presence of various complicating factors.

MATERIALS AND METHODS

Our prospective study included 7 patients with a diagnosis of prostate cancer (T1-T2b, No, Mo), who underwent extraperitoneoscopic radical prostatectomy (ERPE). The patients underwent surgeries from 2016 to 2018, by the same surgeon

Table 1. Patients' distribution

Laser vaporization of the prostate	1 (patient№1)
Laparotomy for peritonitis, appendectomy, right-sided hernioplasty.	1 (patient№2)
Epicystostomy	1 (patient№3)
Transvesical open prostatectomy	1 (patient№4)
Bipolar TURP	3 (group of patients№5)

(experience in ERPE about 500 surgeries). The inclusion criteria for patients are the following: medical history of surgeries on the organs of the abdominal cavity and small pelvis, endoscopic surgery on the prostate gland. Patients were distributed as follows: 1 patient after laser vaporization of the prostate (patient No. 1); 1 patient after laparotomy for peritonitis, appendectomy, right-sided hernioplasty (patient No. 2); 1 patient with an epicystostomy inserted for bladder obstruction as a result of prostatic hyperplasia (patient No. 3); 1 patient after transvesical open prostatectomy (patient No. 4); 3 patients after bipolar TURP (group of patients No. 5). Table I.

It is worth noting that all these patients underwent the first surgeries in other medical institutions. In patient No. 1, the preoperative PSA level was 8.6 ng/ml, in patient No. 2 – 5.5 ng/ml, in patient No. 3 – 6.2 ng/ml, in patient No. 4 – 5.4 ng/ml. In patients who previously underwent TURP: in the first patient, the preoperative level of total PSA was 3.2 ng/ml, in the second patient it was 1.23 ng/ml, and in the third patient it was 2.2 ng/ml. In all 7 patients histologic examination revealed a tumor of the prostate. The sum of points on the Gleason score in patient No. 1 was 3 + 4 = 7, in patient No. 2 it was 4 + 4 = 8, in patient No. 3 the score was 3 + 4 = 7, in patient No. 4 it showed 4 + 3 = 7. In group No. 5: one patient had 3 + 4 = 7, the second – 3 + 3 = 6 and the third – 4 + 3 = 7. Before ERPE, in patient No. 1 the prostate volume was 63 cm³, in patient No. 2 – 52 cm³, in patient No. 3 – 86 cm³, in patient No. 4 – 27 cm³. In patients' group No. 5, one patient had the prostate volume of 12 cm³, the second – 16 cm³, and the third – 11 cm³. The minimum time period after the first surgery before ERPE was 2 weeks, the maximum one was 5 years. All patients of group No. 5 were diagnosed with a prostate tumor immediately after transurethral resection during histological examination of postoperative material. In all other cases, it happened after transrectal puncture biopsy for an elevated PSA level. In all the observations included in this study, we used the Rocco stitch as a stage of posterior reconstruction, as well as the stitching of the bladder to puboprostatic ligaments as a stage of anterior reconstruction.

The preoperative examination of patients before performing the ERPE was carried out in accordance with modern standards and recommendations of the European Society of Urology and included a thorough medical history, physical, laboratory and instrumental types of examination. To exclude common forms of prostate cancer, magnetic resonance imaging of the small pelvis was performed, which confirmed the stage of the disease; the absence of damage to regional lymph nodes and the absence of distant metastasis. In our opinion, more extensive observations are required, followed by statistical studies.

RESULTS AND DISCUSSION

Among all ERPEs performed on seven patients, the maximum duration of the surgery was 6 hours 30 minutes, and the minimum one was 3 hours 40 minutes. There were no conversions from extraperitoneoscopic access to "open" one. We did not perform pelvic lymphadenectomy in those cases due to the absence of indications. All surgeries were conducted in accordance with oncological requirements; histological examination of the preparations did not show "positive" surgical margin. In all cases, taking into consideration the manifested postoperative fibrosis, extrafascial prostatectomy was performed. Intraoperative complications (injuries of the rectum, the ureters, and great vessels), fragmentation of the prostate or damage to its capsule were avoided. The average volume of blood loss did not exceed 350–20 ml; decline in hemoglobin level was in the range of 10–12 g/l. There was no need for blood transfusion. All patients were activated on the first postoperative day. The urethral catheter was removed no earlier than 7 days after the surgery. Drainage from the space of Retzius was removed on the 3rd day. Postoperative complications occurred in 2 patients (28.57%). Due to the lack of tightness of the anastomosis in 2 patients (patient No. 1 and No. 4), the urethral catheter was removed on the 14th day after the control cystography. All patients were discharged for outpatient treatment with recovery. The maximum period of postoperative outpatient follow-up was 22 months. In 6 patients (85.71%), complete urinary retention up to 3 months was noted. One patient (14.29%) had mild urinary incontinence (PAD-test – no more than one pad per day). In these cases, sexual potency was absent in 100% of patients. The maximum postoperative PSA level in the group reached 0.13 ng/ml.

It is common knowledge, in most patients who have previously undergone open surgery, tissue fibrosis develops in the area of the surgery, which, when performing subsequent surgeries, causes a number of "technical" difficulties for the surgeon and this contributes to intraoperative complications [9]. We also encountered such "technical" difficulties in performing ERPEs against the background of previous surgical procedures, where infiltrative and cicatricial interfascial fibrotic changes took place to one degree or another.

Thus, after an open adenomectomy in the patient (taking into consideration that the surgery was performed via transvesical access and the bladder wall was "soldered" with paravesical fatty tissue), we needed to access the Retzius space with excision of postoperative scars (Figure 1).

After that, the Retzius space was marked and under direct vision (according to the Hasson technique), trocars were placed and the wound was sutured layer by layer. The further



Fig. 1. The formation of extraperitoneoscopic access. The postoperative scar in the patient after transvesical adenomectomy was excised.

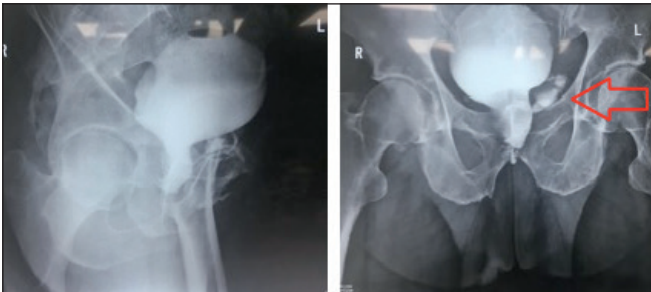


Fig. 3. Cystogram of the patient G.: direct and lateral projection.

surgery progress did not differ from the standard ERPE. In both cases, we had to perform the conversion from extraperitoneoscopic access to laparoscopic one. In the first case, ERPE was performed in patient No. 2, in the second observation it was in patient No. 4. It is worth noting that in these cases we did not use cylindrical dissectors at the stage of marking of the Retzius space to place an optic trocar, but performed this step with the index finger from a small incision under the umbilical ring up to 2 cm. In our opinion, this allows us to perform this stage more precisely and minimizes the chance of trauma to the peritoneum. Nevertheless, the need for conversion was determined by a trauma of the peritoneum at the stage of finger marking of the Retzius space. This in turn led to the ingress of carbon dioxide into the abdominal cavity and, as a result, squeezing our workspace. After the conversion from extraperitoneoscopic access to laparoscopic one, we noted that the greater omentum was “soldered” to the anterior abdominal wall, and the ileocecal angle of the large intestine was medially displaced and adjacent to the rectum. This made us separate the above-indicated structures from each other, for safe access to the Retzius space. After opening the parietal peritoneum, the progress of the surgery did not differ from the standard laparoscopic radical prostatectomy. From our point of view, an important factor determining the success of these surgical procedures is the experience of a surgeon who is aware of all access options for performing ERPE.

In other 4 cases, in patients with a medical history of endoscopic surgery (patient No. 1 and patient group No. 5), infiltrative and cicatricial periprostatic changes were most observed and combined with fibrosclerotic changes in interfascial

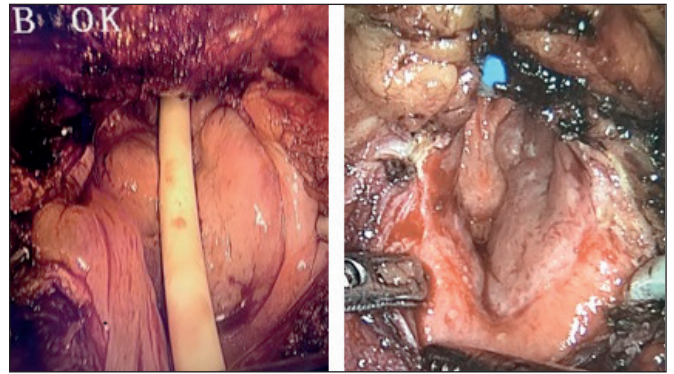


Fig. 2. The prostatic urethra region after dissection of the bladder.

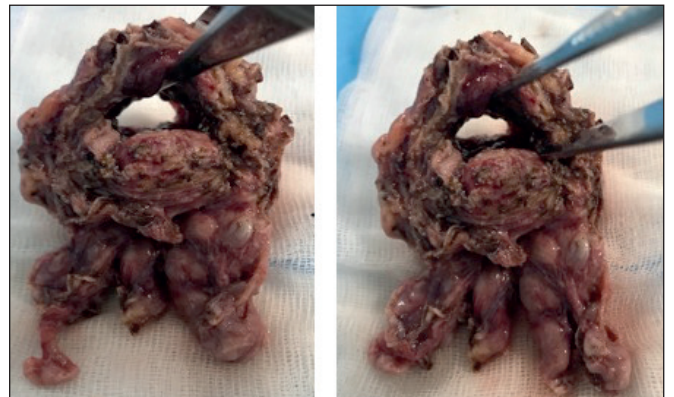


Fig. 4. Gross specimen of the patient G. The prostate with seminal vesicles and sections of the vas deferens as a single unit.

anatomy of the small pelvis, which significantly complicated extrafascial prostate excretion. Therefore, in our observations, we noticed a severe cicatricial deformity of the bladder neck, fixed to the pubic articulation along the anterior semicircle; significant periprostatic infiltrative-cicatricial changes; asymmetry of the sclerosed prostate and the lack of the possibility of interfascial dissection due to cicatricial changes in the anatomical layers. The density of scar tissue did not allow to clearly differentiate the border between the prostate and the bladder neck (Figure 2). The latter required a wide excision with subsequent reconstruction of the bladder neck. In all cases, navigation was carried out along the cylinder of the urethral catheter during its traction.

In our opinion, this stage of the operation is associated with a high risk of damage to the orifices of the ureters due to the wide excision of the bladder neck. Taking into consideration that fact, we performed that stage precisely and the search of the orifices in the deformed vesical triangle took a long time (up to 30 minutes). Clear visualization of the orifices is important in the formation of the posterior semicircle of the vesicourethral anastomosis. Therefore, in our opinion, perhaps, as prevention of such complications in patients of this category, preoperative ureteral stenting should be performed.

In 3 cases (2 patients of group No. 5 and patient No. 1), we were not able to differentiate the anterior surface of the prostate and the dorsal venous complex in scar tissue. The latter was not stitched; the tissues were cut with “cold” scissors, sliding along the surface of the pubic articulation to minimize injury

to the external urethral sphincter. In this case, no bleeding was observed or it was minimal, not requiring through-out suturing of the dorsal venous complex. The described changes, apparently, are determined by the technological features of previously conducted TURP and vaporization. Thus, it is known that transurethral resection of adenomatous nodes is often accompanied by perforation of the surgical capsule of the prostate and the coagulation of bleeding vessels and vaporization of tissues only aggravate the inflammatory changes.

EXAMPLE: PATIENT NO 1.

Patient G., 63 years old, complained of pain in the suprapubic region on the left. Medical history: 3 months ago laser vaporization of the prostate. PSA before surgery was 3.9 ng/ml; prostate biopsy was not performed. Examination: there is no ultrasound of ectasia of the calices-pelvis system (CPS) on both sides, there is no residual urine. After emptying the bladder there is a liquid formation of 5x4 cm in a small pelvis on the left. Cystography is performed (Figure 3) in the direct and lateral projections: in the direct projection, the bladder is uniformly contrasted, there are no filling defects. In the area of the prostatic urethra on the left, the flow of contrast medium into the Retzius space of 6x4 cm is noticed.

3 months after vaporization PSA was 8.6 ng/ml. A transrectal biopsy of the prostate was performed: prostatic adenocarcinoma 4 + 4 = 8 points on the Gleason score. The volume of the prostate was 63 cm³. Endoscopic extraperitoneal extrafascial radical prostatectomy was performed. Surgery duration was 4 hours 50 minutes, blood loss – 320 ml. The drainage was removed on the 3rd day; the urethral catheter was removed on the 9th day. During histological examination, the surgical margin was negative (Figure 4). Urinary stress incontinence of mild severity (up to 1 pad per day) was noted for up to 3 months. After 3 months, urine is completely retained.

Having performed these surgical procedures, we noted that the severity of the adhesive process in the early stages (up to one month) was less than at a later date. In our observations, we managed to avoid serious intraoperative complications such as the rectum trauma, the ureters trauma, massive blood loss. However, periprostatic adhesion due to the previous surgery complicates the excretion of seminal vesicles and the identification of neurovascular bundles in the projection of the crura of the prostate, which forces an extrafascial RPE to be performed without preserving the neurovascular bundles, thereby increasing the risk of impotence and urinary incontinence.

CONCLUSIONS

Previous pelvic surgery should not be considered an absolute contraindication for performing ERPE. The determining factor for success in performing these surgical procedures is the experience of the surgeon. Own experience of ERPE in patients against the background of previous transurethral resections and vaporization of the prostate showed the effectiveness and safety of the method. In patients after “open” surgeries on the prostate, it is advisable to refuse extraperitoneoscopic access. Having performed these surgical procedures, we noted that the severity

of the adhesive process in the early stages (up to one month) was less than at a later date. In our opinion, it is recommended for patients after endoscopic surgeries on the prostate to begin the surgery with cystoscopy and stenting in cases of close locations of the orifices to the bladder neck. However, taking into account the small amount of data from clinical cases, more extensive research is needed in this direction.

REFERENCES

1. Shamloul R., Ghanem H. Erectile dysfunction. *The Lancet*. 2013;381 (9861):153–165. doi:10.1016/S0140-6736(12)60520-0
2. Bill-Axelsson A., Holmberg L., Ruutu M. et al. Radical prostatectomy versus watchful waiting in early prostate cancer. *N Engl J Med* 2005;352:1977- 84.
3. Colombo R., Naspro R., Salonia A. et al. Radical prostatectomy after previous prostate surgery: clinical and functional outcomes. *J Urol* 2006;176(6 Pt 1):2459- 63.
4. Rassweiler J., Sentker L., Seemann O. et al. Laparoscopic radical prostatectomy with the Heilbronn technique: an analysis of the first 180 cases. *J Urol* 2001;166:2101-8.
5. Palisaar J.R., Wenske S., Sommerer F. et al. Open radical retropubic prostatectomy gives favourable surgical and functional outcomes after transurethral resection of the prostate. *BJU Int* 2009;104:611-5.
6. Teber D., Cresswell J., Ates M. et al.: Laparoscopic radical prostatectomy in clinical T1a and T1b prostate cancer: oncologic and functional outcomes-a matched-pair analysis. *Urology* 2009; 73: 577-581. Epub 2008 Dec 18.

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FEATURES OF PHYSICAL AND MECHANICAL PARAMETERS OF ACRYLIC PLASTICS AFTER FULLERENE COATING

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ABSTRACT

The aim of the research is to study the physical and mechanical parameters of the bases in removable laminar dentures after modification of their surface.

Materials and methods: the studied samples were divided into two groups (group I – acrylic plastics, and group II – acrylic plastics with fullerene C_{60} nanocoating), 50 samples in each group. The coefficients of water absorption, water solubility, microhardness and deformation characteristics of materials were studied.

Results and conclusions: The material covered with fullerene C_{60} has a lower coefficient of water absorption and water solubility, which amounted to 0.55% and 0.23% respectively, from the initial weight of samples, as compared with acrylic plastics without coating (0.71% and 0.34%, respectively). The strength parameters of samples of group II were higher by 13.5% as compared to group I. The given results of water absorption and water-solubility show that acrylic plastics with fullerene C_{60} molecules coating has a lower coefficient of water absorption and water solubility, in comparison with acrylic plastics without coating. This indicates a higher degree of resistance to biodegradation of the modified surface material, in turn reducing the washing-out of residual monomer from the denture, which directly improves the strength parameters of the acrylic plastics and can prevent the development of denture stomatitis.

KEY WORDS: acrylic plastics, water absorption, water solubility, nanocoating with fullerene C_{60}

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INTRODUCTION

The quality prosthetics with partial and complete removable laminar dentures is an important issue in the clinical practice of orthopedic dentistry. According to various authors, the need for such types of structures varies from 50 to 75% of the total number of orthopedic patients [1,2,3].

Currently, the main materials used for manufacturing removable dentures are derivatives of acrylic and methacrylic plastics: from 91 to 98% of removable dentures are made of acrylic plastics [4,5,6].

The extensive period of using acrylic plastics in orthopedic dentistry as the main material for manufacturing various types of dentures since the 1930s and up to this day indicates its satisfactory biological, physical and mechanical properties. It meets the requirements of everyday dentistry because of its relatively good biocompatibility, chemical inertness, favorable mechanical properties, stable dimensions, aesthetic, technological benefits, the possibility to fix it, as well as its low cost [7,8,9].

However, among the list of positive qualities of acrylic plastics, there are certain shortcomings. This is supported by the fact that more than 26% of patients cannot use removable dentures, and 37% are forced to adjust to poorly-designed dentures [2,10].

The disadvantages of acrylic prosthesis include inaccurate correspondence of the prosthetic base of the relief of the tissues of the prosthetic bed, inadequate pressure, insufficient mechanical strength, the presence of residual

monomer, disruption of thermoregulation, microbiological imbalance and biodegradation [11,12,13,14].

In order to improve the strength parameters and reduce the degree of water absorption of plastics, we developed a new way of enhancing the removable laminar denture, manufactured according to traditional technology using the nanosized material – molecules of fullerene C_{60} .

THE AIM

The aim of the research is to study the physical and mechanical parameters of the bases in removable laminar dentures after the modification of their surface

MATERIALS AND METHODS

We used the following samples of materials: acrylic plastics; and acrylic plastics, coated with a layer of fullerene C_{60} nanomaterial.

The study of certain physical and mechanical properties was conducted in accordance with the general requirements of GOST 143559-79, as well as GOSTs for testing each indicator on carefully selected samples without cracks, pores and other defects.

Samples of acrylic plastics, and acrylic plastics with fullerene C_{60} nanocoating were obtained using the following technological methods:

1. Polymerization of acrylic plastics by the compression method of forming plastic paste in the cuvette.

2. Coverage of polymerized acrylic plastics with molecules of fullerene C_{60} , by the method of magnetron sputtering of materials.

Measurement of the thickness of samples was conducted using the micrometer with accuracy up to 0.001 mm.

According to the materials and methods of manufacturing, the samples were divided into two groups of 50 samples in each:

Group I – samples made of acrylic plastics

Group II – samples made of acrylic plastics with fullerene C_{60} nanocoating.

DETERMINING THE COEFFICIENTS OF WATER ABSORPTION AND WATER SOLUBILITY

Before testing, the samples were conditioned according to GOST 12423-66 for at least 16 hours (at the temperature of $23 \pm 2^\circ \text{C}$ and relative humidity of $50 \pm 5\%$). The length, width and thickness of the samples were measured using micrometer MK 0-25 GOST 6507-78 with accuracy of ± 0.01 mm in at least three places.

To determine water absorption and water solubility, the samples were immersed in distilled water for 30 days at the temperature of $37^\circ \pm 1^\circ \text{C}$ in a dry air thermostat, so that the samples did not touch the walls of the Petri glass cup, each other and the surface of water. The initial mass (m_0) of samples was determined by weighing them on scales of class II with an error of not more than 0.2 mg. At the end of this period, samples were removed and gently wiped with dry filter paper. After 1 min after removing samples from water, they were weighed with the same precision as in the beginning, determining the mass m_1 . After weighing, the samples were again conditioned to the constant mass in the exicator, as described above. The constant mass was recorded as m_2 . Water absorption (W_a , in $\mu\text{g} / \text{mm}^3$) was calculated by the formula: $W_a = \frac{m_0 - m_1}{V}$, where m_0 is the initial mass of the sample, m_1 is the sample mass after exposure in water for 30 days, V is the volume of the sample. Water solubility (W_{sl} , in $\mu\text{g} / \text{mm}^3$) was calculated by the formula: $W_{sl} = \frac{m_0 - m_2}{V}$, where m_0 is the initial mass of the sample, m_2 is the sample mass after exposure in water for 30 days and drying, V is the volume of the sample.

For the study of microhardness (in mPa), samples of the studied materials were additionally grinded and polished to a mirror luster.

Microhardness of the examined samples was studied according to the Vickers method with the microtrometer PMT-3, by the size of the imprint of the diamond pyramid (indenter) at different loads.

The sample was placed on the microscope stage, whose rotation led the sample to the diamond pyramid, lowering it to the sample, which was examined so that the distance between the center of the imprint and the edge of the sample was not less than 2-2.5 mm. The load time was 10 seconds. Measurements of microhardness were carried out at three points of each sample. After the sample was released from the load, the microscope stage was brought to the microscope's eyepiece. The imprint was measured

with the accuracy up to 0.3 μm .

The value of microhardness by Vickers (Hv, mPa) was determined by the formula:

$$Hv = \frac{18540P}{2a^2}$$

where P is load, g;

2a is arithmetic average of the diagonals length, μm .

For each of the studied samples, we obtained three imprints and found the average value.

The deformation characteristics of all groups of studied samples were examined in their deformation in terms of compression and tension. The study of deformation characteristics of the examined samples in terms of compression was conducted using the deformation machine MRK-1. To determine the compression deformation, samples of materials were cylinders of $4 \times 4 \times 10$ mm. The deformation rate was 0.1 mm / min.

The value of the resilience boundary was determined by the formula:

$$\sigma_{rs} = \frac{P_0}{S_0}$$

where P_0 is the load at which the first deviation from the linearity on the deformation curve (H) is observed;

S_0 is the initial plane of the cross-sectional sample (m^2).

Tension deformation was conducted in the discontinuous facility MRK-1 with the deformation rate of 0.2 mm / min on the dumbbell shaped samples with the dimensions of the working part of $14 \times 10 \times 3$ mm. The samples were fastened to the clamp of the test machine in such a way that the larger axis of the sample coincided with the loading axle. The tightening of the clamps did not allow the sample to slip during the test.

According to the obtained deformation curves, we determined the yielding boundary ($\sigma_{0.2}$), the strength boundary (σ_{st}) and the maximum deformation to destruction Σ_{max} .

To determine the strength boundary, in the formula P_0 was substituted with P_{max} – the load at which the sample is destroyed.

The study of bending deformation characteristics was also carried out in the MRK-1 facility with an aperture for four-point bending. To this end, samples of materials $35 \times 5 \times 3$ mm from different groups were used.

To determine the reliability of the research results, the variational-statistical analysis was used for interrelated observations, calculating the reliability of difference according to Student. Statistical processing was conducted using the STATISTICA 6.0 (StatSoft, USA) software with a mean (M) and a standard error (m). Differences between the groups were considered statistically significant at $p < 0.05$.

RESULTS

Indicators of water absorption and water solubility are presented in Table I.

Based on the data presented in Table I, the average initial mass of samples of acrylic plastics material was 348.8 ± 10.3 mg. After

Table I. Average values of main characteristics of sample materials acrylic plastics and acrylic plastics with fullerene C₆₀ molecules coating and indicators of water absorption and water solubility on the 30th day of the experiment

No	Title of the material	a, mm	b, mm	h, mm	V, mm ³	m ₀ , mg	m ₁ , mg	m ₂ , mg	W _a , μg/mm ³	W _{st} , μg/mm ³
1	Acrylic plastics	6.1 ±0.05	3.5 ±0.02	14.7 ±0.5	315 ±9.26	348.8 ±10.3	351.3 ±10.4	347.6 ±10.3	7.80 ±0.27	3.87 ±0.18
2	Acrylic plastics with nanocoating	6.24 ±0.07 p>0.05	3.47 ±0.01 p>0.05	16.1 ±0.26 p<0.05	348.5 ±3.86 p<0.05	382.1 ±6.2 p<0.05	384.2 ±6.3 p<0.05	381.2 ±6.1 p<0.05	5.90 ±0.30 p<0.05	2.57 ±0.28 p<0.05

Table II. Average values of microhardness indicators in the presented materials (M ± m, n = 10)

Title of the material	H _v , Mpa
Acrylic plastics	307.3±6.5
Acrylic plastics with nanocoating	701.8±13.1 p<0.05

Table III. Average values of strength and plasticity of samples made of the examined materials in the tension study (M ± m, n = 10)

Title of the material	Young's modulus, E, MPa	σ _{rs} , MPa	σ ₀₂ , MPa	σ _{st} , MPa	δ, %
Acrylic plastics	241.78±0.55	36.02±1.01	37.25±1.35	40.25±1.06	0.38±0.038
Acrylic plastics with nanocoating	356.15±9.39 p<0.05	36.54±1.30 p>0.05	38.40±1.47 p>0.05	53.16±1.59 p<0.05	3.20±0.41 p<0.05

Table IV. Average values of the strength and plasticity of samples made of the examined materials in the compression study (M ± m, n = 10)

Title of the material	Young's modulus, E, MPa	σ _{rs} , MPa	σ ₀₂ , MPa	σ _{st} , MPa
Acrylic plastics	939.72±9.09	59.96±2.42	62.76±2.38	95.32±1.9
Acrylic plastics with nanocoating	952.44±12.32 p>0.05	64.67±2.01 p>0.05	67.18±2.06 p>0.05	89.70±1.74 p<0.05

Table V. Average values of strength and plasticity of samples made of the examined materials in the bending study (M ± m, n = 10)

Title of the material	Young's modulus, E, MPa	σ _{rs} , MPa	σ _{st} , MPa	w _{max} , mm
Acrylic plastics	635.8±13.71	48.8±0.83	72.5±1.77	5.08±0.05
Acrylic plastics with nanocoating	1135.4±11.33 p<0.05	56.4±0.6 p<0.05	105.3±0.89 p<0.05	4.99±0.1 p>0.05

30 days of exposure in distilled water at 37°±1°C, the average sample mass increased to 351.3±10.4 mg, and after conditioning the samples to constant mass in the exicator, their average mass decreased to 347.6 ± 10.3 mg. Accordingly, the coefficient of water absorption on the 30th day was 7.80 ± 0.27 μg / mm³, and the coefficient of water solubility was 3.87 ± 0.18 μg / mm³.

The average initial mass of samples of acrylic plastics material with fullerene C₆₀ molecules nanocoating was 382.1 ± 6.2 mg. After 30 days of exposure in distilled water at 37°±1°C, the average sample mass increased to 384.2 ± 6.3 mg, and after conditioning the samples to constant mass in the exicator, their average mass decreased to 381.2 ± 6.2 mg. Accordingly, the coefficient of water absorption on the 30th day was 5.90 ± 0.30 μg / mm³, and the coefficient of water solubility was 2.57 ± 0.28 μg / mm³.

The obtained data show that the material covered with fullerene C₆₀ has a lower coefficient of water absorption

and water solubility, which amounted to 0.55% and 0.23%, respectively, than the initial weight of samples, as compared with acrylic plastics without coating – 0.71% and 0.34%, respectively.

The study of microhardness allows us to evaluate the properties of thin surface layers of dental base materials, that is, their ability to resist local plastic deformation, which arises under the influence of the action of more solid materials.

As our studies have shown (Table II), the microhardness indicators of base material samples are significantly higher in Group II, as compared with Group I. The average value of microhardness is 307.3 ± 13.3 mPa, in the second group – 701.8 ± 26.6, which is by 2.28 times higher than in the second group.

In the study of tension deformation of the materials, it was determined that samples of basic materials are de-

stroyed when stretching after plastic deformation within the range of 0.38-3.20%, which makes it possible to determine the strength of the materials under examination. It should be noted that samples of acrylic plastics are destroyed at plastic deformation of 0.38%, and samples of acrylic plastics with nanocoating at plastic deformation of 3.20% (Table III).

From the data given in the table it is established that the type of material significantly influences the strength value of the base material samples: acrylic plastics and with nanocoating. The plastic deformation is somewhat higher in the sample with nanocoating.

As shown by the conducted studies, compression deformation characteristics, for each of ten samples of basic materials, and with fullerene C_{60} nanocoating, differences in strength and compression deformation were not significant (Table IV).

The result of the bending study is the arithmetic mean of the values in the destructive stress on the bend of the experimental samples from each group. We found that the magnitude of the force, applied to the samples in the second group, leading to deformation, is by 13.5% higher than in the first group (Table V).

DISCUSSION

As a result of the combined effect of the prosthesis on the tissues of the prosthetic bed, complications may arise when used, such as denture stomatitis [4,15]. The percentage of symptoms of denture stomatitis in patients using removable laminar dentures varies according to various authors within 15-70% [16,17].

One of the main causes of denture stomatitis is the presence of a residual monomer in the prosthesis. The residual monomer is the amount of monomer that is not connected to the polymer during the polymerization process. Incomplete polymerization of acrylates reduces the physical, mechanical and biological properties of dentures. The monomer can be washed into saliva and cause cytotoxic effects in the oral cavity. The higher the number of monomers that have not reacted, the higher will be the harmful effect [18,19,20].

In case of disrupted polymerization regime, the prosthetic base may contain from 3.4 to 8% free monomer, which is released from the denture for 5 years. But even in case of correct mode and advanced polymerization techniques, up to 0.5% of residual monomer remains in the plastic [15,21].

There are two indicators that affect the amount and rate of leaching of the residual monomer in the oral cavity: water absorption – the ability of the material to saturate and retain water over time and water solubility – the number of components of the material that is washed away and replaced by water molecules [22].

The main component of saliva is water, which is one of the main factors of biodestruction of acrylic dentures. Water molecules can easily penetrate into the polymeric network, which allows the removal of unbound monomer or other components of the plastics. It takes from one to

two months after the start of using a denture to saturate polymer with water. The mouth fluid, as physiologically active, provokes the release of toxic substances from the denture polymeric bases more than the neutral extractant – distilled water [23].

The excess content of residual monomer and the degree of water absorption affect the strength parameters of denture. The strength of denture decreases with excessive content of residual monomer, resulting in its deformation under load. In addition, monomer is washed primarily from the surface of the prosthetic base, and thus the structure of the polymer dissolves, creating tension that ultimately leads to decreased strength. In orthopedic structures, this tension over time causes cracking and breakage of the bases of dentures [24].

Fractures of dentures reach 15% in the first year of use. Breakdowns of plastic bases make up 35-49% of the total number of manufactured removable laminar dentures. Duration of using the removable laminar dentures until the first break is on average 0.5-1.4 years [10,25].

Since currently there is no material that could replace acrylic plastics, an important task is to improve its biological, physical and mechanical properties. Thus, it is possible to increase the parameters of strength and reduce water absorption of plastic by means of a new way of improving the removable laminar dentures, produced according to the traditional technology, with nanosized material – molecules of fullerene C_{60} .

CONCLUSIONS

1. The given results of water absorption and water solubility show that acrylic plastics with fullerene C_{60} nanocoating has a lower coefficient of water absorption and water solubility, as compared to acrylic plastics without coating. This indicates a higher degree of resistance to biodegradation of the modified surface material, in turn reducing the washing-out of residual monomer from the denture, which directly improves the strength parameters of the acrylic plastics.
2. The obtained data prove that nanocoated plastics have higher physical-mechanical characteristics as compared to conventional plastics. The microhardness index is by 2.28 times higher in modified plastics, indicating a better surface ability to withstand mechanical stresses directed on the surface, without changing the surface structure.
3. Samples with nanocoating are more resistant to destruction because the index of relative residual deformation prior to the sample destruction is by 2.82% higher than in conventional plastics. Therefore, it can be argued that such material can be used in dentistry to reduce the number of breakages of removable dentures and prolong their lifetime.

REFERENCES

1. Zholudev S.Ye. Sposoby lecheniya neperenosimosti s'yemnykh zubnykh protezov [Methods of treating intolerance to removable dentures]. Panorama of prosthetic dentistry. 2003; 3: 28–34. (In Russian).

2. Bocharov V.S., Moskvina Yu.N., Kim A.R. Vliyaniye bazisnykh materialov s'yemnykh protezov na parametri immunogo gomeostaza slizistoy obolochki rta [Influence of base materials of removable dentures on the parameters of immune homeostasis of the oral mucosa]. Pacific Medical Journal. 2014; 3: 62-64. (In Russian).
3. Rozumenko V.A. Klinicheskaya aprobatsiya usovershenstvovannogo metoda izgotovleniya polnogo s'yemnogo plastinchnogo proteza pri neperenosimosti akrilovoy plastmassy [Clinical testing of an improved method of manufacturing a complete removable laminar prosthesis in case of intolerance to acrylic plastic]. Ukrainian Dental Almanac. 2011; 4: 42-45. (In Russian).
4. Paliychuk I.V. Analiz vykorystannya riznykh vydiv ortopedychnykh konstruksiy ta yikh vplyv na slizovuyu obolonku porozhnyny rota [Analysis of the use of various types of orthopedic structures and their influence on the oral mucosa]. Dental news. 2015; 2 (83): 17-18. (In Ukrainian).
5. Zholudev S.Ye. Rabochaya klasifikatsiya zabolevaniy slizistoy obolochki proteznogo lozha u lits, pol'zuyushchikhsya s'yemnymi akrilovymi protezami [The working classification of diseases of the mucous membrane of the prosthetic bed in persons using removable acrylic prostheses]. Dentistry problems. 2005; 3: 40-43. (In Russian).
6. Bayraktar, Guvener B, Bural C. Influence of polymerization method, curing process, and length of time of storage in water on the residual methyl methacrylate content in dental acrylic resins. J Biomed Mater Res B Appl Biomater. 2006;76:340-345.
7. Nidzelskiy M.Ya., Davydenko V.Yu., Davydenko H.M. Porivnyal'na kharakterystyka rivny zalyshkovoho monomeru v bazysakh znimnykh proteziv iz akrylovykh plastmas, vyhotovlenykh za riznymi tekhnolohiyamy polimeryzatsiyi [Comparative characteristics of the residual monomer level in the bases of removable prostheses made of acrylic plastics, made according to different polymerization technologies]. Bulletin of Biology and Medicine. 2014; 2(2): 45-48. (In Ukrainian).
8. Kostik M., Pejic A., Igic M. Adverse reactions to denture resin materials. European Review for Medical and Pharmacological Sciences. 2017; 21:5298-5305.
9. Labunets' V. A. Kozlov O. V., Shabliy V. F. et al. Zahal'ni polozhennya zabezpechennya systemy yakosti v zubotekhnichnomu vyrobnytstvi [General Provisions for Quality Assurance in Dental Engineering]. Visnyk stomatolohiyi. 2010; 1: 49-51. (In Ukrainian).
10. Mikhaylova S. G. Razvitiye i formirovaniye atrofii proteznogo lozha pod bazysami polnykh s'yomnykh protezov v zavisimosti ot tekhnologii ikh izgotovleniya [The development and formation of atrophy of the prosthetic bed under the bases of complete removable prostheses depending on the technology of their manufacture]. Tauride medical-biological bulletin. 2009; 4(48): 141-144. (In Russian).
11. Vakhnenko O. M. Analiz stanu normatyvnoyi bazy, shcho rehulyuye nadannya stomatolohichnoyi dopomohy naseleennyu Ukrayiny [Analysis of the status of the normative base that regulates the provision of dental care to the Ukrainian population]. Sovremennaya stomatolohyya. 2009; 4: 145-147. (In Ukrainian).
12. Gozhaya L.D. Allergicheskkiye i toksiko-khimicheskkiye stomatity, obuslovlennyye materialami zubnykh protezov : metod. posobiye dlya vrachey stomatologov. [Allergic and toxic-chemical stomatitis caused by the materials of dentures: method]. Moscow; 2001, 31 p.
13. Gonçalves T.S., Morganti M.A., Campos L.C. Allergy to auto-polymerized acrylic resin in an orthodontic patient. Am J Orthod Dentofacial Orthop. 2006;129:431-435.
14. Krychka N.V. Problema vidpovidnosti proteznomu lozhu, mitsnosti ta biolohichnyy indyferentnosti proteziv iz akrylovykh plastmas [The problem of the suitability of the prosthetic bed, durability and biological indifference of the prosthetics from acrylic plastics]. Problems of Continuous Medical Education and Science. 2015; 3: 79-82. (In Ukrainian).
15. Sokolovs'ka V. M., Nidzel's'kyy M. YA., Dudchenko M. O. Vplyv akrylovykh plastmas na slizovuyu obolonku porozhnyny rota [Influence of acrylic plastics on the mucous membrane of the oral cavity]. Dermatovenereology. Cosmetology. Sexual pathology. 2015; 3-4: 212-215. (In Ukrainian).
16. Chirkova N.V., Komarova Yu. N. Analiz faktorov, vliyayushchikh na period adaptatsii u patsiyentov so s'yemnymi plastinchnymi protezami [Analysis of factors affecting the adaptation period in patients with removable laminar prostheses]. Modern orthopedic dentistry. 2011;15:50. (In Russian).
17. Zverkhanovskiy A.A., Yarovaya A.V., Maksimenko P.V. Optimizatsiya konstruksii polnogo s'yemnogo proteza s tsel'yu profilaktiki proteznykh stomatitov. [Optimization of the design of a complete removable prosthesis for the prevention of prosthetic stomatitis]. Ukraïns'kiy stomatologichniy al'manakh. 2016; 3: 30-35. (In Russian).
18. Rashid H., Sheikh Z., Vohra F. Allergic effects of the residual monomer used in denture base acrylic resins. Eur J Dent. 2015; 9: 614-619.
19. Neves C.B., Lopes L.P., Ferrao H.F. et al. Ethanol postpolymerization treatment for improving the biocompatibility of acrylic relines resins. Biomed Res Int. 2013;2013:485246.
20. Nik TH, Shahroudi AS, Eraghihzhadeh Z, Aghajani F. Comparison of residual monomer loss from cold-cure orthodontic acrylic resins processed by different polymerization techniques. J Orthod. 2014;41:30-7.
21. Romanova Yu.G., Novitskaya I.K., Vit V.V. Deystviye metilmetakrilata na slizistuyu obolochku polosti rta (morfologicheskoye issledovaniye). [Effects of methyl methacrylate on the oral mucosa (morphological study) Experimental and clinical medicine. 2012; 4: 50-53. (In Russian).
22. Bettencourt A.F., Pinheiro L.M., Castro M.F. et al. Biodegradation of acrylic based resins. Dental Materials. 2010;26(5):171-180.
23. Blanca Liliana Torres León, Altair Antoninha Del Bel Cury, Renata Cunha Matheus Rodrigues Garcia. Loss of residual monomer from resilient lining materials processed by different methods. Rev Odonto Ciênc 2008;23:215-9.
24. Mal'ginov N.N., Podkolzin A.A., Lebedenko I.Yu. Sanitarno-khimicheskkiye svoystva bazisnykh plastmass v zavisimosti ot rezhimov polimerizatsii. [Sanitary-chemical properties of basic plastics, depending on the modes of polymerization]. Russian dental journal. 2000; 1: 11-15. (In Russian).
25. Kuznetsov V.V., Pysarenko O.A. Udoskonalennya tekhnolohiyi pokrashchennya yakosti bazysiv znimnykh plastynkovykh proteziv. [Improving the technology of improving the quality of the bases of removable plate prostheses]. Ukrainian Dental Almanac. 2011; 1: 61-63. (In Ukrainian).

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ORIGINAL ARTICLE

MODELS OF INDIVIDUAL LINEAR DIMENSIONS NECESSARY FOR THE CONSTRUCTION OF THE CORRECT FORM OF DENTAL ARCHES IN YOUNG MEN WITH A WIDE FACE, DEPENDING ON THE FEATURES OF ODONTOMETRIC AND CEPHALOMETRIC INDICATORS

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ABSTRACT

The aim is development and analysis of regression models of linear dimensions necessary for the construction of the correct form of dental arches in young men with a wide face, depending on the features of odontometric and cephalometric indicators.

Material and methods: Primary computed tomographic indices of tooth size and cephalometric parameters of 44 young men with normal occlusion were obtained from the data bank of the National Pirogov Memorial Medical University, Vinnytsya. Face type was determined using the Garson morphological index. In licensed statistical package "Statistica 6,0" developed regression models of linear dimensions necessary for the construction of the correct form of dental arches.

Results: As a result of researches, it is established that all 18 reliable models of the sizes used for construction of the correct form of dental arches, depending on peculiarities of odontometric and cephalometric indices with a coefficient from 0.645 to 0.944 are constructed. Built models in adolescents with a broad face type more often include odontometric than cephalometric indicators. The most commonly used odontometric indices are: the width of the crowns of the teeth in the mesio-distal and vestibulo-oral directions, as well as the distance from the middle of the cutting edge to the apex of the root of the teeth in the vestibulo-oral direction.

Conclusions: In adolescents with a broad type of face with normal occlusion, all 18 possible reliable regression models of reproduction of the individual characteristics of the dental arches of the upper and lower jaws were determined and analyzed.

KEY WORDS: young men with orthognathic bite, face type, odontometric and cephalometric parameters, regression analysis, dental arch

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INTRODUCTION

A correct and bright smile has become a kind of "business card" of a person, and thus symbolizes his position in public life. That is why achieving such a result – an excellent "business card" has become the main goal of dentistry in recent decades.

Building a dentition is a complex process that requires a comprehensive approach. To get a harmonious smile, the doctor cannot act in a formulaic fashion. It should be based on the features of the patient's face, considering anthropometric points, and features of the teeth, considering odontometric parameters.

The fact of the relationship of the cranial skull with the parameters of the upper and lower jaws is proved. Differences of transversal sizes of lower and upper jaws in girls and boys with different head shapes revealed [1]. Specifics were also found in such odontometric parameters as the root length of the incisors and canines on the upper and lower jaws. Higher values of the investigated parameters were found in the representatives of mesocephals compared to brachycephals [2]. Face types affect the ratio of dental arches of the upper and lower jaws [3].

Equally important is the ethnic and regional component. Bedoya A. et al found significant differences in the bite force, dental arch transversal width, and bizygomatic width scores from representatives of three different tribes living in the Amazon. [4]. In this regard, there is a need to conduct research on individual populations, considering ethnicity. Such works are actively appearing in different corners of the world, which testifies to the significant relevance of this topic [5, 6]. Of particular note is the work on the study of the relationship between the type of dental arches and face for different types of occlusion [7, 8].

Only the inclusion of the maximum number of variables (the maximum number of anthropometric points and lines on the brain and facial part of the skull; the maximum number of odontometric indicators) can ensure the completeness and integrity of the study [9].

THE AIM

The aim – development and analysis of regression models of linear dimensions necessary for the construction of the

correct form of dental arches in young men with a wide face, depending on the features of odontometric and cephalometric indicators.

MATERIAL AND METHODS

Primary computed tomographic indices of tooth size and cephalometric parameters of 44 young men and 50 young women with normal occlusion close to orthognathic occlusion (determined by 11 points by MG Bushan et al. [10]) obtained from the data bank of the research center of National Pirogov Memorial Medical University, Vinnytsya. All surveys of young men and young women were conducted on the informed consent principle. Bioethics Committee of National Pirogov Memorial Medical University, Vinnytsya (Protocol No. 3 of March 16, 2017) found that the studies carried out comply with the bioethical and moral requirements of the Declaration of Helsinki, the Council of Europe Convention on Human Rights and Biomedicine (1977), the relevant provisions of WHO and the laws of Ukraine under the order of the Ministry of Health of Ukraine No. 281 of 11.01.2000.

Dental cone-ray tomograph – Veraviewepocs 3D, Morita (Japan) was used for the study. The studies were conducted according to the scheme developed by Gunas I.V., Dmitriev N.A. and Marchenko A.V. [11] within the following characteristics: three-dimensional image volume – 8x8 cm cylinder, 0.2/0.125 mm layer thickness, 11-48 μ Sv irradiation dose, 60-90kV/2-10mA voltage and current.

Metric indices of central (medial) and lateral (lateral) incisors, canines, first and second premolars, as well as the first molars of the upper and lower jaws were studied. Since in the previously conducted by Gunas I.V., Dmitriev N.A. and Marchenko A.V. studies [11] did not establish significant or trending differences when comparing CT-tomography sizes of the same teeth of the right and left sides, we further use the average values of the corresponding teeth on the upper and lower jaws: upper (11) or lower (41) central incisors; upper (12) or lower (42) lateral incisors; upper (13) or lower (43) canines; upper (14) or lower (44) first premolars; upper (15) or lower (45) second premolars; upper (16) or lower (46) first molars.

Measurement of the width of the crowns of the teeth (VSHIR, mm) and the width of the teeth at the level of the anatomic neck (MDDEG, mm) in the mesio-distal direction; width of tooth crowns (TSHIR, mm), width of teeth at the level of anatomic neck (VDEG, mm), distance from anatomical neck to apex of root (VLROOT, mm) and distance from middle of cutting edge to apex of root (L, mm) in vestibulo-oral (vestibulo-lingual) direction; as well as root and incisor root lengths (ALROOT, mm) in the mesio-distal direction were performed in the i-Dixel One Volume Viewer [Ver.1.5.0] J Morita Mfg. Cor.

The following cephalometric dimensions were also measured (using a soft centimeter tape and Martin's compass, mm) [12]: AL_AL is the width of the base of the nose (distance between the alar points); AU_AU – ear diameter (biauricular width); AU_GL is the distance from

the auricular point to the glabella (averaged); AU_GN – distance from auricular point to chin (average); AU_GO is the distance from the auricular point to the angle of the mandible (average); AU_N is the distance from the auricular point to the nasion (averaged); AU_SN – distance from auricular point to subnasion (averaged); AU-I is the distance from the auricular point to the interincisors point (averaged); CHI_CHI is the width of the mouth slit; DUG_AU_AU is a transverse arc measured by a ribbon from the right tragus point to the left; DUGS_G_OP is a sagittal arch measured by a ribbon from a glabella to the occipital point; DUG_G_OP – the largest girth of the head due to the glabella and nasion; EK_EK – exterior (biorbital) width (direct size between the outer corners of the eye slits); EU_EU – maximum head width (occipital diameter); FMT_FMT – smallest width of head (frontal diameter); G_OP – the greatest length of the head, is the distance from the glabella to the opisthocranium; GO_GN – mandibular body length (average); GO_GO – width of mandible (width between corners of mandible); LS_LI – height of red lip border; MF_MF is the inter-orbital (anterior inter-orbital) width (straight distance between the inner corners of the eye pits); N_GN – morphological length of the face (direct distance from the nasion to the gnathion); N_I is the distance between the nasion and the interincision point; N_PR – distance between nasion and prosthion; N_PRN – length of nose (distance between nasion and pronasion); N_SN – the height of the nose (distance between the supra-nasal and sub-nasal points); N_STO – the height of the upper part of the face (distance from the nasal to the oral points); SN_PRN – depth of nose (distance between sub-nasal point and pronasion); SN_STO – height of upper lip (distance from sub-nasal point to sthomonion); STO_GN – height of lower part of face (distance from mouth to chin point); STO_SPM – height of lower lip (distance from sthomonion to suprumental); TR_GN – physiological length of face (distance from trichion to gnathion); TR_N – forehead height (straight distance between trichion points (hairline) and nasion); V_GOL – the projection distance from the crown of the head (vertex) to the upper edge of the ear hole; ZM_ZM – average width of face (distance between zygomatic maxillary (zygomatic maxillary) points); ZY_ZY – width of face (distance between zygomatic points).

The type of face was determined using the Garson morphological index – the ratio of the morphological length of the face (the direct distance from the nasion to the gnathion) to the width of the face in the area of zygomatic arches [13]. With a value of up to 78.9 young men were referred to a group with a very wide face; 79.0-83.9 – wide face; 84.0-87.9 – average face; 88.0-92.9 – narrow face; 93.0 and above – very narrow face. The following distribution was established: with a very wide face – 6, with a wide face – 25, with an average face – 6, with a narrow face – 6, with a very narrow face – 1. Therefore, only young men with a wide face were selected for modeling.

In licensed statistical package “Statistica 6,0”, using direct stepwise regression analysis, constructed mathematical models of the following characteristics of dental arches (mm),

depending on the features of odontometric and cephalometric indices: distances between the apexes of the palatine roots of the upper first molars (NAPX_16), between the apexes of the distal buccal roots of the upper first molars (DAPX_16), between the apexes of the medial buccal (vestibular) roots of the upper first molars (MAPX_16), between the apexes of the medial roots of the lower first molars (MAPX_46), between the apexes of the distal roots of the lower first molars (DAPX_46), between the molar points by Pon (PONM), between the premolar points by Pon (PONPR), between the vestibular medial cusp of the upper first molars (VESTBUGM), and between the cusp of the upper canine (BUGR13_23), between the apexes of the roots of the upper canine (APX13_23), between the cusp of the lower canine (BUGR33_43), between the apexes of the roots of the lower canine (APX33_43); as well as canine sagittal distance of the maxillary dental arch (DL_C), premolar sagittal distance of the maxillary dental arch (DL_F), molar sagittal distance of the maxillary dental arch (DL_S), depth of palate at the level of canine (GL_1) (GL_2) and palate depths at the level of the first molars (GL_3).

The following conditions were considered in the regression analysis: the final variant of the obtained equation must have a coefficient of determination (R^2) of at least 0.60; an F-criterion value of at least 3.0; the number of free members should be as low as possible. Residue analysis was also performed: when the obtained results fell within ± 3 standard deviations from the mean, re-analysis with and without emissions was performed to ensure that they did not have any effect on the displacement of the final results [14].

RESULTS

In adolescents with a wide face type, regression models of linear dimensions necessary to construct the correct form of dental arches, depending on the odontometric and cephalometric indicators have the following linear equations:

$$\text{NAPX}_{16} = -0,316 + 5,930 \times \text{MDDEG}_{42} + 3,670 \times \text{VSHIR}_{12} - 3,402 \times \text{TSHIR}_{15} + 0,069 \times \text{DUGS}_{G_OP} - 0,639 \times L_{41} + 1,308 \times \text{TSHIR}_{44} \quad (R^2=0,845; F_{(6,18)}=16,34; p<0,001);$$

$$\text{DAPX}_{16} = 64,63 + 3,723 \times \text{VSHIR}_{45} + 3,244 \times \text{TSHIR}_{13} - 0,424 \times \text{GO}_{GO} - 1,601 \times L_{42} + 1,111 \times L_{14} + 0,752 \times \text{VLROOT}_{43} - 0,588 \times \text{SN}_{PRN} \quad (R^2=0,883; F_{(7,17)}=18,33; p<0,001);$$

$$\text{MAPX}_{16} = 15,33 + 2,206 \times \text{VSHIR}_{45} + 5,748 \times \text{TSHIR}_{41} + 0,943 \times \text{SN}_{STO} - 0,285 \times G_{OP} + 0,699 \times \text{SN}_{PRN} + 0,102 \times \text{TR}_{N} \quad (R^2=0,900; F_{(6,18)}=27,14; p<0,001);$$

$$\text{MAPX}_{46} = 15,90 + 2,250 \times \text{TSHIR}_{16} + 1,497 \times L_{43} - 3,870 \times \text{MDDEG}_{41} - 0,290 \times N_{SN} - 1,265 \times \text{VLROOT}_{11} + 2,428 \times \text{VSHIR}_{13} \quad (R^2=0,936; F_{(6,17)}=41,54; p<0,001);$$

$$\text{DAPX}_{46} = -0,170 + 0,326 \times \text{SN}_{STO} + 4,992 \times \text{VSHIR}_{14} - 3,805 \times \text{VDEG}_{42} + 1,886 \times \text{MDDEG}_{12} + 1,511 \times \text{TSHIR}_{16} - 1,359 \times \text{TSHIR}_{14} \quad (R^2=0,793; F_{(7,16)}=8,73; p<0,001);$$

$$\text{PONM} = 6,372 + 1,373 \times \text{TSHIR}_{15} + 0,205 \times \text{AU}_{GN} + 2,825 \times \text{VDEG}_{43} - 0,367 \times N_{SN} - 2,155 \times \text{VDEG}_{42} + 2,490 \times \text{VSHIR}_{44} - 0,520 \times \text{TSHIR}_{14} \quad (R^2=0,893; F_{(7,17)}=20,34; p<0,001);$$

$$\text{VESTBUGM} = -6,515 + 1,213 \times \text{TSHIR}_{15} + 0,313 \times \text{AU}_{GN} + 2,441 \times \text{VSHIR}_{43} - 0,234 \times N_{SN} + 0,685 \times L_{44} - 0,388 \times L_{13} \quad (R^2=0,914; F_{(6,18)}=31,76; p<0,001);$$

$$\text{PONPR} = -8,931 + 1,404 \times \text{VSHIR}_{43} + 1,116 \times \text{VSHIR}_{16} + 0,077 \times \text{ZM}_{ZM} + 0,982 \times \text{VSHIR}_{12} + 1,401 \times \text{TSHIR}_{11} - 0,261 \times \text{VLROOT}_{41} + 0,178 \times L_{12} \quad (R^2=0,942; F_{(7,17)}=39,31; p<0,001);$$

$$\text{BUGR13}_{23} = -59,91 + 3,618 \times \text{VSHIR}_{11} + 0,107 \times \text{DUG}_{G_OP} + 2,863 \times \text{VDEG}_{43} + 0,960 \times \text{ALROOT}_{42} - 0,328 \times L_{42} - 0,268 \times N_{STO} - 1,116 \times \text{MDDEG}_{11} \quad (R^2=0,904; F_{(7,17)}=22,82; p<0,001);$$

$$\text{APX13}_{23} = 57,98 + 0,686 \times L_{14} + 1,562 \times \text{MDDEG}_{12} - 3,119 \times \text{VSHIR}_{43} - 0,418 \times \text{VLROOT}_{41} - 0,155 \times \text{TR}_{N} + 0,495 \times \text{LS}_{LI} - 0,151 \times \text{V}_{GOL} \quad (R^2=0,875; F_{(7,16)}=16,04; p<0,001);$$

$$\text{BUGR33}_{43} = 8,675 + 2,529 \times \text{VSHIR}_{12} + 0,724 \times L_{44} - 0,619 \times \text{ALROOT}_{11} - 1,921 \times \text{MDDEG}_{12} + 2,243 \times \text{VDEG}_{42} - 0,311 \times L_{14} \quad (R^2=0,944; F_{(7,17)}=41,25; p<0,001);$$

$$\text{APX33}_{43} = 6,277 + 0,177 \times \text{AU}_{GO} - 0,603 \times \text{STO}_{SPM} + 1,115 \times \text{VSHIR}_{43} - 1,359 \times \text{VLROOT}_{11} + 0,812 \times L_{43} + 1,493 \times \text{VSHIR}_{12} \quad (R^2=0,768; F_{(6,18)}=9,91; p<0,001);$$

$$\text{DL}_{C} = -26,14 + 1,775 \times \text{VSHIR}_{11} + 0,103 \times \text{EU}_{EU} + 1,160 \times \text{MDDEG}_{42} \quad (R^2=0,645; F_{(3,21)}=12,72; p<0,001);$$

$$\text{DL}_{F} = -10,64 + 2,038 \times \text{VSHIR}_{11} + 0,682 \times \text{VSHIR}_{43} + 1,208 \times \text{VSHIR}_{41} \quad (R^2=0,701; F_{(3,21)}=16,38; p<0,001);$$

$$\text{DL}_{S} = 16,01 + 2,154 \times \text{VSHIR}_{11} + 2,735 \times \text{VSHIR}_{44} - 1,945 \times \text{MDDEG}_{12} - 0,066 \times \text{AU}_{AU} + 0,259 \times \text{MF}_{MF} + 0,521 \times \text{ALROOT}_{11} - 0,499 \times \text{VLROOT}_{12} - 0,944 \times \text{VSHIR}_{16} \quad (R^2=0,937; F_{(8,16)}=29,88; p<0,001);$$

$$\text{GL}_{1} = -8,194 - 1,674 \times \text{VLROOT}_{12} + 0,427 \times \text{ALROOT}_{13} + 0,116 \times \text{DUG}_{G_OP} - 0,637 \times L_{43} - 0,198 \times \text{AU}_{GO} + 0,735 \times \text{ALROOT}_{11} - 0,271 \times \text{AL}_{AL} \quad (R^2=0,905; F_{(7,17)}=23,14; p<0,001);$$

$$\text{GL}_{2} = 22,52 + 1,252 \times \text{VLROOT}_{13} - 0,242 \times \text{EK}_{EK} + 4,779 \times \text{VSHIR}_{44} - 5,757 \times \text{VSHIR}_{14} + 1,307 \times \text{TSHIR}_{14} - 1,366 \times \text{VSHIR}_{12} \quad (R^2=0,901; F_{(6,18)}=27,12; p<0,001);$$

$$\text{GL}_{3} = -69,49 + 0,364 \times \text{EU}_{EU} + 2,722 \times \text{TSHIR}_{43} - 0,148 \times \text{EK}_{EK} - 0,282 \times N_{I} + 0,113 \times \text{DUG}_{G_OP} - 0,041 \times \text{DUGS}_{G_OP} \quad (R^2=0,795; F_{(6,18)}=11,60; p<0,001).$$

DISCUSSION

The data obtained allow us to supplement the picture we obtained in previous studies and to make comparisons.

Of the 18 possible computed tomography sizes used to construct the correct dental arch shape, for young men with a wide face type constructed all 18 reliable models, depending on the characteristics of odontometric and cephalometric indicators with a coefficient of determination from 0.645 to 0.944. In previous studies of Marchenko A.V. with colleagues [15, 16, 17] on a similar sample, it was found that the young men of the general group and mesocephals had 17 reliable models each

(respectively R^2 from 0.640 to 0.889 and 0.806 to 0.980), and in brachycephals – also all 18 models (R^2 from 0.894 to 0.965).

As a result of the analysis of our data, it is found that models built for young men with a wide face type more often include odontometric (69.7 %, of which 20.2 % are on the upper incisors; 12.8 % – on the lower incisors; 4.6 % – upper canines; 11.0 % – lower canines; 10.1 % – upper premolars; 7.3 % – lower premolars; 3.7 % – upper molars) than cephalometric (30.3 %) indicators. Among the odontometric indices, the most commonly models include: width of crowns of teeth in mesio-distal direction (22.9 %, of which 12.8 % on upper jaw); the width of the crowns of the teeth in the vestibulo-oral direction (11.9 %, of which 9.2 % on the upper jaw) and the distance from the middle of the cutting edge to the apex of the root of the teeth in the vestibulo-oral direction (11.9 %, of which 7.3 % on the lower jaw). Cephalometric indicators most often include: the largest head circumference and nose height (2.8 % each); sagittal arch, greatest width of head, exterior eye width, height of forehead, height of upper lip, depth of nose, distance from auricular point to chin and distance from auricular point to angle of lower jaw (1.8 % each).

In researches of Marchenko A.V. with colleagues [15, 16, 17] found that the models built also more often include odontometric (in the general group – 71.3 %; in mesocephals – 56.3 %; in brachycephals – 74.5 %) than cephalometric indicators (respectively 28.7 – 43.7 – 25.5 %). The authors proved that in the general group and in brachycephals, the models most often include incisors sizes (30.4 and 41.8 %, respectively), and in mesocephals – incisors (20.6 %) and small angular teeth (21.8%). In all groups, among the tooth sizes, the most frequently included tooth crown sizes were mesio-distal (25.4 % overall; mesocephals 13.8 %; brachycephals 16.4 %) and vestibulo-oral (respectively 12.3 – 9.2 – 12.7 %) directions; width of the teeth at the level of the anatomical neck in the mesiodistal direction (respectively 9.0 – 9.2 – 10.0 %); and only in mesocephals – the distance from the middle of the cutting edge to the apex of the root (10.3 %). Among the cephalometric indicators, the most frequently included models were: in the general group – the largest girth of the head (4.1 %), the external eye width, the transverse arc and the ear diameter (2.5 % each); for mesocephals, the average width of the face and the interoptical width (5.7 % each) and the distance between the nasion and the prosthion (3.4 %); in brachycephals – sagittal arch, height of upper lip, height of lower part of face and height of red border of lips (2.7 % each).

However, it should be borne in mind that there are single works, the results of which indicate that there is no connection between the types of face and dental arch. Paranhos L.R. et al. [18] didn't investigate the association between the facial type and mandibular arch morphology among Brazilian Caucasians. The study included a sample comprised of 51 individuals (21 male and 30 female) with occlusion and without previous orthodontic treatment. The facial type was defined by SN.SGn and SN.GoGn. Statistical processing of the obtained results did not reveal statistically significant relationships.

In contrast, the vast majority of works in the analysis of literary sources point to the opposite. Anwar N. and Fida M. [19] compare dental arch dimensions and arch forms in various vertical facial patterns during the study of 100 persons of 13-30 years (40

normodivergent, 30 hypodivergent and 30 hyperdivergent facial patterns). After statistical processing, it was discovered significant differences in arch dimensions in mandibular posterior intermolar width ($p=0.04$) and maxillary total arch length ($p=0.03$).

Serbian researchers studied what types of faces are most commonly present in the population of Serbia and average values for the development of dental arches. Study performed on 300 subjects with class I dentoalveolar relations, for whom were determined the type of face and dental arches. The distribution of face types was: narrow – 50.33%, medium type of face – 30.67%, and wide – 19%. The average anterior width of the lower dental arch was 35.93 mm and for upper was 36.75 mm. And accordingly, posterior – 46.52 mm and 46.53 mm. Average height of the upper dental arch was 24.22 mm, and for the lower dental arch 19.32 mm [20].

Al-Tae H.M. and Al-Joubori S.K. [21] processed maxillary and mandibular occlusal frontal and lateral facial photographs of 90 (45 males and 45 females aged 18-25 years) Iraqi subjects to found the relationship between the shape of the dental arch and the types of face. Statistical data processing revealed significant differences in different groups of malocclusions and revealed manifestations of sexual dimorphism.

A similar study was conducted by a group of Indian scientists [22] on 90 untreated persons (45 males, 45 females in age 17-24 years) whom were measured the Jarabak ratio and performed different dental measurements. As a result, the relationship between cephalometric and dental arches was identified with manifestation of sexual dimorphism as in the previous study.

And as a result, Chinese scientists have conducted research to determine effects of transverse relationships between maxillary arch, mouth, and face on smile esthetics. They, after statistical processing of data, revealed indicators of the ratio of these objects with a probable error, which allow us to develop a kind of formula of a beautiful face [23].

Thus, the development of regression models, considering both craniometric and odontometric parameters, makes it easier for dentists. As can be seen from the literature, not only the anthropometric points but also the ethnic and regional characteristics play an important role in shaping the final outcome of treatment.

CONCLUSIONS

In adolescents with a wide type of face with normal occlusion, close to orthognathic occlusion, all 18 possible reliable (with a coefficient of determination from 0.645 to 0.944) regression models of reproduction of individual characteristics of dental arches of the upper and lower jaw depending on odontometric and cephalometric parameters were constructed.

REFERENCES

1. Gunas I., Glushak A., Samoylenko A. Dental arch Transversal characteristics in boys and girls with orthognathic bite: head shape and face type dependence. *Current Issues in Pharmacy and Medical Sciences*. 2015;28(1):42-45.
2. Marchenko A.V., Gunas I.V., Petrushanko T.O. et al. Computer-tomographic characteristics of root length incisors and canines of the upper and lower jaws in boys and girls with different craniotypes and physiological bite. *Wiadomosci lekarskie (Warsaw, Poland)*. 1960. 2017;70(3 pt 1):499-502.

3. Domenyuk D.A., Vedeshina E.G., Dmitrienko S.V. Correlation of dental arch major linear parameters and odontometric indices given physiological occlusion of permanent teeth in various face types. *Archiv euromedica*. 2016;6(2):18-22.
4. Bedoya A., Osorio J.C., Tamayo J.A. Dental Arch Size, Biting Force, Bizygomatic Width and Face Height in Three Colombian Ethnic Groups. *International Journal of Morphology*. 2015;33(1):55-61.
5. Anwar N., Fida M. Variability of arch forms in various vertical facial patterns. *Journal of the College of Physicians and Surgeons Pakistan*. 2010;20(9):565-570.
6. Othman S.A., Xinwei E.S., Lim S.Y. et al. Comparison of arch form between ethnic Malays and Malaysian Aborigines in Peninsular Malaysia. *The Korean journal of orthodontics*. 2012;42(1):47-54.
7. Traldi A., Valdrighi H.C., Souza L.Z. et al. Evaluation of facial morphology and sagittal relationship between dental arches in primary and mixed dentition. *Dental press journal of orthodontics*. 2015;20(4):63-67.
8. Grippaudo C., Oliva B., Greco A.L. et al. Relationship between vertical facial patterns and dental arch form in class II malocclusion. *Progress in orthodontics*. 2013 Dec 1;14(1):43.
9. Rai R. Correlation of nasal width to inter-canine distance in various arch forms. *The Journal of Indian Prosthodontic Society*. 2010;10(2):123-127.
10. Bushan M.G., Vasylenko Z.S., Hryhoreva L.P. *Spravochnik po ortodontii [Orthodontics Guide]*. Chisinau: Cartya Moldovenienasca; 1990. 486 p. (In Russian)
11. Gunas I.V., Dmitriev N.A., Marchenko A.V. Methodological aspects of computed tomography odontomorphometry of boys and girls with the physiological bite. *Journal of Education, Health and Sport*. 2015;5(11):345-355.
12. Bunak V.V. *Antropometriya. Prakticheskij kurs [Anthropometry. Practical course]*. M.: Uchpedgiz; 1941. 367 p. (In Russian)
13. Profit R.W., Fields H.W., Sarver D.M. *Sovremennaya ortodontiya [Modern orthodontics]*. M.: MEDpress-inform; 2006. 560 p. (In Russian)
14. Radchenko S.G. *Metodologiya regressionnogo analiza [Regression Analysis Methodology]*. Monograph. K. : «Korniychuk»; 2011. 375 p. (In Russian)
15. Marchenko A.V., Petrushanko T.O., Gunas I.V. Modeliuvannia za dopomohoiu rehresiinoho analizu transversalnykh rozmiriv verkhnoi y nyzhnoi shchelepy ta sahitalnykh kharakterystyk zubnoi duhy v yunakiv v zalezhnosti vid osoblyvostei odontometrychnykh i kefalometrychnykh pokaznykiv [Modeling by regression analysis of the transversal dimensions of the maxilla and mandible and the sagittal characteristics of the dental arch in adolescents depending on the features of odontometric and cephalometric parameters]. *Reports of morphology*. 2017;23(1):107-111. (In Ukrainian)
16. Marchenko A.V., Gunas I.V., Petrushanko T.O. Rehresiini modeli indyvidualnykh liniinykh rozmiriv neobkhdnykh dlia pobudovy korektnoi formy zubnoi duhy v yunakiv mezotsefaliv v zalezhnosti vid osoblyvostei odontometrychnykh i kefalometrychnykh pokaznykiv [Regression models of individual linear dimensions required for constructing the correct dental arch shape in mesocephals youth, depending on the features of odontometric and cephalometric indicators]. *World of medicine and biology*. 2017;2(60):83-88. (In Ukrainian)
17. Marchenko A.V. Modeliuvannia transversalnykh rozmiriv verkhnoi y nyzhnoi shchelepy ta sahitalnykh kharakterystyk zubnoi duhy v yunakiv-brakhikhefaliv v zalezhnosti vid osoblyvostei odontometrychnykh i kefalometrychnykh pokaznykiv [Modeling of transversal dimensions of the maxilla and mandible and sagittal characteristics of dental arch in young brachycephals depending on the features of odontometric and cephalometric parameters]. *Bulletin of the Vinnitsa National Medical University*. 2017;21(2):396-400. (In Ukrainian)
18. Paranhos L.R., Ramos A.L., de Novaes Benedicto E. et al. Is there any association between facial type and mandibular dental arch form in subjects with normal occlusion? *Acta Scientiarum. Health Sciences*. 2014;36(1):129-134.
19. Anwar N., Fida M. Clinical applicability of variations in arch dimensions and arch forms among various vertical facial patterns. *Journal of the College of Physicians and Surgeons Pakistan*. 2011;21(11):685-690.
20. Arbutina A., Čupić S., Umičević-Davidović M. et al. Face types and sizes of dental arches in subjects with class I molar relationship. *Glasnik Antropološkog društva Srbije*. 2012(47):41-50.
21. Al-Tae H.M., Al-Joubori S.K. Dental arches dimensions, forms and its association to facial types in a sample of Iraqi adults with skeletal and dental class II-division 1 and class III malocclusion (A cross sectional study). *Journal of Baghdad College of Dentistry*. 2014;26(2):160-166.
22. Khera A.K., Singh G.K., Sharma V.P. et al. Relationship between dental arch dimensions and vertical facial morphology in class I subjects. *Journal of Indian Orthodontic Society*. 2012;46(4_2):316-324.
23. Zhang K., Huang L., Yang L. et al. Effects of transverse relationships between maxillary arch, mouth, and face on smile esthetics. *The Angle Orthodontist*. 2016;86(1):135-141.

Research on the normative indicators of health of the population of Ukraine are included in the Concept of the National Program «Health 2020: The Ukrainian dimension» (Ordinance of the Cabinet of Ministers of Ukraine of 31.10.2011 №1164-p). The work is a fragment of scientific topics National Pirogov Memorial Medical University, Vinnytsia «Current trends and newest technologies in the diagnosis and treatment of odontopathology, diseases of periodontal tissues and mucous membrane of the mouth» (State registration number: 0119U005471).

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ORIGINAL ARTICLE

BITTEN WOUNDS OF THE MAXILLOFACIAL AREA IN CHILDREN

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ABSTRACT

The aim of the work is to determine the frequency, structure, features of clinical manifestations and treatment of bitten wounds of the face and neck in children of Poltava region. **Materials and methods:** It has been analyzed 91 histories of disease of thematic patients undergone treatment at the Surgical Department of Pediatric town clinical hospital of Poltava.

Results: In the structure of traumatic injuries of maxillofacial area in children 5.3% were patients with bitten wounds of the face and neck. Among the injured were children of the age 7-12 years old (30.2%). In 74.7% of cases, the bites were complicated by acute inflammatory processes. Urban residents accounted for 71.8% of the total number of cases, while rural residents accounted for 28.2%. Boys were injured by 53.6% and girls by 46.4%. Sharps (74.5%), punctures (19.3%) and lacerations (6.2%) differed in form. The comprehensive treatment of patients with bitten maxillofacial area wounds was carried out according to the protocol of care.

Conclusions: The clinical picture and severity of bitten wounds of maxillofacial area in children have individual features, which are largely due to topographic and anatomical localization of injuries.

The choice of the optimal variant of primary surgical treatment of wounds and the amount of surgery should be determined individually depending on the severity of the injury, the time of injury. Special attention should be paid to normalization of psycho-emotional state of patients and prevention of scar formation.

KEY WORDS: children, bitten wounds, maxillofacial area, treatment

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INTRODUCTION

It is known that the age-specific features of the anatomical structure of the face cause the versatility and sometimes inconsistency of the general appearance of post-traumatic wound defects of severity and the nature of the injury itself. According to statistics, the most frequent causes of injuries of the maxillofacial area (MFA) in children are road accidents (41.3%), domestic (39.6%) and sport (13%) injuries and other factors (6, 1%) [1, 2, 3]. In 65% of cases, children between the ages of 6 and 14 are injured, and boys are twice as likely as girls. About 35% are 4-5-year-old patients treated for soft tissue injury (ST), with injuries inflicted by animals predominant in the structure of injuries [4, 5]. In general, the frequency of bitten wounds among all traumatic injuries is 7-12%, and in the area of head and neck – up to 34.5% with a steady tendency to increase their number recently [6, 7].

Researchers say that dogs, cats, rodents, insects, or humans are the most affected by bites, moreover (up to 84%) injuries caused most often with dogs, most of them (up to 67%) being vaccinated, and cats (15.4%) [4, 8, 9].

The likelihood of damage to facial muscles with their multifaceted interconnection and cause and effect disorders, especially neurological ones, requires a well-tailored individual approach to the treatment and rehabilitation of each individual child [8].

Research of the staff of our department has revealed disorders of psycho-emotional state and behavioral reactions

in children with injuries of ST, which is why traumatization of the psyche was the most frequent: even when visual assessment of their appearance, such patients had negative reactions, which were followed during communication with each other on all stages of comprehensive medical care. This necessitated the need to pay considerable attention to the outreach work not only with the child but also with her relatives. In addition, special attention should be paid to improving their quality of life in the postoperative period by determining the ways of sedation in this category of patients and the need for correction of changes in the oral fluid [10].

THE AIM

The aim of the work is to determine the frequency, structure, features of clinical manifestations and treatment of bitten wounds of the face and neck in children of Poltava region.

MATERIALS AND METHODS

The staff of the Department of Pediatric Surgical Dentistry thoroughly analyzed the content of 91 histories of disease of thematic patients who were treated at the surgical department of Town Polyclinic of Pediatric Dentistry of Poltava for an 8-year period, determining the frequency and structure of bitten wounds of the head, face and neck. Clini-

cal symptomatology of the course of the wound process and features of treatment of the bitten wounds are determined by direct observation of the respective patients. General clinical, additional, and sometimes special examination methods were used to determine the clinical diagnosis.

Given that there is no detailed classification of bitten wounds of MFA in children, in clinical practice we used a general surgical nomenclature, separately distinguishing any bites caused by non-native predators, considering them, like other researchers [4, 6], quite difficult.

In some cases, they used a rather interesting, in our opinion, the clinical classification of injuries of MFA, caused by dogs, in children, proposed by V.V. Liubym (2004), where the author takes into account the degree of injuries and their number, the presence of facial injuries, the occurrence of clinical symptoms of infection [8, 11].

The collection of anamnesis of the disease included the determination of the species of the animal, its location and time and circumstances of the injury, the nature of the previous measures. In general, the treatment of patients was carried out according to the protocol of providing medical care to patients with bitten wounds, but the choice of the optimal variant for primary surgical treatment of wounds and the amount of surgical intervention depended on the severity of the injury, taking into account the individual topographic-anatomical localization of the injury itself [4, 7, 8, 8].

RESULTS AND DISCUSSION

In the table 1 it is showed the average distribution of the bitten wounds of the MFA according to localization, which in some way coincides with the data given in the literature concerning the occurrence of these types of traumatic injuries in other regions of Ukraine [4, 5, 6]. They accounted for 5.3% of the total number of patients with various traumatic injuries of MFA. The largest part of the injuries was in the anatomical areas, which were prominent: the lips, cheeks, nose and multiple wounds have a small proportion (Table I).

Of the victims, urban residents accounted for 71.8% of the total population, while rural residents accounted for 28.2%. Boys were injured by 53.6% and girls by 46.4% (Table II).

The careful collection of medical history allowed us to determine that a large percentage of bitten wounds in the nursery, preschool and young age groups are due mainly to improper conditions of animals, carelessness and irresponsibility of parents, features of child psychology (curiosity, lack of insanity) little life experience and inability to reasonably understand the possible consequences. Instead, in the older age group, injuries are primarily caused by adolescents' challenging behavior, which, in the absence of animal communication skills, predominantly provoked the latter's response and resulted in bites. This is the opinion of other researchers, too [1, 2, 3, 4, 6, 8].

In our observations, animal bites were most often recorded in the summer (68 cases – 74.7%). Depending on

the type and degree of physical contact of the child with the animal, there were salivation of the skin on the area of the saddles, salivation of the damaged skin with the intact mucous membrane, light bites (single, shallow, combined with bites of the limbs, trunk,) single bites and scratches of the brush (except fingers), salinization of damaged mucous membranes, severe bites (any bites of the head, face, neck, fingers, wide bites).

Sharps (74.5%), punctures (19.3%), and lacerations wounds (6.2%) were distinguished by their shape, and the torn ones, irregularly shaped, were usually accompanied by significant distortion of the damaged tissues and bleeding profusely, most often formed after a sharp fang of animals, they had a deep wound canal with a small inlet.

In all cases, there was a pronounced glow of the edges of the wound, especially in the area of the lips, the naso-labial folds and cheeks, creating the appearance of great loss of tissues, and with damage to the circular muscle there was no tight closing of the lips and their eversion. With such injuries, ST swelling developed rapidly. In the case of injury to the lip, cheek, tip or wings of the nose and ear, defects of tissues of different sizes, shape and configuration are more likely to occur (Fig. 1).

At the objective examination it was not forgotten about the possibility of damage to the parotid gland and branches of the facial nerve, which can provoke a false idea of the nature and severity of injury, and in the mandibular area – the possible damage to the mandibular salivary gland and vessels. The features of the location and nature of the wounds around the eyes and the mouth during primary surgical treatment were taken into account to prevent the appearance of scar deformities, eyelid rotation and red lip edging.

According to the researchers, wounds after animal bites are mostly contaminated with the microflora that grows in their mouth, and presents microorganisms with pronounced pathogenic properties (aerobes (*St.aureus*, *Str.viridans*, gram-negative rods, etc.), anaerobes (*Act. Fusobacterium spp.*, *Prevotella spp.*, *Porphyromonas spp.*) And viruses, which can provoke infectious inflammatory process with their suppuration and the possibility of developing abscesses and phlegmon. Bitten wounds can be a gateway to the bacterium *Capnocytophaga canimorsus*, which can cause lightning sepsis or infection with tetanus. After a bite (or scratching) of cats, the development of felinosis («cat scratch disease»), caused by the *Bartonella hensellae* germ, and most often occurs as chronic regional lymphadenitis, is possible. It should also be borne in mind that animals, especially homeless and unvaccinated animals, are likely to be a source of rabies virus [1, 2, 3, 9, 12].

The above stipulates the need for preventive measures against rabies and tetanus, which are organized, conducted and controlled at the state level in accordance with the normative documents (Order of the Ministry of Health of Ukraine of April 15, 2004 №205 «On Improvement of Measures for the Prevention of Rabies Diseases», MPH Order Ukraine dated 29.11.2007 No. 757 «On Amendments to the Order of the Ministry of Health of Ukraine dated 15.04.2004

Table I. Distribution of bitten wounds of maxillofacial area by location

Anatomical area						
lips	cheeks	cheekbone	eyelids	nose	ear shells	multiple damage
35%	29%	8%	2%	5%	1.8%	19.2%

Table II. Distribution of patients with bite wounds of the maxillofacial area by age

Age group			
from 1 to 3 years	from 3 to 7 years	from 7 to 12 years	12 to 15 years
15.9%	24.6%	30.2%	29.3%



Fig. 1. The appearance of patients with bitten wounds of different anatomical localization on the head and neck at the stages of treatment

No. 205» On Improvement of Measures ... «, Annual Orders of the Ministry of Health of Ukraine «On Improvement of Prophylactic Vaccinations in Ukraine») [7, 8].

Paragraph 3 of the above Order clearly provides the first aid instruction to the injured person, according to which we thoroughly washed the wounds, scratches, saddles, covered areas with a stream of liquid soap, treated the edges of the wounds with 70° alcohol or 5% tincture of iodine, imposed a sterile bandage. The edges of the wound were not healed within 3 days, except for the injuries that required

special surgical interventions and according to vital indications: several guide stitches were applied after numerous pre-treatment wounds. To stop external bleeding, flashes of bleeding vessels were performed. A special registration form N 058/o is completed for the purpose and course of anti-rabies vaccinations.

To summarize, anti-rabbinic care consists of local wound treatment, administration of an anti-rabbit vaccine, or concomitant administration of anti-rabbit immunoglobulin and vaccine. Given that the rabies virus spreads perineu-

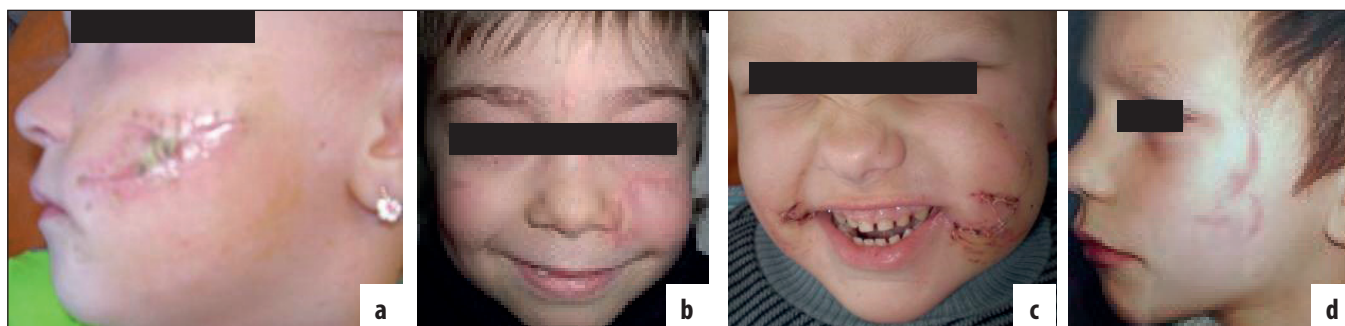


Fig. 2. General appearance of the face of children with scars formed after healing of bitten wounds



Fig. 3. The appearance of the face of the child Yu, 3.5 years, 1.5 years after the received bitten injuries. Cicatricial deformities of the eyelids of the left eye

rally at a rate of 3-5mm per hour and bites inflicted in the MFA are located close enough to different departments of the CNS, and the choice of the wrong vaccination tactics can quickly lead to fatal consequences, we together with the radiologist have decided to determine indications for immediate anti-rabies vaccination, after which the children have been under our care for at least 30 minutes. After the course of immunotherapy, a certificate was issued indicating the type and series of drugs, the course of vaccinations, post-vaccination reactions. There is also a generally accepted general scheme of treatment-and-prophylactic vaccinations (regardless of the localization of the injury) [7].

In our observations, 80 children accompanied by relatives (87.9%) went to the clinic for the first day after the trauma independently, 6 persons (6.6%) were referred from trauma centers and 5 (5.5%) were admitted through the clinic. at the place of residence. However, in 68 cases (74.7%) the course of the bitten wounds was accompanied by the appearance of symptoms of acute inflammatory process of different severity. In 4 patients (4.4%), there was a partial difference in sutures. We did not observe any other complications during the hospital stay.

The anamnesis collection revealed that relatives of only 21 patients (23.1%) knew about the need for simple preventive measures for rabies that can be applied at home, and in these families, after the bite, carefully treated the wounds of 10% of the economic district. soap from the periphery to the center, preventing the spread of driftwood in the adjacent areas.

In 89 patients (97.8%), immediately after hospitalization, we immediately began primary surgical treatment of wounds, and in 2 cases (2.2%) they were quite insignificant in size and depth of lesions and they healed under the scab. Before surgery, questions were resolved on the type of anesthesia, the choice of suture, the immobilization of the operated area of the face and the subsequent nutrition of the child, taking into account the peculiarities of the anatomical location of the wounds.

The choice of method of anesthesia depended on the type and prevalence of the wound, its location and age of the child. In 51 cases (56.0%) children were operated on with intravenous anesthesia, in 32 – (35.2%) under infiltration anesthesia. In 8 traumatized (8.8%) with extensive and deep wounds, surgical interventions were performed under intubation anesthesia. In local anesthesia, 25 children out of 32 (78.1%) preferred infiltration anesthesia with a low concentration anesthetic solution, 5 – (15.6%) performed conduction anesthesia, and 2 – (6.3%) used a combination of them. In cases where surgical treatment was performed under general anesthesia, the indication for the choice of intubation anesthesia was the presence of wounds in the oral cavity or in cases where they penetrated into it.

It should be noted that the surgical treatment of the bitten wounds of the face and neck of each patient had certain difficulties, because they took into account the shape, location, nature and severity of the injury. To date, there are many unresolved issues regarding the features of surgical care in this category of patients, which are the basis for lively discussion in literature [1, 2, 4, 7, 8, 13].

In general, the suturing of penetrating wounds was layer-by-layer, starting with the oral mucosa with precise comparison of the direction of the muscle fibers, gentle excision of the non-viable areas and subsequent drainage for 2-3 days, except for shallow and small wounds. Sutures were applied to the skin, taking into account the Langer voltage lines. It should be noted that the most difficult to treat were bitten wounds in the area of the nose, eyelids and ears.

In the case of bite or full tear off of the flap of the nose, cheeks or ears, the latter were repaired in 6 patients (6.6%), having previously evaluated their viability and the timing of injuries. The postoperative period was necessarily accompanied by hypothermia of the replanted part of tissues for 1-2 days for 2-3 hours and carrying out of complex medication therapy.

According to the researchers, even when the signs of the inability of the tissues to full healing, their partial restoration is possible, because during the necrotization of the flap, the wound has time to fill with granulations, reducing the area of the defect. Replants that were previously housed in a clean plastic bag, had ice, and were sometimes stored for up to 24 hours were best used. The larger the implant by area, the shorter its storage life prior to implantation [4, 8], which coincided with the results we have accumulated.

In children with complicated course of the ST wound process and in the absence of treatment of fresh post-traumatic scars (Fig. 2), scar deformities are most often formed (13 patients – 14.3%), which led to aesthetic and functional disorders of individual areas of the face and neck. They caused impaired growth of anatomical structures, led to the emergence of psycho-emotional disorders with impaired social adaptation of the child and very difficult to correct [10] (Fig. 3).

We did not observe keloid scars. In 12 patients (13.5%) there were hypertrophic scars, while in the other 77 patients (86.5%) where primary surgery was performed, they were visually evaluated as normotrophic.

To prevent coarse scarring in all cases, a set of measures was carried out, which included external ointment therapy after the removal of sutures elastoprotectors («Tsepan», «Warren», «Kontraktubeks») 3-4 g/d up to 6 months, pressing point massage on the scar through 7 days after suture removal, mimetic gymnastics (covers the muscles located in the projection of scars) 7 days after suture removal, physiotherapy (UFO at the time of sutures, electrophoresis with lidase and potassium iodide after suture removal). Considering the timing of scar formation [5], this complex, when necessary, was repeated 4-6 times a year by a course of 10-15 procedures, which in most cases allowed to obtain a good cosmetic result. For the same purpose, we have recently introduced into clinical practice an enzyme complex with collagenolytic proteases «Fermenkol»; whose pharmacological action is aimed at the destruction of the components of the scar (collagen and hyaluronic acid). It has selective activity against the process of transformation of collagen, helps to reduce the thickness of the epidermis and dermis in areas of scar-altered skin. We apply «Fermenkol» in the form of applications (30-40 days, interval between courses 10-14 days), phonophoresis (10-12 procedures, interval between courses 10-14 days), electrophoresis (10-15 procedures, interval between courses 7- 10 days). This technique has already shown good immediate results, and considering that, the children who received such treatment are under the supervision of the dispensary, its effectiveness in the long term we will consider in the following publications. If it is necessary, surgical correction of hypertrophic scars is carried out, as indicated, no earlier than 1-2 years after injury.

CONCLUSIONS

1. In the structure of traumatic injuries of MFA in children who were hospitalized in the surgical department of PTCL of Poltava in the 8-year period, 5.3% were patients with bitten wounds of the face and neck. Among the injured persons were predominantly children 7-12 years (30.2%) with the highest proportion of wounds of the anatomical areas, which are prominent in relief. In 74.7% of cases, the bites were complicated by acute inflammatory processes.
2. 87.9% of the victims approached the clinic with the assistance and support of their relatives, 6.6% were referred from trauma centers and 5.5% were admitted through the polyclinic at the place of residence. The clinical picture and severity of bitten MFA wounds in children have individual features, which are largely due to topographic and anatomical localization of injuries.
3. Complex treatment of patients with bitten MFA wounds should be carried out according to the protocol of care for patients with bitten wounds, however, the choice of the optimal variant for primary surgical treatment of wounds and the amount of surgery should be determined individually depending on the severity of the injury, the duration of treatment compulsory consideration of the patient's vaccination. Particular attention should be paid to the normalization of the psycho-emotional state of patients and the prevention of scar formation.

REFERENCES

1. Zelenskiy V.A., Mukhoramov F.S. Detskaya khirurgicheskaya stomatologiya i chelyustno-litsevaya khirurgiya [Pediatric surgical dentistry and oral and maxillofacial surgery]. Moscow: Medicine; 2008, 206 p. (Ru)
2. Topolnitskiy O.Z. Stomatologiya detskogo vozrasta. Khirurgiya [Dentistry of childhood. Surgery]. Moscow: GEOTAR-Media; 2016, 311 p. (Ru)
3. Khar'kov L.V., Yakovenko L.M., Chekhova I.A. Khirurhichna stomatolohiya dytyachoho viku [Surgical dentistry of childhood]. Kyiv: Book Plus; 2003, 480 p. (UK)
4. Khar'kov L.V., Yakovenko L.N., Yefimenko V.P. ta in. Ukushennyye rany chelyustno-litsevoy oblasti u detey i ikh lecheniye [Bitten wounds of the maxillofacial region in children and their treatment]. Sovremennaya stomatologiya. 1998; 4: 40-46. (Ru)
5. Hurzhii O.V., Bilokon' S.O., Krychevs'ka N.M. ta in. Chastota ta struktura ukushenykh ran miakykh tkanyn oblychchya ditey [Frequency and structure of bitten wounds of soft tissues of children's face]. Medichna gazeta Poltavshini. 2004 March 26. (UK)
6. Kutsevlyak V.I., Tkachenko L.V., Lyubyy V.V. ta in. Analiz povrezhdeniy, nanesennykh zhyvotnymi, v Khar'kovskom regione [Analysis of damage caused by animals in the Kharkov region]. Voprosy eksperimentalnoy i klinicheskoy stomatologii. 2003; 5: 23-25. (Ru)
7. Tkachenko P.I., Bilokon' S.O., Lokmatova N.M. ta in. Ushkodzhennia shchepno-lytsevoi dilianky u ditey [Damage to the maxillofacial area in children]: navchalnij posibnik. Poltava; 2019, 119 p. (UK)
8. Lyubyy V.V. Lecheniye detey s ukushennymi ranami chelyustno-litsevoy oblasti, nanesennymi sobakami (kliniko-mikrobiologicheskoye issledovaniye) [Treatment of children with bitten wounds of the maxillofacial area inflicted by dogs (clinical and microbiological examination)]: dis ... cand. Med. nauk: Ukrainskaya Medicinskaya Stomatologicheskaya Akademiya. Poltava, 2004. 140 p. (Ru)

9. Tkachenko P.I., Starchenko I.I., Bilokon S.O. ta in. Insect bites as the cause of infectious and allergic inflammatory processes of the maxillofacial area in children. *Wiad. Lek.* 2019; 72 (5): 950-955.
10. Tkachenko P.I., Dobroskok V.O., Bilokon' S.O. ta in. Proiavy stresornoj reaktsii u ditej pry travmatychnomu poskodzhenni shchepno-lytsevoi dilianky [Manifestations of stress response in children with traumatic damage to the maxillofacial area]. *Aktualni problemi suchasnoyi medicini.* 2017; 2: 274-279. (Uk)
11. Kutsevlyak V.I., Lyubyy V.V. Rabochaya klassifikatsiya povrezhdeniy tkaney chelyustno-litsevoy oblasti, nanosenykh sobakami, u detey [Working classification of injuries of the tissues of the maxillofacial area caused by dogs in children]. *Voprosy eksperimentalnoj i klinicheskoy stomatologii.* 2003; 6: 175-177. (Ru)
12. Tkachenko P.I., Starchenko I.I., Bilokon' S.O. ta in. Nespetsyfichni limfadenity shchepno-lytsevoi dilianky u ditej (kliniko-morfolohichni aspekty [Non-specific lymphadenitis of the maxillofacial area in children (clinical and morphological aspects)]. *Poltava*, 2018. 120 p. (Uk)
13. Strachunskiy LS, Bedenkov AV. Antibakterial'naya terapiya ukushennykh ran u detey [Antibacterial therapy for bitten wounds in children]. *Detskij doktor.* 2000; 4: 32-33. (Ru)

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ORIGINAL ARTICLE

PAIN AS LEADING SYNDROME OF THE SOMATOFORM DISORDERS AT THE PEDIATRICKS

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ABSTRACT

The aim: Study of somatoform vegetative dysfunction' clinical features at adolescent age with a chronic pain (HA syndrome and AP syndrome), and also socially-psychological factors of its formation too.

Materials and methods: There are 82 teenagers have been examined in this research: 48 girls (58,5 %) and 34 young men (41,5 %) at the age of 16 – 17 years. Research will be done according to diagnostic criteria of ICD-10.

Results: An aetiological basis of HAS and APS are various somatoform disorder mostly at teenage age (70,8 % cases at girls and in 58,8 % – at young men). 32,2 % of the patients had various neurotic disturbances with anxiety-depressive symptoms in a genesis of HAS and APS. Somatoform vegetative dysfunction – the most widespread reason of HAS and APS development among teenagers. Among teenagers HAS cases (68,8 % – at girls, 58,8 % – at young men) essentially prevail over APS (31,2 and 41,2 % cases accordingly). All adolescents had combine negative life events in their life. Girls felt psychotraumatic experience more strongly than young man. The greatest combine negative life experience has been revealed in a subgroup of girls with HAS. The least influence of psychotraumatic factors was observed at young men with APS.

Consequently, SVD, accompanied by severe pain in adolescence – is pathogenic complex and combined mental disorders, requiring adequate psychopharmacological and psychotherapeutic intervention.

Conclusions: Chronic stressful situations were experienced by each of the examined patients. Each of the teens noted combination of stress problems in their lives. The widespread common problem among the examined adolescents was a sense of being overprotected by parents. Consequently, SVD, accompanied by severe pain in adolescence – is pathogenic complex and combined mental disorders, requiring adequate psychopharmacological and psychotherapeutic intervention.

KEY WORDS: somatoform disorder, headache, abdomen pain, abuse syndrome, addictive behavior

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INTRODUCTION

Different variants of somatoform disorders – are one of the most widespread types of mental disorders occurring now in adolescence in common somatic practice. Much of the pathology is presented by autonomic dysfunction syndrome (SVD). Clinical pathogenetic basis of SVD – is dysregulations of suprasedgmental vegetative structures, developing as a systemic reaction of higher nervous and mental activity on acute or chronic emotional stress. So SVD manifests as vegetative disorders, various emotional and cognitive and behavioral disorders, in which intrapersonal psychological conflict is not expressed by psychopathological symptoms, but by somatic equivalents – somatoform neurotic complex of symptoms. Adolescence is characterized by polymorphic clinical picture of SVD. But almost all the variations of SVD in adolescents are accompanied by functional disorders of cardiovascular system and gastrointestinal tract, as well as pain. Most commonly, symptoms of chronic pain manifest in adolescents in the form of syndromes of cephalgia (CE), cardialgia (CA) and abdominal pain (AB). Psychosocial nature – is the basis of this cluster of psychopathological disorders, when somatic symptoms

become the main manifestation of emotional and interpersonal problems in adolescents. [1, 2] One can attribute psychophysical infantilism, destructive parenting styles, alexithymia to psychological qualities and characteristics of personality, which condition the formation of SVD in adolescence [3,4].

Due to the whole complexity of pathogenesis SVD is often the basis for the development of comorbid mental and behavioral pathology.

Therefore, early diagnosis and effective treatment of SVD in adolescence – is the major problem of modern psychiatry, as the complexity of their differential diagnosis and therapy is connected with the fact that an important pathogenetic role in the development of psychopathologic disorders is played by psychological mechanisms and social factors [5].

THE AIM

To study clinical features of formation of comorbid combination of SVD with manifestations of chronic pain (CEs and ABes) and different kinds of addictive behavior in adolescents.

MATERIALS AND METHODS

Within the research, 82 adolescents were examined: 48 girls (58.5%) and 34 boys (41.5 %) aged 16 – 17. All teenagers were students of senior high school. Reason for seeking psychiatric help was badly jugulated pain or failure to jugulate pain without identification of any serious somatic disease that can cause similar pain. Differential diagnostic examination of patients was conducted according to the diagnostic criteria for mental and behavioral disorders within the ICD-10 [6], statistical data processing – by methods of variation statistics using Microsoft Excel. The study complies with: Law of Ukraine «Про лікарські засоби» № 123/96-ВР from 04.04.96 р., ст. 8; requirements of the Directive 2001/20/EU The European Parliament and the Council; Convention on the Protection of Human Rights and Dignity in the Application of Biology and Medicine Convention on Human Rights and Biomedicine (1997 y.), Of the Law of Ukraine «About psychiatric help»; The Declaration of Helsinki: Recommendations for Doctors in Biomedical Research with Human Involvement (1964); WHO recommendations to the Ethics Committees, conducting the examination of biomedical research; requirements of Good Clinical Practice (GCP).

RESULTS AND DISCUSSION

Table I shows the distribution of adolescents according to sex, as well as according to identified psychopathological nosologies and in accordance with presence of headache syndrome or gastralgia. It was found that somatoform vegetative dysfunction with cephalgia syndrome (F45.30) was most frequently observed in the group of examined adolescents – 23,2% of cases. In general, among the patients examined, more than in half of cases SVD was the leading clinical manifestation of various somatoform disorders (60.9 %) in 29 girls (60.4 %) and 20 boys (58.8%). Anxiety and depressive symptoms within various disorders were recorded in the whole of 32.9 % of cases: in 17 girls (35.4 %) and 10 boys (29.4%). Least likely to cause the formation of SVD were asthenic symptoms within organic disorder of CNS, which was predominantly detected in boys. CEes prevailed among both girls and boys considerably, in comparison with the number of cases, in which abdominal pain was presented as the leading complaint. But if the number of cases of CEes in boys was for 17.7% higher than the number of patients with ABes ($p < 0.05$), among the girls this difference was already 37.5 % – that is almost twice as much ($p < 0.01$). An important result was the data that in both girls and boys in identifying hypochondriacal disorder (F45.2) and chronic pain disorder (F45.4) ABes remarkably prevailed over CEes ($p < 0.05$).

As is known and as mentioned above, SVD is somatoform expression of affective reaction to experiencing chronic or acute emotional stress. So SVD is considered as the conversion of unresolved intrapersonal and interpersonal conflicts. The results of diagnostic examination of adolescents showed that acute or chronic stressful situations occurred in each of the examined patients. Data,

obtained during the diagnostic interview of patients, are presented in Table II.

Overall, each of the adolescents talked about combination of different problematic areas, stressors in their lives. The greatest number of combined traumatic factors was identified in the subgroup of girls with CEes and it reached 139.1 % in relation to the total number of patients in this subgroup. In other subgroups level of stressors was considerably lower and did not exceed 90 % ($p < 0.01$). The obtained results showed that among girls experiencing psycho-traumatic factors was notably stronger than among boys. The least influence of stressful factors was found in boys with ABes.

The most common problem among the examined adolescents was sense of being overprotected by parents (65.9 % of cases). At the same time there was remarkable difference in such style of parent-child relationships in boys and girls. Among girls, suffering CEes and ABes, overprotection by parents was observed in almost equal numbers of cases and in more than 80% of patients. And among boys with ABes such style of parental behavior was detected 2.6 times more frequently ($p < 0.01$).

An important indicator of increased stress vulnerability of the examined adolescents was the second most common among them prevalence of feelings of psychological loneliness. More than half of the patients reported that they felt such feeling (51.2 % of adolescents in general). Psychological loneliness was mostly experienced by patients with ABes – both boys and girls. At that girls of the subgroup with ABes considerably more frequently experienced psychological loneliness as compared to patients of other subgroups ($p < 0.01$).

Almost half of the examined adolescents called frequent conflicts with parents and fear of the future as traumatic effects – in whole in 46.3 and 45.1% respectively. Constant conflicts with parents considerably more often were detected in boys with CEes, and fear of the future – in young men and women with ABes ($p < 0.05$). Patients of both sexes with ABes also considerably more often called a sense of constant misunderstanding of their experiences and condition by parents, as well as anxiety and fears about inability to meet the expectations of relatives as a psychogenic stressor ($p < 0.05$). These psychogenic factors were not so significant for adolescents, suffering CEes.

Rather important result was the data that almost every fourth teenager (overall 26.8 % of cases) had a sense of meaninglessness in relation to his/her own life, which directly correlated with the severity of depressive symptoms in patients, as shown in Tables II and III.

Specific feature of these disorders is that in girls with CEes (18.2%) and ABes (26.7%) they were less common. At ABes among both boys and girls meaninglessness was experienced by every fourth patient. The fact that boys with CEes experienced meaninglessness significantly more frequently indicates a high probability of comorbid transition of SVD to depressive pathology. This thesis was confirmed by the data that 40.0 % of boys with CEes had constant conflicts with teachers at school. The majority of

Table 1. Distribution of adolescents according to gender, nosological entities disorders and a leading pain syndrome (CEes and ABes), absolute amount (%)

Nosological forms of disorders	Examined patients				Total in groups
	boys, N = 34		girls, N = 48		
	CEes	ABes	CEes	ABes	
Somatoform vegetative dysfunction with CEes, F45.30	6** (30,0)	-	13** (39,4)	-	19 (23,2)
Hypochondriacal disorder, F45.2	1 (5,0)	3* (21,4)	2 (6,1)	6** (40,0)	12 (14,6)
Panic disorder, F41.0	3* (15,0)	-	7* (21,2)	-	10 (12,2)
Slight depressive episode with somatic symptoms, F32.01	2 (10,0)	3 (21,4)	3 (9,1)	2 (13,3)	10 (12,2)
Chronic pain disorder, F45.4	2 (10,0)	4* (28,6)	1 (3,0)	3* (20,0)	10 (12,2)
Somatoform autonomic dysfunction with ABes, F45.31	-	4** (28,6)	-	4** (26,7)	8 (9,8)
Adjustment disorder: depressive reaction with CEes, F43.21	2 (10,0)	-	5* (15,2)	-	7 (8,5)
Asthenic organic disorder of CNS with CEes, F06.6	4* (20,0)	-	2 (6,1)	-	6 (7,3)
Total (% of the total number of patients)	20 (24,3)	14 (17,1)	33* (40,2)	15 (18,3)	82 (100)

* p < 0,05; ** p < 0,01.

Table 2. Distribution of adolescents according to gender, the leading pain syndrome (CEes and ABes), presence of intrapersonal and interpersonal problems, absolute amount (%)

The content of the problems	Examined patients				Total in groups
	boys, N = 34		girls, N = 48		
	CEes, N = 20	ABes, N = 14	CEes, N = 33	ABes, N = 15	
Overprotection by parents	5 (25,0)	9** (64,3)	27 (81,8)	13 (86,7)	54 (65,9)
Psychological loneliness	12 (60)	10 (71,4)	8 (24,2)	12 (80,0)	42 (51,2)
Frequent conflicts with parents	11* (55,0)	5(35,7)	16** (48,5)	6 (40,0)	38 (46,3)
Fear of the future	4 (20,0)	11 (78,6)	13 (39,4)	9 (60,0)	37 (45,1)
Misunderstanding with parents	7 (35,0)	7 (50,0)	12 (36,4)	10* (66,7)	36 (43,9)
Fear not to meet expectations	4 (20,0)	6 (42,9)	15 (45,5)	11 (73,3)	36 (43,9)
Meaninglessness	8* (40,0)	4 (28,6)	6 (18,2)	4 (26,7)	22 (26,8)
Conflicts with teachers	8 (40,0)	4 (28,6)	5 (15,2)	2 (13,3)	19 (23,2)
Unsubstantiated claims of parents	6 (30,0)	4 (28,6)	6 (18,2)	3 (20,0)	19 (23,2)
Conflicts with close friends	3 (15,0)	2*(14,3)	5 (15,2)	2 (13,3)	12 (14,6)
Total (% of total patients)	68 (82,9)	62 (75,6)	113** (139,1)	72 (87,8)	82 (100)

* p < 0,05; ** p < 0,01.

patients in this subgroup had constant conflicts with parents (in 55.0 % of cases), experienced sense of psychological isolation (60.0 %) and suffered more often than others (30.0 % of cases) from unsubstantiated claims, accusations from parents. These data support the conclusion that CEes in boys correlate with severe affective (depressive symptoms) and behavioral disorders (oppositional protest behavior).

An important factor in understanding the nature of psychogenic basis in the formation of CEes and ABes in the examined adolescents was that conflicts with close friends were considered by the patients as the most significant

psycho-traumatic impact most rarely – overall in 14.6 % of cases and in almost equal proportions in all subgroups. Consequently, availability of problems in family relationships and depressing intrapersonal experiences have more significant pathogenetic sense in the development of neurotic (somatoform) and behavioral disorders in adolescence. These results were confirmed by rather low importance of conflict situations at school, with teachers for adolescents (overall in 23.2 % of cases).

In patients, in whom the leading manifestation of SVD was CEes, minimum level of depression was recorded at asthenic

Table 3. Distribution of adolescents according to gender, leading pain syndrome (CEes and ABes), nature of addictive behavior, absolute amount (%).

Characteristics of addictive behavior	Examined patients				Total in groups
	boys, N = 34		girls, N = 48		
	CEes, N = 20	ABes, N = 14	CEes, N = 33	ABes, N = 15	
Emotionally dependent relationship in the family	6 (30,0)	9 (64,3)	26 (78,8)	14 (93,3)	55 (67,1)
Internet addiction of social networking	8 (40,0)	6 (42,9)	26 (78,8)	7 (46,7)	47 (57,3)
Gaming Internet addiction	17 (85,0)	10 (71,4)	7 (21,2)	9 (60,0)	43 (52,4)
Occasional use of drugs	12 (60,0)	5 (35,7)	3 (9,1)	-	20 (24,4)
Nicotine Addiction	13 (65,0)	6 (42,9)	-	-	19 (23,2)
Emotionally addictive relationship with a partner	4 (20,0)	-	6 (18,2)	2 (13,3)	12 (14,6)
Abuse of alcohol (beer)	8 (40,0)	2 (14,3)	-	-	10 (12,2)
Cannabinoid addiction	6 (30,0)	-	-	-	6 (7,3)
Food addiction (anorexia)	-	-	-	5 (33,3)	5 (6,1)
Total (% to number of patients in group)	70 (350,0)	38 (271,4)	68 (206,1)	37 (246,7)	82 (100)

organic CNS disorder with CEes (F06.6), and the maximum one – at the depressive reaction with CEes (F43.21), chronic pain disorder (F45.4) and mild depressive episode with somatic symptoms (F32.01). Severity of depression in girls considerably prevailed in all kinds of nosological disorders ($p < 0.05$). The exception was only mild depressive episode, at which maximum severity of depressive symptoms was recorded in young men ($24,8 \pm 2,8$ points). The same tendency of notable prevalence of depressive experiences among girls was observed in patients with ABes. Only at chronic pain disorder (F45.4) in boys and girls the highest level of depression was recorded. The fact that at chronic pain disorder and mild depressive episode the highest level of depressive symptoms was observed indicated that: these types of mental pathology are subjectively most severely suffered by teenagers. All the adolescents (11 boys and 9 girls), who were diagnosed with these types of pathology, reported troublesome relationships in family and school during a long time. However, they did not associate their mental state with interpersonal problems, experienced by them.

CONCLUSIONS

Thus, it was found during the research that among the examined patients adolescents who were diagnosed CEes remarkably prevailed over those who had ABes. Leading etiological basis of pain syndrome in adolescence are different variants of somatoform disorders. Significant contribution to the genesis of CEes and ABes is also made by affective neurotic disorders.

Chronic stressful situations were experienced by each of the examined patients. Each of the teens noted combination of stress problems in their lives. Overall among girls influence of psycho traumatic impact on formation of SVD was considerably stronger than among boys. The largest number of combined psycho traumatic factors was identified in the subgroup of girls with CEes. The

least stressful influence of psycho traumatic factors was observed in young men with ABes.

The widespread common problem among the examined adolescents was a sense of being overprotected by parents (65.9 % of cases). At the same time there was considerable difference in similar style of parent-child relationships in boys and girls. 51.2 % of teens said they felt sense of psychological isolation, that is most typical for of patients with ABes. Overall in 46.3 and 45.1 % of the examined adolescents frequent conflicts with parents and fear of the future were called as traumatic effects. In boys CEes correlated with severe affective and behavioral disorders.

The study of depression level according to A. Beck depression inventory found that all the examined patients had at least moderate severity of depressive symptoms. Patients with CEes had maximum depression level, recorded in the depressive reaction with CEes (F43.21), chronic pain disorder (F45.4) and mild depressive episode with somatic symptoms (F32.01). Severity of depression in girls notably prevailed at almost all kinds of nosological disorders ($p < 0.05$). The highest level of depression in both boys and girls was observed at chronic pain disorder (F45.4).

It is important to note that all the examined patients did not consult psychiatrist timely, as the main complaint among adolescents were headache or abdominal pain, masked mental disorders. Consequently, SVD, accompanied by severe pain in adolescence – is pathogenic complex and combined mental disorders, requiring adequate psychopharmacological and psychotherapeutic intervention.

REFERENCES

1. Antropov Y.F. Psychosomatic disorders in children and adolescents. Moscow, 1997, p.198
2. Isaev D.N. Psychosomatic disorders in children. St. Petersburg: Peter, 2000. p. 512.
3. Mendelevich V.D., Solovieva S.L. Neurosologia and psychosomatic medicine. Moscow: Medpress-inform, 2002. p. 608.

4. Bräutigam V., Christian, P., Rad M. Psychosomatic Medicine. Moscow, 1999. p.376
5. Aleksander F. Psychosomatic medicine. Principles and application. Moscow: Perrls, 2000. p. 296
6. Rodtsevych O.G. Somatoform vegetative dysfunction of digestive system in children: clinical findings, diagnostics, treatment. Medical news. 2010. 1: 40-41.

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CLINICAL AND MICROBIOLOGICAL ASSESSMENT OF ROOT CANAL DECONTAMINATION IN CHRONIC APICAL PERIODONTITIS USING THE ULTRASOUND

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ABSTRACT

The aim: To study the effectiveness of chronic apical periodontitis treatment by the combined use of ultrasonic treatment of root canals and multicomponent antimicrobial gel according to the results of clinical and microbiological researches.

Materials and methods: 64 patients with chronic apical periodontitis at the age of 18-56 years were treated. Patients were divided into two groups: the main and control. In the main group the root canals of 36 teeth were sonicated in combination with multicomponent antimicrobial gel, in the control – 35 teeth were treated by a standard method. The content of the root canals for microbiological studies was obtained before endodontic treatment and before permanent obturation. Frequency of content and number of bacteria in the samples were evaluated.

Results: All samples before treatment were positive for the presence of variable bacterial flora, among which *Staphylococcus epidermidis* (43.9%), *Enterococcus faecalis* (37.9%), *Streptococcus spp.* (24.8%), *Candida albicans* (24.4%), *Fusibacterium* (9.4%) were the most dominant, their number was 7.4-4.8 lg CFU/ml. Repeated research after the proposed and standard method of root canal decontamination has shown a significant decrease in microflora. According to the data of clinical and microbiological examination, the method which was developed by us revealed a positive result in 86% of cases compared with 63% when treated by the standard method.

Conclusions: The effectiveness of a complex treatment method with combined use of the ultrasonic irrigation and multicomponent antimicrobial gel for root canals decontamination in chronic apical periodontitis is demonstrated. Significant reduction of microflora growth and destruction of microbial associations, good penetration of multicomponent antimicrobial gel into endodontic structures due to ultrasound compared with a standard method were achieved.

KEY WORDS: chronic apical periodontitis, endodontic treatment, root canal, ultrasound, microbiological examination

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INTRODUCTION

Despite the continuous improvement in the quality of dental care, the prevalence of caries complications is 35-47%. Chronic periodontitis remains a significant problem due to the fact that it causes tooth extraction in 48-80% of cases [1]. According to foreign researchers, in 4-10 years after endodontic treatment, up to 10% of teeth with chronic apical periodontitis are subjected to extraction [2].

The main reason for this is the presence of bacteria that remain in the root canal system. A feature of the microbiocenosis of infected root canals is the complex nature of microbial associations with a prevalence of anaerobic flora [3], among which *Enterococcus faecalis* stands out – an anaerobe that is resistant to many antiseptics. Microorganisms that persist in the dentinal tubules, the apical delta of the lateral canals and their branches as a result of pulp destruction and lack of blood supply maintain a state of chronic inflammation [4]. The chronic foci of infection changes the reactivity of the body and increases the resistance of microorganisms to antibacterial agents, so the fight against foci of chronic infection in the periodontal ligament is of paramount importance [5].

To eliminate microorganisms from the infected root canals system, it requires a widespread introduction of

a modern strategy for endodontic antimicrobial therapy, including thorough antiseptic treatment using medicines of selective action [6-9]. An important component of the success of endodontic treatment of the teeth is the complete and qualitative preparation and obturation of the root canal [2, 10].

The task of the dentist at this stage of treatment is to remove the biofilm and smeared layer from the root canal system [9]. In recent years, ultrasonic systems for biomechanical treatment of root canals have emerged. The action of ultrasound based on the effects of cavitation, acoustic flow, bactericidal effects and increased bacterial activity of antiseptics [11, 12]. The combination of modern technologies for instrumental treatment of root canals with a new generation of antiseptics is a promising direction.

THE AIM

The aim of this research was to study the effectiveness of chronic apical periodontitis treatment by the combined use of ultrasonic treatment of root canals and multicomponent antimicrobial gel according to the results of clinical and microbiological researches.

MATERIALS AND METHODS

Clinical and laboratory studies were carried out in two groups of patients of both sexes aged 18-56 years: the main and control. In 34 patients of the main group 36 teeth were treated: 23 (63.89%) multi-rooted and 13 (36.11%) single-rooted. There were 7 (19.44%) teeth with chronic fibrous apical periodontitis, 18 (50.0%) teeth with chronic granulation and 11 (30.56%) teeth with chronic granulomatous apical periodontitis. In 30 patients of the control group 35 teeth were treated: 9 (25.71%) teeth with chronic fibrous apical periodontitis, 15 (42.86%) with chronic granulation and 11 (31.43%) teeth with chronic granulomatous apical periodontitis.

Treatment of various forms of chronic apical periodontitis in both groups of patients was performed for 2 visits. During the first visit the root canal preparation was carried out using the "Crown-down" technique with the help of X-Smart endomotor and ProTaper system, irrigation of the root canals – with a 3% sodium hypochlorite solution and 15% EDTA. In the main group of patients the root canals were sonicated in combination with multicomponent antimicrobial gel using Suprasson SP 4055 ("Satelec Sas Acteon Division", France). After that in the main group of patients multicomponent antimicrobial gel (the active components of which are metronidazole benzoate, chlorhexidine diacetate 2%, hydrocortisone acetate) was entered into the root canals, in the control – a 2% chlorhexidine gel was applied in the canals. The tooth cavity was isolated with a sterile cotton ball, carious cavity was filled with a temporary cement for 2 days.

On the second re-call in the main group of patients ultrasound biomechanical treatment of root canals with multicomponent antimicrobial gel was repeated, in the control – standart instrumental treatment and irrigation were carried out. In the case of positive dynamics of treatment and checking the tooth on a hermeticity, the root canals of both groups were obturated by method of lateral compaction of gutta-percha with Acroseal sealer ("Septodont", France).

The content of the root canals served as a material for microbiological research, which was obtained on the first visit before endodontic treatment and before permanent obturation. Sampling of material from a root canal was carried out before the drug administration using a sterile endodontic paper pin No. 25, which was kept in a semi-liquid transport medium at 2-4 °C. Material plating was performed on the media for cultivation and identification of the microorganisms. Obtained results were expressed through the decimal logarithm (lg) of the number of colonies of the forming units (CFU), the frequency – in per cents. To justify the choice of an antiseptic in apical periodontitis treatment, the sensitivity assessment of obtained virulent bacteria strains to multicomponent antimicrobial gel and chlorhexidine gel was determined. They were applied by the disc and hole method for gel dosage forms. The effectiveness of the proposed method of treatment was studied according to clinical, radiographic and microbiological studies in terms: during treatment, after 3, 6, 12 and 18 months. The analysis

of statistical data was performed using the method of the Student parametric criterion according to the principle of variation statistics. Values of $p < 0.05$ were considered statistically significant.

All research methods have been examined and approved by the appropriate ethics committee and have therefore been performed in accordance with the ethical standards laid down in the Declaration of Helsinki (1964-2013), ICH GCP (1996), EEC Directive No 609 (of 24.11.1986), Orders of the Ministry of Health of Ukraine № 690 of 23.09.2009, № 944 of 14.12.2009, № 616 of 03.08.2012. An informed consent to participate in the study was received and all patients underwent standard clinical examination in accordance with the medical protocol (Order No. 566 of 11.23.2004).

RESULTS

Based on the results of microbiological researches in each patient an association of various types of bacteria was revealed, when studying the cultural spectrum of the root canal content after creation of endodontic access. From the material that was investigated, aggressive species of pathogenic bacteria and yeast-like fungi were revealed: *Staphylococcus epidermidis*, *Streptococcus spp.*, *Enterococcus faecalis*, *Peptostreptococcus spp.*, *Fusobacterium nucleatum*, *Bacteroides*, *Prevotella spp.*, *Candida albicans*, *Actinomyces spp.*, *Lactobacillus spp.* (Tables I-II).

As can be seen from the above tables, *Staphylococcus epidermidis* (43.9%), *Enterococcus faecalis* (37.9%), *Streptococcus spp.* (24.8%), *Candida albicans* (24.4%), *Fusobacterium nucleatum* (9.4%) were most commonly identified in the patients of the main and control groups before treatment.

In a quantitative study of the root canal microflora in the patients of both groups, a high concentration of *Staphylococcus epidermidis* (7.3 ± 1.1 Ig CFU/ml), *Enterococcus faecalis* (5.5 ± 0.7 CFU/ml), *Streptococcus spp.* (5.7 ± 0.8 Ig CFU/ml), *Candida albicans* (5.3 ± 0.9 Ig CFU/ml) were observed before irrigation and instrumental treatment. The amount of *Peptostreptococcus spp.*, *Fusobacterium nucleatum*, *Bacteroides*, *Prevotella spp.*, *Actinomyces spp.*, *Lactobacillus spp.* averaged 4.2 ± 0.7 Ig CFU/ml.

In the main group of patients after using multicomponent antimicrobial gel in combination with ultrasound, no microbial associations of *Enterococcus faecalis*, *Peptostreptococcus spp.*, *Prevotella spp.*, *Actinomyces spp.*, *Lactobacillus spp.* were revealed.

The frequency of finding other microorganisms was significantly ($p < 0.001$) decreased compared with the initial results. In rare cases, *Staphylococcus epidermidis* (1.6 ± 0.5 Ig CFU/ml), *Streptococcus spp.* (1.1 ± 0.5 Ig CFU/ml), *Candida albicans* (1.2 ± 0.4 Ig CFU/ml), *Bacteroides* (1.2 ± 0.4 Ig CFU/ml), *Fusobacterium nucleatum* (1.1 ± 0.3 Ig CFU/ml) were identified.

In the control group, the detection frequency and the number of bacteria after endodontic treatment also decreased compared with the initial data, however, it was remained significantly ($p < 0.05$) higher than in the main group of patients. The most resistant microorganisms to standard endodontic treatment of the root canal system

Table I. Qualitative and quantitative content of root canal microbiocenosis in chronic apical periodontitis in the main group of patients (n=36)

Kind of microorganism	Frequency of content, %		Bacteria concentration Ig CFU/ml	
	Before treatment	Before obturation	Before treatment	Before obturation
<i>Staphylococcus epidermidis</i>	42.3	18.1	7.2±1.1	1.6±0.5*
<i>Streptococcus spp.</i>	24.5	11.6	5.6±0.8	1.1±0.5*
<i>Enterococcus faecalis</i>	38.4	0	5.5±0.7	0
<i>Peptostreptococcus spp.</i>	5.9	0	4.1±0.6	0
<i>Fusibacterium nucleatum</i>	9.1	2.3	4.3±0.8	1.1±0.3*
<i>Bacteroides</i>	6.0	1.4	4.3±0.7	1.2±0.4*
<i>Prevotella spp</i>	5.5	0	4.3±0.9	0
<i>Candida albicans</i>	23.5	5.6	5.2±0.9	1.2±0.4*
<i>Actinomyces spp.</i>	4.1	0	3.9±0.7	0
<i>Lactobacillus spp.</i>	7.8	0	4.3±0.8	0

Note: * – statistically significant differences in data comparison before and after treatment, p<0.05

Table II. Qualitative and quantitative composition of root canal microbiocenosis in chronic apical periodontitis in the control group of patients (n=35)

Kind of microorganism	Frequency of content, %		Bacteria concentration Ig CFU/ml	
	Before treatment	Before obturation	Before treatment	Before obturation
<i>Staphylococcus epidermidis</i>	41.8	28.9	7.4±1.0	5.1±0.7
<i>Streptococcus spp.</i>	25.1	18.4	5.7±0.7	4.3±0.6*
<i>Enterococcus faecalis</i>	37.3	18.6	5.4±0.8	3.7±0.6
<i>Peptostreptococcus spp.</i>	6.0	0	4.2±0.7	0
<i>Fusibacterium nucleatum</i>	9.7	6.4	4.8±0.8	3.2±0.5
<i>Bacteroides</i>	5.6	1.7	4.1±0.7	2.4±0.5
<i>Prevotella spp</i>	5.2	3.7	3.9±0.8	1.8±0.4*
<i>Candida albicans</i>	25.3	16.1	5.4±0.9	2.3±0.4*
<i>Actinomyces spp.</i>	4.3	0	4.1±0.8	0
<i>Lactobacillus spp.</i>	7.6	2.4	4.2±0.7	2.1±0.5*

Note: * – statistically significant differences in data comparison before and after treatment, p<0,05

were *Staphylococcus epidermidis* (33.9%; 5.1 ± 0.6 Ig CFU/ml), *Enterococcus faecalis* (18.6%; 3.7 ± 0.6 Ig CFU/ml), *Streptococcus spp.* (18.4%; 4.3 ± 0.6 Ig CFU/ml), *Candida albicans* (16.1%; 2.3 ± 0.4 Ig CFU/ml) and *Fusibacterium nucleatum* (6.4%; 3.2 ± 0.5 Ig CFU/ml).

During the control examinations after root canals obturation, complications were occurred in 3 (8.33%) patients of the main group and in 11 (31.43%) patients of the control group. Pain sensations when tooth biting and a slight swelling of the soft tissues quickly disappeared after 2-3 sessions of UHF therapy.

The dynamics of radiographic changes in 3 months after the treatment was practically identical in both groups of patients, although complete bone healing in the periapical area was not observed in any clinical cases. In 6 months on the control X-ray images of treated teeth in the main group of patients the absence of foci destruction in the periapical zone was revealed in 33.33% (12/36) of cases, and reduction of focus of apical bone resorption by ½ or more was evidenced in 41.67% (15/36) of cases. In a year of dynamic evaluation in the main group of patients the expansion of destruction focus in periapical bone

tissues was not established. At the same time, 58.33% (21/36) of patients had complete bone healing, in 27.78% (10/36) of cases the focus of bone destruction was decreased by ½ or more from the initial sizes, and in 13.89% (5/36) of patients the resorption lesion in periapical zone was decreased by less than ½.

In the control group of patients in 34.29% (12/35) of cases the lesion of resorption was decreased by ½ or more of initial sizes, in 25.71% (9/35) of cases a partial healing of periapical bone tissue was observed, in 17.14% (6/35) the focus of bone destruction was not changed, in 20.0% (7/35) of patients the widening of the periapical destruction zone was revealed. The absence of positive dynamics during 12 months of assessment in the main group of patients was noted in 13.89% (5/36) of cases, in the control group – in 37.14% (13/35) of cases.

DISCUSSION

As a result of microbiological studies, it was revealed that all root canals in both groups of patients with chronic apical periodontitis were infected with associative micro-

flora. Facultative anaerobes from the group of gram-negative and gram-positive microorganisms prevailed in the structure of the detected microflora. Most often identified microorganisms were *Staphylococcus epidermidis* (43.9%), *Enterococcus faecalis* (37.9%), *Streptococcus spp.* (24.8%), *Candida albicans* (24.4%), *Fusibacterium nucleatum* (9.4%).

The proposed method of root canal treatment using ultrasound with multicomponent antimicrobial gel promotes rapid canal treatment and complete removal of pulp decay products, qualitative irrigation of additional canals. In 86.11% of platings, the root canal microflora was sensitive to multicomponent antimicrobial gel and only in 62.86% of platings to chlorhexidine gel. Performed microbiological studies have shown that multicomponent antimicrobial gel has a pronounced antibacterial effect on the mixed microflora of the root canals of treated teeth. The use of sonicated antiseptic solutions is a complete method for irrigation of the root canal system, including the macrocanals and microcanals of dentin and cementum, in which pathogenic microorganisms are located.

The traditional method of root canal decontamination is not effective enough for influencing on the pathogenic microflora of the root canals, especially with destructive forms of chronic apical periodontitis. There is a danger of further penetration of *Streptococcus faecalis* directly from the dentinal tubules into the periodontal tissues, and an increase in the number of fusobacteria and bacteroids.

Developed scheme of complex treatment of destructive apical periodontitis using both the ultrasound and multicomponent antibacterial gel has shown microbiological efficiency in comparison with the standard method of periodontitis treatment.

CONCLUSIONS

1. The use of ultrasonic treatment in combination with multicomponent antibacterial gel for root canal decontamination in chronic apical periodontitis allowed to achieve a negative growth of microflora and destruction of microbial associations in 86% of cases, with standard endodontic treatment – in 63% of cases ($p < 0.05$). It proves a high antimicrobial activity of gel and its good penetration into endodontic structures due to ultrasound.
2. A standard endodontic treatment of the root canals is insufficient for the antiseptic action on the pathogenic microflora of the root canals, which was found in destructive forms of chronic apical periodontitis.
3. Clinical and laboratory data indicate the perspectiveness and effectiveness of the combined use of ultrasonic therapy of root canals with multicomponent antibacterial gel in the treatment of chronic apical periodontitis.

REFERENCES

1. Solov'eva Zh.V. Analiz mikroflory kornevogo kanala pri endodonticheskoj patologii po rezul'tatam pervichnogo obsledovaniya pacientov [Analysis of the microflora of the root canal with endodontic pathology according to the results of the primary patients' examination]. *Mezhdunarodnyj zhurnal prikladnyh i fundamental'nyh issledovanij*. 2014; 2:168-172. (In Russian).

2. Shebab E.I., Din Mohamed Saber, Marwa Mohammad Aly Abou Seeda, Ehab Hassanien. The effect of instrument material, taper and degree of root canal curvature on cyclic fatigue of rotary nickel-titanium instruments. *ENDO (Lond Engl.)*. 2013; 7 (1): 59-64.
3. Siqueira J.F., Antunes H.S., Rôças I.N. et al. Microbiome in the apical root canal system of teeth with post-treatment apical periodontitis. *PLoS One*; 11(9): e0162887.
4. Koval O.V. Kliniko-laboratorne obgruntuvannya metodu obrobky korenevnykh kanaliv pry likuvanni khronichnoho periodontytu: avtoref. dys. ... kand. med. nauk : 14.01.22 [Clinical and laboratory substantiation of processing method of the root canals in the treatment of chronic periodontitis]. Abstract of thesis. Odessa, 2011. 19 p. (In Ukrainian).
5. Kostiuk I.R. Vplyv patolohii periodonta na zahalnyi stan orhanizmu. Suchasni metody medykamentoznoho likuvannya periodontytu postiynykh zubiv: perevahy ta nedoliky (ohliad literatury) [Influence of periodontal pathology on the general state of an organism. Modern methods of antiseptic treatment of apical periodontitis of permanent teeth: advantages and disadvantages (literature review)]. *Bukovynskiy medychnyi visnyk*. 2014; T.18, 3(71):199-205. (In Ukrainian).
6. Ishkov M.O., Bielikov O.V., Burdeniuk I.P. Kharakter mikroflory korenevnykh kanaliv pry khronichnykh verkhivkovykh periodontytakh ta yii porivnialna chutlyvist do dii antimikrobynykh preparativ in vitro [The nature of root canal microflora in chronic apical periodontitis and its comparative sensitivity to the action of antimicrobial medicines in vitro]. *Buk. med. visnyk*. 2012; T. 16, 2 (62):67-69. (In Ukrainian).
7. Kazeko L.A. Irrigacionnye rastvory, helatnye agenty i dezinfektanty v endodontii : ucheb.-metod. Posobie [Irrigation solutions, chelating agents and disinfectants in endodontics: textbook]. In: Lobko SS, Kazeko LA. Minsk : BGMU; 2013: 48 p. (In Russian).
8. Nikolishyn A.K., Sidash Yu.V. Suchasni metody medykamentoznoi obrobky korenevnykh kanaliv pry khronichnykh verkhivkovykh periodontytakh [Modern methods of antiseptic treatment of the root canals in chronic apical periodontitis]. *Ukr. stomat. almanakh*. 2010; 3:36-39. (In Ukrainian).
9. Antunes H.S., Rôças I.N., Alves F.R. et al. Total and specific bacterial levels in the apical root canal system of teeth with post-treatment apical periodontitis. *J Endod*. 2015;41(7):1037-1042. doi: S0099-2399(15)00240-X.
10. Gadzhula N.G. Clinical effectiveness of treatment the patients with chronic apical periodontitis. *International Journal of Medicine and Medical Research*. 2016; 2(2):30-33.
11. Barer G.M., Ovchinnikova I.A., Zav'yalova V.A. et al. Ul'trazvuk skvoz' prizmu endodontii [Ultrasound through the prism of endodontics]. *Klinicheskaya stomatologiya*. 2002; 1:32-34. (In Russian).
12. Bonsor S.Dzh., Pirson G.Dzh. Sovremennyye vozmozhnosti klinicheskogo primeneniya fotoaktiviruemoy dezinfekcii [Modern opportunities of clinical applications of photoactivated disinfection]. *Klinicheskaya stomatologiya*. 2007; 1:24-27. (In Russian).

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ORIGINAL ARTICLE

CONCEPTUAL DIRECTIONS IN ORGANIZATION OF MEDICAL ASSISTANCE FOR CHILDREN IN THE CONDITIONS OF EDUCATION

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ABSTRACT

The aim of this work is: to define the Conceptual model of medical provision of children in educational institutions in modern conditions.

Materials and methods: analysis of data from a longitudinal study of children's health; questionnaire of parents, teachers, heads of educational institutions on the volume of medical support for students; questioning students' lifestyle and social determinants of health.

Results: According to the study has determined the medical and social determinants which negative affect on health status of school age children; detected the most appropriate types of school health services which based on the parents, medical and teachers opinion. The important also is monitoring of health status of children for develop of prevent measure for improve health status and forming of healthy lifestyle behavioral. Problematic issues to be addressed include: improving the legal framework on the competences and volumes of health care for pupils in educational institutions; material equipment; setting up a system for monitoring and analyzing the health status of students and educational groups, identifying health risk factors; establishing a continuous multimodal health-oriented system of student-oriented youth behavior.

Conclusions: The health status of students and the level of health-oriented behavior, the reform of the medical sector require introduction of an effective system of medical support for students of organized groups, improving the system of preventive care for students, parents, which is presented in the Conceptual model.

KEY WORDS: school health services, medical care, health status

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INTRODUCTION

The hallmarks of today are the reform of the health care and education systems.

The main changes in the general secondary education system concern the structure of the educational process, the level of educational load, the introduction of a profile education in high school, as well as the introduction of innovative pedagogical technologies, the introduction of an inclusive educational system for children with special needs. All this is happening on a background of reduction of programs that prevent the development and spread of noncommunicable diseases, as well as programs that form health-forming behavior among students; increasing number of children with addictive behaviors and the spread of nervous system diseases, mental and behavioral disorders confirms the imperfection of medico-psychological and pedagogical support of schoolchildren.

Health care reform has touched many aspects of health care, including the health care system of children in organized groups. Preschool departments in pediatric clinics were abolished in accordance with the conditions of reforming the primary care unit. Today, the provision of medical care to children in educational settings is predominantly provided by a nurse, and in case if number of students is

more than one thousand, by both nurse and a doctor who have become full-time units of educational institutions. Mainly, educational institutions do not yet have a license to conduct medical practice, which has led to changes in the types and volumes of medical provision for schoolchildren.

With primary care reform, the volume of patients under the care of a pediatrician or family physician has increased. Many school-age children attend educational institutions not quite near their homes, which makes it impossible to take preventative measures on the level of educational institutions due to the lack of timely monitoring of health of the educational groups. Mean while, educational institutions have a strong potential for influencing health-forming behavior.

Therefore, in order to improve the health of children in educational institutions, prophylaxes and prevention spread of noncommunicable diseases, and to shape the health-oriented behavior of schoolchildren, it is necessary to develop a cross-sectoral approach to health care for children in educational settings.

THE AIM

The aim of this work is to substantiate the concept of health care for children in educational institutions in the context

of reforming the health care system and development of the preventive medicine system.

MATERIALS AND METHODS

Analysis of longitudinal monitoring of the state of health of children (grades 1 through 9), data of parents questionnaire (251), teachers (87), heads of educational institutions (322) and medical professionals (55) on the expedient and possible volumes of medical care for children in terms of educational institutions; a survey of students (821) on lifestyle, social determinants, and health behaviors.

RESULTS AND DISCUSSION

The problem of health formation is multifaceted. Among the factors that determine human health, leading places are those of lifestyle, behavior and health care. When planning preventive measures, it is important to know exactly what factors are being targeted, reducing the impact of what factors or indicators need to be achieved. From this point of view, information about real health is important.

In Ukraine, the main institution that conducts cumulation and analysis of statistical information on health status, provision of health care and health resources is the State Medical Center of the Ministry of Health of Ukraine [1].

Today, due to medical sector reform, some statistical forms for determining the prevalence and structure of diseases among different segments of the population have lost their validity, therefore, a more complete analysis of the health status of the child population of Ukraine can be carried out on the basis of data from the Center for Medical Statistics for 2017 only.

Thus, in the period 2001-2017 yy., in Ukraine the prevalence of diseases changed among children 7-14 years by 2,4%, among adolescents (15-17 years) has increased by 46,6%, (from 1485,7 to 2177,7‰).

The statistics of the average Ukrainian or regional prevalence rates of diseases make it possible to compare them, to determine the most common classes of diseases according to the ages of 7-14 and 15-17 years, to estimate the dynamics of changes. However, this information is rather important for planning strategic directions. But for targeted prevention initiatives it is advisable to determine the dynamics of changes in the health status of children in each educational institution and educational group. Given the potential of a powerful influence of the educational institution, this is logical and appropriate.

Health monitoring, pathological analysis, in particular, helps to identify "critical" periods for the deterioration of students' health, periods of disease manifestation, which provides ample and effective opportunities for preventive work. Thus, an analysis of the health status of students in one of the Kharkiv high schools during the period of their education from the first to the ninth grade showed that the pathological indices are wavy. The increase occurred in the third grade (from 2308,2 to 2860,5‰, $p < 0,05$), mostly among boys. The stage of completion of elementary school

was characterized by the stabilization of adaptation processes, which was manifested by the positive dynamics in the health status of the fourth grade students - the stabilization of the general pathological lesions (PL) to 2715,2‰ ($p > 0,05$) during the school year and improving indexes (up to 2464,3‰, $p < 0,05$) during the summer vacation, which was also most pronounced among boys. Upon further observation, at the elementary school stage, the indicators of general PL increased up to 2766,4‰ during fifth grade studying, among both girls and boys ($p < 0,05$), with maximal PL indexes on the beginning of sixth grade studying (2900,0‰ - among boys, 2880,6‰ - among girls). The following is the dynamics of the decline PL until graduating seventh grade, common for students of both sexes. In the eighth grade, the level of PL increased slightly among boys and girls, but the indexes of PL among girls were higher throughout the school year (2777,8 and 2596,2‰ among girls, vs. 2631,6 and 2333,3‰ among boys). During the ninth grade, girls' PL levels increased and almost did not change among boys. Thus, peak waves of pathological lesion should become the point of application of preventive efforts. The analysis of pathological lesions also allows determining the critical periods for the manifestation of diseases of individual groups. Thus, in our study, the most critical period for elementary school students was the sixth grade, when the highest PL indexes took place in these five disease classes: endocrine system, eating disorders; diseases of the musculoskeletal and urogenital systems, disorders of the psyche and behavior, diseases of the eye and adnexa. For girls, the periods with the highest PL indexes were sixth grade (the highest prevalence of eye and adnexa diseases, respiratory system, and musculoskeletal disorders) and the eighth grade with the highest PL indexes in diseases of digestive system, urogenital system, disorders of the psyche and behavior. That is, health monitoring data enables the introduction of preventive initiatives, taking into account age and gender characteristics, which is crucial for the effectiveness of interventions. When non-communicable pathologies are spread, the health care system must be focused on preventative measures, and the effectiveness of these measures depends on the precise identification of problematic issues for the development of prevention programs. According to WHO, health is mostly correlated with a lifestyle where behavioral factors such as unhealthy eating, low physical activity, tobacco and alcohol use have the most negative effects. Other social determinants of health formation, micro- and macro-social factors, which, among other things, shape worldview and behavior, are also of great importance [2, 3].

Identification of important social factors, factors that influence the formation of health of modern adolescents and determine their life values, identify the risks of deterioration of their health, contribute to the development of targeted prevention programs aimed at shaping the health behavior of modern adolescents. Based on a survey of students, it is possible to obtain information on their adherence to the daily regimen, nutritional status, health behaviors, as well as information on the need for schoolchildren to know the

factors that shape health with the further development of preventive measures. Thus, according to the experts of the State Institution «Institute of Health Protection of Children and Adolescents of NAMS of Ukraine» it is determined that the main reason that hinders a healthy lifestyle is indicated by “lack of time” (49,3%) and “laziness” (32,2%), which indicates an inadequate organization of free time and an unconscious attitude to health. The problem that needs to be corrected is the non-compliance with the regime’s timetables, the lack of interest in health information and health preserving behavior (only 27,0% of students read special editions); “tensed” or “unsatisfying” situation in the family (23,8%). Today, parents have lost control of their children’s sleeping patterns lack of control over the length of night sleep, multiplicity of meals, homework time, or amount of time spent beneath computer. Such studies allow to develop diagnostic tools which determine the factors that have negative affect of medico-social factors on the health and health-oriented behavior of students. Thus, further analysis of the questionnaire data using the method of S. Kulbak in the modification of A. Genkin and E. Gubler allowed to calculate the diagnostic coefficients (DC) of the informative nature of various medical and social factors. Thus, the factors that maximally adversely affect health and health-oriented behavior (with a high DC that has a negative impact) include such medico-social factors as: the fact of smoking of all family members; dissatisfaction with the relationship in the family or a tense situation in it; if a schoolkid does not adhere to a healthy lifestyle or health is the main reason for his/her non-compliance; if they are keen on a show business leaders or have a positive attitude to low alcohol advertising. Poor self-assessment of healthy lifestyle knowledge also becomes a negative factor; the lack of desire or opportunity for physical education, visiting to sports sections is also significant. Low levels of physical activity (1 hour per week), less than 6 hours of nighttime sleep and nutrition, preferably once a day also show high negative effects.

In the context of reforming the educational and medical sectors, a clear vision of the health care system for children in general secondary education settings is needed. Therefore, in order to determine the real opportunities and needs for different types of medical care for students in educational settings, including preventive orientation, a survey was conducted: teachers, heads of educational establishments or their deputies, health care providers of medical assistance to students in educational institutions in different areas of Ukraine.

In conditions of overwhelming absence of licenses for conducting medical activity in educational establishments, preventive work can and should become the main type of work of medical workers in schools. Due to the change of subordination of medical workers to the Ministry of Education and Science of Ukraine, it is the educators who will influence the updating of the functional duties of medical workers of educational institutions, formation of new skills and competences.

According to the survey, the collaboration of health professionals and the teaching staff in educational insti-

tutions is generally effective. For example, according to educators and health professionals among the important sections of the work involvement of a health care worker were identified: working with parents on health issues, conducting anti-epidemic measures, monitoring nutrition and providing emergency care.

Some discrepancies were related to physical education control and health monitoring, to which health care providers paid less attention due to the expansion of primary care physicians.

Principals and educators, in comparison with medical professionals, pay less attention to carrying out in the institution of medical and rehabilitation work with schoolchildren: outpatient admission and carrying out of health measures in the conditions of educational institution, which may be caused by the absence of legislative documents on medical practice.

The existing system of medical support for schoolchildren can be reflected in parents’ assessment. The definition of parents’ vision of certain in-demand medical care for their children at school became important.

According to the survey, it is determined that in general parents are satisfied with medical care in the educational setting; the share of schoolchildren who refer to a health-care provider during the school year is about 60,0%. On the part of parents, the most demanded types of medical care in educational institutions are: assistance in the treatment of a child with complaints (82,2%), obtaining qualified assistance in the event of urgent conditions (36,6%), vaccination (34,7%). Unfortunately, parents do not pay much attention to the importance of preventive work. According to survey only 27,2% of parents are demanding it in schools. That is, when parents give their children under care of educational institution, they expect providing outpatient care to the child if needed, which slightly differs from the opinion of the principals.

Thus, the analysis of the results of monitoring the health of children, determining the risk factors for its deterioration, outlining the requirements for medical assistance from consumers of school medical services, taking into account the needs and value orientations of the students themselves become the basis for the development of purposeful preventive measures at the educational institution or among educational staff. And all this is possible only with the establishment of a clear system of medical care for children in educational institutions, which will facilitate interaction with health care institutions and ensure the effective functioning of the educational institution.

Therefore, in the current conditions of transformation of the education system and the medical sector due to the imperfection of the regulatory framework on the background of further deterioration of children’s health, it is urgent to develop the Concept of health care for children in educational settings, which aims to prevent the spread of non-communicable pathology, development of skills health-oriented behavior.

Problems that need solving nowadays are:
– lack of a clear up-to-date legal framework on the provision of medical assistance to children in terms of educational

- institutions, competences and volumes of medical care;
- the functioning of a system of monitoring the health of educational groups in an educational institution, control of epidemiological situation in an educational institution is not coordinated; identifying risky forms or addictive behaviors among children and adolescents;
- lack of an algorithm for the development and implementation of timely effective and appropriate prevention programs aimed on improving level of health and health-oriented behavior of student youth;
- lack of information system for accounting data on the relationship between the dynamics of health and the effectiveness of preventive measures;
- crisis of the system of professional and competence development for specialists providing medical care to children in educational institutions;
- lack of effective algorithm for intersectoral interaction of specialists who provide medical, prophylactic or medical rehabilitation assistance to students of general secondary educational institutions.

To address these issues, consider the following Conceptual Guidelines for Children's Health Care in Institutions.

Conceptual Guideline 1. Improvement of the system of medical support for children and students in conditions of educational institutions, establishment of medical support for professional self-determination of adolescents, preparation of young men for military service.

Ways of implementation should include:

1. Improvement of the legal support for the health care of children and adolescents, taking into account the existing national legal framework, updating the documents on ensuring the sanitary and hygienic well-being of the conditions of learning;
2. Setting at the legislative level the main structure that should coordinate the activities of school health systems;
3. Improvement of functional duties and competencies of medical workers providing medical assistance in educational institutions, defining ways of their interaction and subordination with other structures and organizations, including issues of medical support of professional self-determination of teenagers, preparation of young men for military service;
4. Updating normative documents on logistical and medical equipment of medical offices of institutions of general secondary education, observance of sanitary and hygienic requirements;
5. Outlining the authority of the medical worker of the educational institution regarding his participation in planning educational activities for the formation of HLS of students, work with parents, participation of the medical worker in these activities, their multiplicity;
6. Determining the feasibility and appropriateness of conducting rehabilitation measures for children with chronic pathology or special medical needs in institutions of general secondary education.

Conceptual Guideline II. Prevention of the prevalence of non-communicable pathology, formation of health preserving behavior of children. Ensuring the sanitary and hygienic well-being of educational institutions.

Measures to guide on:

1. Strengthening health workforce to ensure the effective functioning of medical support children in learning groups; provide an up-to-date algorithm for upgrading their skills and competences;
2. Provide a general health care system for children and students with a team of specialists of the following profiles: pediatricians, adolescent therapists, public health specialists, dietitians, psychologists; social workers; nurses;
3. Provide the capacity of health facilities and vertical structure (at subnational, national and regional levels) to effectively guide and coordinate the health care system of children and adolescents who are enrolled; to define clearly their structural subordination, reporting and communication;
4. Establish a system of monitoring, cross-sectoral interaction for the provision of highly effective medical and preventive care;
5. Introduce strategic planning for healthy lifestyle activities (HLS) with all stakeholders involved;
6. Define standards for assessing the quality of the health care system for children in educational settings, introduce their use (based on the standards proposed by WHO's ERB "European concept of quality standards for school medical services and competencies for school health professionals", development of tools for assessing the quality of care).

The expected results of the implementation of the Conceptual areas of health care for children in educational institutions, taking into account the European experience, are promotion of a significant increase in the efficiency, quality and accessibility of medical care for school-age children, reduce of the prevalence of diseases among the child population, reduce of the prevalence of behaviorally-oriented health risk factors.

Advantages of realization of Conceptual directions:

- optimization of the personnel component of the medical aid system in the conditions of educational institutions;
- coverage of student youth;
- building a clear vertical of subordination and functions to achieve student youth health goals;
- optimizing the health monitoring system and the prevalence of disruptive behavior among children and adolescents, improving the effectiveness of prevention-oriented activities and programs;
- defining the procedure for upgrading the qualification and competencies of medical professionals in educational institutions;
- improvement of the system of intersectoral communication.

CONCLUSIONS

The formation and preservation of the health of the child population is now a problem for both education and health systems. It is appropriate to create and implement school health care measures to ensure that health care is provided to students in educational settings, to prevent the spread of non-communicable diseases and to develop healthy lifestyle skills.

In the context of global change in the country, it is important not to lose some important aspects of children's

health, such as health monitoring, assessing the impact of social determinants, coordinated cross-sectoral interaction to prevent the spread of non-communicable diseases among student youth and developing their health skills oriented behavior.

This is the basis for the creation of a clear system of medical care for children in educational institutions, which is based on the improvement of the legal framework, optimization of the personnel component, establishment of intersectoral interaction, definition of a clear system of monitoring of the health of schoolchildren taking into account the needs and opportunities.

REFERENCES

1. Center for Medical Statistics of the Ministry of Health of Ukraine. URL: <https://moz.gov.ua/article/statistic/centr-medichnoi-statistiki-moz-ukraini>.
2. WHO. Situation of child and adolescent health in Europe (2018). URL: <http://www.euro.who.int/en/health-topics/Life-stages/child-and-adolescent-health/publications/2018/situation-of-child-and-adolescent-health-in-europe-2018>.
3. WHO. Health Behaviour in School-aged Children (HBSC). URL: <http://www.euro.who.int/en/health-topics/Life-stages/child-and-adolescent-health/health-behaviour-in-school-aged-children-hbsc>.

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ASSOCIATION BETWEEN EMOTIONAL-VOLITIONAL DYSFUNCTION AND FEATURES OF AGGRESSION OR HOSTILITY IN MENS WITH DIFFERENT FORMS OF SUBSTANCE ADDICTIONS: A CROSS-SECTIONAL STUDY

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ABSTRACT

The aim: The research aim was to study features of emotional-volitional sphere and its association in mens with different forms of Substance Addictions.

Materials and methods: We examined 146 patients with alcohol and drug addictions using Toronto Alexithymia Scale, Zverkov-Eidmann's questionnaire and Buss-Durkee questionnaire.

Results: The study showed an increase in the overall level of alexithymia, a moderate level of aggressiveness and a sufficient level of volitional self-regulation without a significant difference between the groups. The indirect correlation of "persistence" with the "general level of alexithymia", "difficulty identifying feelings" and "physical aggression" in group 1 and at the same time the indirect correlation between "self-control" and "verbal aggression" and "volitional self-regulation" with "difficulty describing feelings" can be explained by the opposite meaning of these concepts and phenomena themselves. However, it is interesting that the indicators "physical aggression" and "difficulty describing feelings" in group 2 were significantly lower, but at the same time correlated with "general level of alexithymia" and "irritability", respectively. On other hand in group 1 the indicator "suspiciousness" is directly related to the "general level of alexithymia", but its level is significantly lower in comparison with group 2.

Conclusions: The phenomenon of alexithymia is not only recorded in the clinical picture of patients with various forms of addiction, but can also induce the development of manifestations of aggressiveness and hostility in them. Correction of alexithymia is necessary to understand the emotional state of these patients and choose the right approach to their treatment and rehabilitation.

KEY WORDS: alexithymia, hostility, aggression, volitional regulation, substance addiction

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INTRODUCTION

Addiction remains a significant public health concern. The problem of alcohol and drug addictions in according to its significant social role has important subject either for psychiatrists and narcologists or for other physicians. Now the most accepted point of view is supposed biopsychosocial approach considering alcohol addiction as a result of complex interaction of biological, psychological and social factors [1].

Alexithymia refers to the difficulty in identifying and describing feelings, the inability to discriminate between feelings and physical sensations, having a limited fantasy life and the inclination to an externally oriented way of thinking [2]. Alexithymia, which results in poor emotional regulation and stress-management abilities, has sometimes been considered as a vulnerability factor for medical and psychiatric illnesses. Alexithymia has been described as having five main components: a difficulty in identifying one's emotions, a difficulty in describing self-feelings verbally, a reduction or incapability to experience emotions, an externally orientated cognitive style and poor capacity for fantasising or symbolic thought [3].

Alexithymia rates in the general population have been reported to be 9% to 17% for men and 5% to 10% for women, whereas estimates are as high as 70% in some clinical groups [4]. Some researches shown that people with substance abuse disorder have more problems in alexithymia in comparison to the normal people [5,6]. Alexithymia is a multifaceted construct that has a complex relationship with various risk factors and psychological drinking constructs [7].

If the context of addiction is saturated with emotions, then reality, on the contrary, becomes emotionally impoverished, in real social relations the intensity of the emotional background decreases. This is especially noticeable when the attitude of others to the addict changes in a negative way. His detachment begins to perform a defensive reaction [8].

Personal self-regulation is a control of different mental activities and managing in an adequate and identified way. Self-regulation is a leading process of a personal psychological and physiological state [9]. Nowadays there is still inconsistent evidence about the role of self-regulation in

addiction's development. There is data which indicate lower rates of self-regulation in patients with Substance Abuse Disorder than non-clinical samples, but no significant associations were found between self-regulation with addiction severity [10]. However numerous behavioral treatments for addictive disorders include components explicitly aimed at targeting self-regulation (e.g., coping and emotion regulation) [11]

Aggressive and hostility are one of the typical features of addictive behavior. It is known that addicts who had higher scores on aggression and hostility reported more situations that triggered their use of substances and less confidence that they could resist using when faced with such situations in the future. This was especially true for situations involving unpleasant internal states, situations involving rejection, and situations involving conflict with family and friends [12]. In these patients aggressiveness and hostility usually develop in the absence or restriction of the use of psychoactive substances, but their features depending on emotional and will disorder remain poorly understood.

THE AIM

The research aim was study emotional-volitional dysfunction and its association with features of aggression and hostility in mens with substance addiction.

MATERIALS AND METHODS

STUDY DESIGN

Institution based observational cross-sectional study design was employed.

SETTINGS

The study was conducted in Poltava Regional Drug Addiction Dispensary (Poltava, Ukraine) from September, 5 – February, 20, 2019.

PARTICIPANTS

We examined 146 men of the age of 24 to 52 years old who were treated at the detoxication therapy stage. The eligibility criteria were voluntary informed consent to participate in the study; male; age over 18; clinical diagnosis: «Mental and behavioural disorders due to use of alcohol. Dependence syndrome. Currently abstinent but in a protected environment» (F10.21), «Mental and behavioural disorders due to multiple drug use and use of other psychoactive substances. Dependence syndrome. Currently abstinent but in a protected environment» (F19.21). Exclusion criteria were female sex, age younger than 18 years, concomitant severe somatic pathology. We declare that during the study of patients' rights, they have been taken into account in accordance with the requirements of the Helsinki Convention. Patients were divided into two experimental groups,

namely, group 1 which consisted of 81 men with a clinical diagnosis of F19.21, and group 2 included 65 mens with a diagnosis of F10.21.

VARIABLES

We studied severity of Alexithymia, Volitional Self-regulation and Manifestations of aggressiveness and hostility. As potential confounders we described age and duration in hospital before examination.

MEASUREMENTS

The level of severity of alexithymia was studied according to the Russian version of the Toronto Alexithymia Scale (TAS-20R,) which was validated in 2010. It comprises three main factors. Difficulty identifying feelings (DIF) assesses a person's ability to recognise their emotions, difficulty describing feelings (DDF) assesses a person's ability to communicate their emotions to others, and externally oriented thinking (EOT) assesses a person's tendency to focus their attention externally [13].

Volitional self-regulation was evaluated for the Zverkov-Eidmann's questionnaire. It includes three scales: the definition of the generalized level of volitional self-regulation (VSR) which described the ability to consciously manage their own actions, emotions and states, the subclass – the "Persistence" (P) which characterizes the available potential conscious mobilization of the completion of action, and the subclass – "self-control" (SC) which accord to the level of arbitrary emotional control reactions and states [14].

Manifestations of aggressiveness and hostility were assessed by the Buss-Durkee questionnaire with the calculation 8 subscales, namely physical aggression (PA), indirect aggression (IA), irritability (Ir), negativism (N), insult (I), suspicion (S), verbal aggression (VA), feelings of guilt (FG), and indices of aggression (IndA) and hostility (IndH) [15].

STUDY SIZE

Study size was arrived at GPower 3.1.9.4, using d-Coen's effect size – 0.417 (by pilot study), $\alpha = 0.05$ and power was 80% [16]. As a result, final sample size was 81 patients in first group and 65 in the second one.

STATISTICAL METHODS

The obtained data was subjected to statistical processing. Medians (Me) and interquartile interval (IQR) or mean (M) and standart deviation (SD) were calculated for each variation line. We apply the criteria of Shapiro-Wilk for evaluate the normality of distribution. If data was normal distributed, we have used parametric Students test for two independent groups. Nonparametric methods were used for statistical analysis – U-test of Mann-Whitney (for two independent groups) and Spearmen linear correlation coefficient since the distribution was non-normal. Statistical

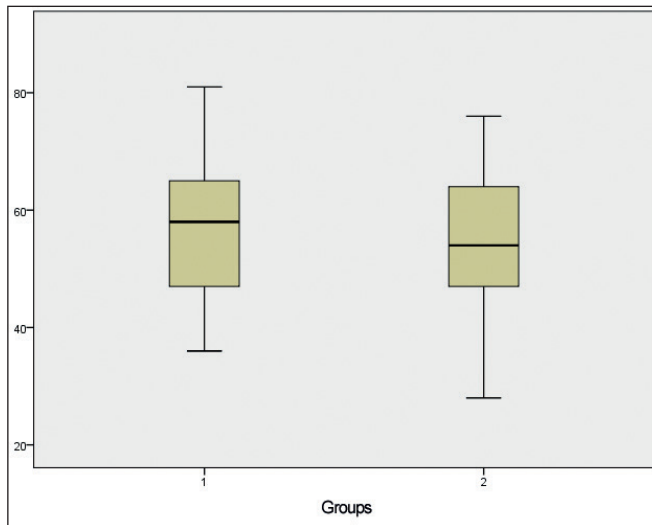


Fig. 1. Overall level of Alexithymia by TAS-20R in groups.

calculations were performed using the IBM SPSS Statistics 23.0. The results were considered statistically significant at $p \leq 0,05$.

RESULTS

Average age in the group 1 was 36.3 ± 7.1 years, and in 2 – 38.9 ± 12.5 years.

Duration in hospital before examination was 14 days in each group.

The investigate of the alexithymia revealed that its overall level in the second group was not significantly differ from ones in the first, although the score in both groups remained within an elevated level, namely in the first group – $58.0 (47.0-62.25)$, in the second – $54.0 (47.0-64.5)$ which demonstrated on fig 1.

Level of DIF was 21.9 ± 3.9 in the first and 21.6 ± 6.5 in the second group, at the same time level of EOT was 18.7 ± 6.2 and 19.1 ± 4.4 accordingly, but both are not differ significant. The total score of DDF in patients of group 1 was 16.4 ± 3.9 and in ones of group 2 was 14.3 ± 4.1 . It is significantly higher by 14.7% compared to group 2, which showed on fig.2.

There were no statistical differences in the indicators that describes volitional self-regulation. The results indicating a sufficient level were within average values, namely rating of VSR in group 1 – 12.3 ± 4.5 and in group 2 – 12.1 ± 4.5 , SC – 8.1 ± 3.5 and 8.6 ± 3.3 accordingly and P – 6.6 ± 2.7 in first and 6.2 ± 2.6 in second groups. It was presented on fig.3.

Analysis of subscale by the Buss-Durkee questionnaire demonstrated next values in group 1 and 2 respectively: PA – 5.9 ± 1.6 and 5.2 ± 1.9 , IA – 5.2 ± 1.4 and 5.3 ± 2.1 , Ir – 5.9 ± 2.1 and 6 ± 2.3 , N – 3.2 ± 1.6 and 3.6 ± 1.3 , I – 5.1 ± 1.6 and 5.8 ± 1.2 , S – 6.3 ± 1.9 and 7.9 ± 1.9 , VA – 7.9 ± 2.3 and 7.6 ± 1.8 , FG – 7.4 ± 1.2 and 7.8 ± 1.3 . It was discovered that the S, I and FG indices were significantly higher by 25.4%, 13.7% and 5.1% respectively in the second group, while the PA was higher by 13.5% in the first group compared to the second, which showed on fig.4.

The IndA of both groups was within the average values and have not significant difference, namely in group

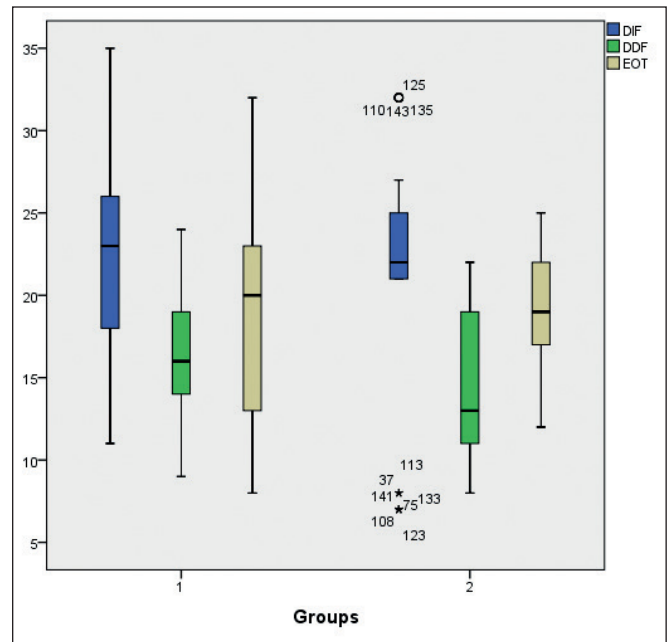


Fig. 2. Features of subscales by TAS-20R in groups.

1 – 19.7 ± 3.5 and in group 2 – 19.1 ± 5.3 . IndH in patients from group 2 was defined higher by 17.5% compared with group 1, although the performance of both groups was above the upper limit of normal values. It was presented on fig.5.

A detailed analysis of the indicators of patients in the first group revealed a direct moderate correlation between alexithymia and Ir ($r_1 = 0,311$, $p_1 = 0,025$), DIF and S ($r_1 = 0,332$, $p_1 = 0,016$); indirect moderate correlation between VSR and PA ($r_1 = -0,515$, $p_1 = 0,006$), I ($r_1 = -0,341$, $p_1 = 0,013$), between P and PA ($r_1 = -0,504$, $p_1 = 0,002$), DIF ($r_1 = -0,358$, $p_1 = 0,009$), level of alexithymia ($r_1 = -0,352$, $p_1 = 0,010$), between SC and I ($r_1 = -0,392$, $p_1 = 0,004$), S ($r_1 = -0,490$, $p_1 = 0,003$); and indirect small correlation between SC and PA ($r_1 = -0,274$, $p_1 = 0,049$).

In the second group there were defined direct moderate correlation between DDF and Ir ($r_2 = 0,561$, $p_2 = 0,007$), and between alexithymia and PA ($r_2 = 0,548$, $p_2 = 0,008$), N ($r_2 = 0,543$, $p_2 = 0,009$); indirect strong correlation between SC and VA ($r_2 = -0,731$, $p_2 = 0,002$), between VSR and DDF ($r_2 = -0,713$, $p_2 = 0,008$); indirect moderate ones between VSR and VA ($r_2 = -0,573$, $p_2 = 0,005$), between SC and FG ($r_2 = -0,436$, $p_2 = 0,043$), DDF ($r_2 = -0,667$, $p_2 = 0,003$), between P and DDF ($r_2 = -0,632$, $p_2 = 0,004$), between EOT and VA ($r_2 = -0,471$, $p_2 = 0,027$).

We determine correlation in the both groups between follow indicators: indirect moderate between IA and VSR ($r_1 = -0,609$, $p_1 = 0,017$; $r_2 = -0,515$, $p_2 = 0,014$), P ($r_1 = -0,470$, $p_1 = 0,007$; $r_2 = -0,540$, $p_2 = 0,010$), SC ($r_1 = -0,510$, $p_1 = 0,003$; $r_2 = -0,560$, $p_2 = 0,007$) and FG with P ($r_1 = -0,320$, $p_1 = 0,017$; $r_2 = -0,453$, $p_2 = 0,034$); between Ir and VSR, P and SC indirect moderate in the first group ($r_1 = -0,425$, $p_1 = 0,002$; $r_1 = -0,324$, $p_1 = 0,019$; $r_1 = -0,510$, $p_1 = 0,017$) and indirect strong in the second one ($r_2 = -0,711$,

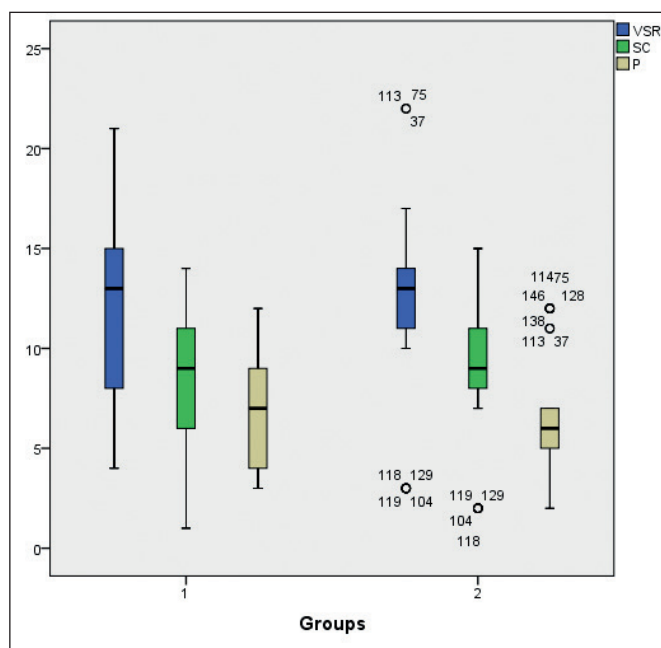


Fig. 3. Rating of volitional self-regulation by the Zverkov-Eidmann's questionnaire.

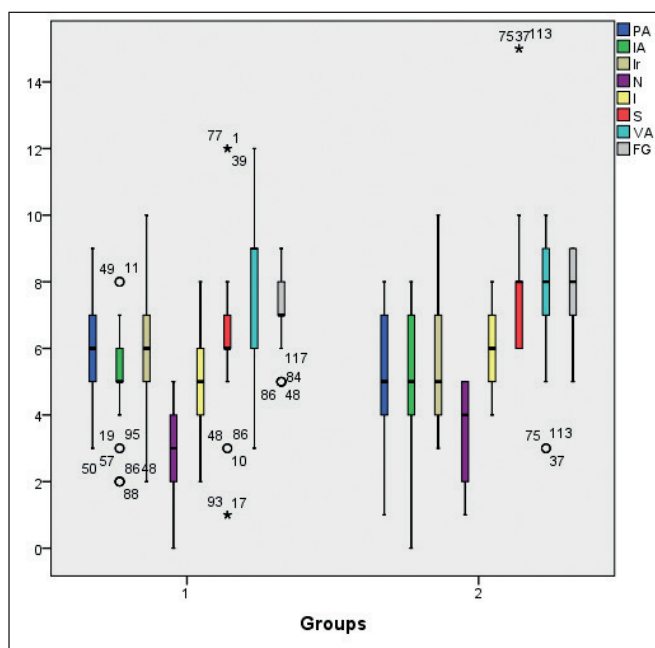


Fig. 4. Rating of subscales by the Buss-Durkee questionnaire.

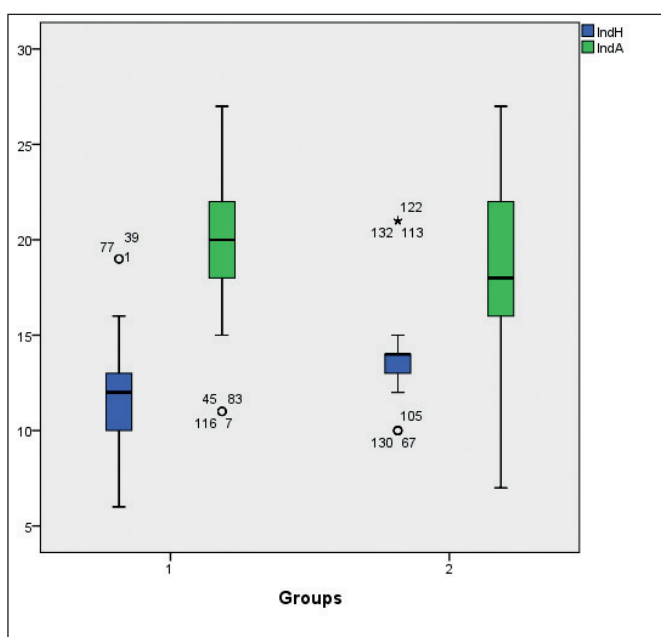


Fig. 5. Evaluating of indices by the Buss-Durkee questionnaire.

$p_2 = 0,004$; $r_2 = -0,713$, $p_2 = 0,005$ $r_2 = -0,720$, $p_2 = 0,007$) in accordance; between P and VA direct moderate in the first group ($r_1 = 0,420$, $p_1 = 0,002$) and indirect strong in the second group ($r_2 = -0,724$, $p_2 = 0,016$).

DISCUSSION

The study showed an increase in the overall level of alexithymia, a moderate level of aggressiveness and a sufficient level of volitional self-regulation without a significant difference between the groups. The indirect correlation of “persistence” with the “general level of alexithymia”,

“difficulty identifying feelings” and “physical aggression” in group 1 and at the same time the indirect correlation between “self-control” and “verbal aggression” and “volitional self-regulation” with “difficulty describing feelings” can be explained by the opposite meaning of these concepts and phenomena themselves.

However, it is interesting that the indicators “physical aggression” and “difficulty describing feelings” in group 2 were significantly lower, but at the same time correlated with “general level of alexithymia” and “irritability”, respectively. On other hand in group 1 the indicator “suspiciousness” is directly related to the “general level of alexithymia”, but its level is significantly lower in comparison with group 2.

It can be assumed that the described manifestations of aggressiveness and hostility were secondary and arose due to the inability of patients to identify their true experiences. As a result, these secondary emotional manifestations, arising as a response to alexithymia, and not to the underlying disease, distort the clinical picture, while primary emotions may remain unidentified by the patient and not detected during therapy. With a superficial examination, this can lead to the fact that some of the “targets” of therapy will remain without impact, which, in turn, may affect the quality of treatment and the stability of remission.

On the other hand, one should not confuse the difficulty of identifying certain feelings with a reluctance to recognize these symptoms. Psychotherapeutic measures aimed at manifestations not identified by the patient himself can lead to a decrease in compliance with the therapist. Therefore, we consider it necessary to initially carry out the correction of alexithymia, along with the treatment of the underlying disease, with the subsequent impact on the already identified and conscious manifestations of hostility and aggressiveness.

CONCLUSIONS

The phenomenon of alexithymia is not only recorded in the clinical picture of patients with various forms of addiction, but can also induce the development of manifestations of aggressiveness and hostility in them. Correction of alexithymia is necessary to understand the emotional state of these patients and choose the right approach to their treatment and rehabilitation.

Further studies of alexithymia in patients with different forms of addiction will improve understanding of this phenomenon and modernize existing treatment and rehabilitation programs.

REFERENCES

- Zhyvotovska L.V., Borysenko V.V., Scrypnikov A.M. Osobystisni osoblyvosti patsientiv iz zapiiny my formy alkoholnoi zalezhnosti [Personal features of patients with dipsomaniac forms of alcohol addiction]. *Medychna psykholohiia*. 2017;3:67-70. (in Ukrainian).
- Haan H., Joosten E., Wijdeveld T. et al. Alexithymia is not a stable personality trait in patients with substance use disorders. *Psychiatry Research*. 2012;198(1):123-9. doi: 10.1016/j.psychres.2011.09.027
- Hemming L., Taylor P., Haddock G. et al. A systematic review and meta-analysis of the association between alexithymia and suicide ideation and behavior. *Journal of Affective Disorders*. 2019;254:34-48. doi: 10.1016/j.jad.2019.05.013
- Mattila A.K., Ahola K., Honkonen T. et al. Alexithymia and occupational burnout are strongly associated in working population. *Journal of Psychosomatic Research*. 2007;62:657-65. doi: 10.1016/j.jpsychores.2007.01.002
- Ghorbani F., Khosravani V., Bastan V.S. et al. The alexithymia, emotion regulation, emotion regulation difficulties, positive and negative affects, and suicidal risk in alcohol-dependent outpatients. *Psychiatry Research*. 2017;252:223-30. doi: 10.1016/j.psychres.2017.03.005.
- Hamidi S., Rostami R., Farhoodi F. et al. A study and comparison of Alexithymia among patients with substance use disorder and normal people. *Procedia – Social and Behavioral Sciences*. 2010;5:1367-70. doi: 10.1016/j.sbspro.2010.07.289
- Cruise K.E., Becerra R. Alexithymia and problematic alcohol use: A critical update. *Addict Behav*. 2018 Feb;77:232-46.
- Skrypnikov A.M., Zhyvotovska L.V., Herasymenko L.O. et al. Alexithymia in healthy people and its role in development of different disorders. *The Medical and Ecological Problems*. 2019;23(1-2):30-3. doi: 10.31718/mep.2019.23.1-2.07
- Berdibayeva S., Nurdaulet I., Saparbaikyzy S. et al. Psychological Features of Gender Relations in Self-regulation of Personality. *Procedia – Social and Behavioral Sciences*. 2015;171:203-8. doi: 10.1016/j.sbspro.2015.01.108.
- Ghalehban M., Besharat M.A. Examination and Comparison of Alexithymia and Self-Regulation in Patients with Substance Abuse Disorder and Normal Individuals. *Procedia – Social and Behavioral Sciences*. 2011;30:38-42. doi: 10.1016/j.sbspro.2011.10.008
- Roos C.R., Witkiewitz K. A contextual model of self-regulation change mechanisms among individuals with addictive disorders. *Clinical Psychology Review*. 2017;57:117-28. doi: 10.1016/j.cpr.2017.08.008
- McCormick R.A., Smith M. Aggression and hostility in substance abusers: The relationship to abuse patterns, coping style, and relapse triggers. *Addict Behav*. 1995;20(5):555-62.
- Taylor G.J., Kivlyt L.K., Bagbi M. et al. Nadezhnost i faktorialnaya validnost russkoy versii 20-punktovoy torontskoy shkaly aleksitimii [Reliability and factorial validity of the russian version of the 20-item Toronto alexithymia scale]. *Sotsialnaya i klinicheskaya psichiatriya*. 2012;22(3):20-25. (in Russian).
- Chudakova V.P. Doslidzhennia «volovoho samokontroliu/volovoi samorehuljatsii» – pokaznyka sformovanosti psykhologichnoi hotovnosti do innovatsiinoi diialnosti y konkurentozdatnosti osobystosti: diahnostrychno-interpretatsiinyi component [The study of «volitional self-control / volitional self-regulation»- indicator of formation psychological readiness for innovation activity and competitiveness of the individual: diagnostic and interpretation component]. *Osvita ta rozvytok obdarovanoi osobystosti*. 2016 Jan;44(1):39-47. (in Ukrainian)
- Greben N.F. *Psichologicheskie testyi dlya professionalov*. Minsk: Sovrem. Shk.; 2007. 496 p. (in Russian)
- Faul F., Erdfelder E., Lang A.G. et al. G*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods*. 2007;39:175-191.

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ORIGINAL ARTICLE

COMPLEX ESTIMATION OF FITNESS TRAINING SYSTEMS AND WOMEN'S SOMATIC HEALTH OF THE FIRST PERIOD MATURE AGE

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ABSTRACT

The aim: To model, to ground and to check experimentally the efficiency of the complex organized system of fitness trainings and system of health improving trainings; to discover their influence on the status of women's somatic health of the first period mature age.

Materials and methods: Analysis, systematization, pedagogical observation, modelling, pedagogical experiment, tests: Ruffier, Stange, Romberg's, Harvard step test and tests of PWC170.

Results: Complex organized system of fitness trainings (dosed, systematic, complex motive activity, managed by trainer) appeared more effective (11.68 %) in comparison with system of individual health improving trainings (6.54 %). Both systems contributed to reducing of weight (CG2 – 3.8 %, EG2 – 16.3 %), decrease in body's parts sizes, in particular, of breast (CG2 – 0.5 %, EG2 – 1.3 %), waist (CG2 – 2.3 %; EG2 – 13.75 %), pelvis (CG2 – 3.6 %; EG2 – 5.3 %), formation of physical characteristics (strength – CG2 – 2.1 %, EG2 – 17.4 % and flexibility – CG2 – 4.5 % and EG2 – 9 %). Differences in the level of physical capacity are marked, mainly, in the control group (PWC170absolute – 12.2 %; PWC170relative – 19.3 %), in comparison with experimental (PWC170 absolute – 10.2 %; PWC170 relative – 17.5 %).

Conclusions: In general both systems assisted the improvement of somatic health level that proves the efficiency of system approach to organization of trainings in this age-related group.

KEY WORDS: somatic health, fitness trainings, health improving trainings, women of the first period mature age

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INTRODUCTION

Health promotion in conditions of modern society development, with its peculiar features of socio-economic, scientific and technological progress, changes in values and motivational attitudes, is the problem of primary importance. The importance of maintaining and improving human health is determined by legal normative documents, which emphasize that the highest social value in a country is a person, his/her life and health. At the same time, it is important to note that for each person there is an optimal range of physical activity, necessary for the normal body's development and functioning, preservation of health. Fitness activities completely provide the body's need for movement activity, they are safe because they are based on the natural locomotions of person. Fitness programs are multi component technologies. Physical component is based on determining the level of physical development, physical qualities, functional status of the human body's systems; the main factor which influences the status of health is the right orientation of physical activity, in particular: its intensity, duration, number of exercises. Psychical component is determined by personal capabilities, individual characteristics of psyche; the basic factor is aspiring to perfection and development. Socio-economic component determines the level of consciousness

to systematic trainings, motivation, necessities, interests, financial possibility; the basic factor is the requirement in notional social equality, public recognition, realization of the potential.

The profit of the use of fitness varieties is well-proven in scientists' works. In particular scientists [1] investigated the efficiency of aerobics programs, that are conducted by continuous and interval methods, with the aim of health promotion at the time of metabolic syndrome. Scientists came to the conclusion, that for people with low level of motive activity and metabolic syndrome, any program of aerobic training by duration of 16 weeks with frequency three times per a week is sufficient for improvement of health status. However, more intensive, but shorter aerobics program appeared less effective, that is why scientists did not recommend it for health promotion in this population group.

Scientists [2] offer the technology of application Body Pump training as an alternative to the traditional training with the large loading for overweight and obesity women. Researchers proved that this programme helps to promote metabolism and can be the same effective as well as traditional power training.

Also the comparative analysis of influence of aerobic interval and continual training on health status of people

with a metabolic syndrome made scientists [3]. During research the identical positive results were uncovered in reduction of average of arterial pressure, body weight and percent age of fat; it was discovered, that intensity of exercises was an important factor for the improvement of aerobic possibilities and removal of risk of metabolic syndrome factors.

During analysis of scientific publications it was found out, that most of them study the influence of efficiency of different fitness programs on health status of old age people or people with certain diseases. In spite of wide spectrum of researches the insufficient attention is paid to the study of health promotion problems of reproductive age women (first period of mature age), that should provide a sufficient birth-rate, but mostly are inclined to deterioration of health, because of certain physical, psychical and socio-economic confusions.

THE AIM

Aim – to model, to ground and to check experimentally the efficiency of the complex organized system of fitness trainings and system of health improving trainings; to discover their influence on the status of women's somatic health of the first period mature age.

While formulating the hypothesis of the study, we proceeded from the assumption that the experimental program of fitness trainings for women of the first period mature age, which requires the organization of the systematic complex training process and provides the dosed doing of physical exercises under the trainer's guidance, will be more effective than the system of individual health improving self-trainings, however, both training systems will help to reduce weight and girth of body parts, formation of physical qualities (strength and flexibility), improvement of cardiovascular and respiratory systems, vestibular apparatus, working capacity, and, accordingly, improvement of women's somatic health.

MATERIALS AND METHODS

Experimental work to verify training systems and women's somatic health required the application of theoretical and empirical research methods. Among the theoretical methods we have used: analysis, generalization, systematization, classification, pedagogical observation, direct questioning, modelling; among empirical were methods of putting the results of the study into practice (pedagogical experiment), methods of control and measurement, methods of data processing.

In order to develop the system approach to the study of the problem, the methods of analysis, generalization and systematization of literary sources were applied in the following stages: analysis of national scientific works, concerning the criteria of somatic health, standardization of motor activity, physiological negative changes of the organism caused by hypodynamics and positivity activities, as a result of optimization of motor activity; works related to health protection and fitness researches. The

classification method was used in order to investigate current types of fitness programs. Pedagogical observation was realized with the purpose of identifying the tools and techniques used by trainers while conducting fitness programs; monitoring the implementation of training systems that were proposed to women. Direct survey was organized to find out the motivations, needs, and problems of women of the first period mature age who are engaged in wellness fitness. The modelling method was used to design the complex organized system of fitness trainings for women of the first period mature age, optimal for their biological needs in motor activity, improving the functional status of their bodies and physical development. Pedagogical experiment was conducted as a specially organized research to test the effectiveness of the complex organized system of fitness trainings and the system of individual recreational health improving trainings for women of the first period mature age, to determine the status of women's somatic health before and after the experiment. The experiment involved 52 women aged 21-35 years who had no contraindications to active trainings, to significant motor experience (training experience from 0 to 1 year). Through random selection, participants of the experiment were divided into two groups (control and experimental), each of 26 people. The experimental group of women performed the tasks of the complex organized system, trained on the basis of various fitness clubs, and the control group did it at the place of residence.

ORGANIZATION OF EXPERIMENT

In the first stage, literature sources were analyzed, the basic concepts of the research subject and the organization of the experimental work were grounded, the object, aim and objectives of the research were determined; women were questioned (motivation for training, needs, health problems were found out), primary check was performed on three indicators: physical development, functional status, level of general working capacity. On the basis of the obtained results the control and experimental groups were formed; the experimental fitness training system was designed to contribute to significant or effective improvement in the functional status, physical development and increase of the general working capacity of women of the first period mature age. The second stage of the research involved the implementation of the fitness training system, monitoring the fulfilment of the terms. In the third stage, the control check of women's health status on certain indicators was realized and the report was prepared.

In order to obtain credible data about the women's health in the course of the experiment we used complex evaluation and monitoring after the indicators:

1. Physical development (height, body weight, body's parts sizes), the formation of physical qualities (muscle strength of the abdominal abs (lifting the torso in a sitting position from the lying); flexibility (leaning forward from a sitting position). Tools: ruler, cales, stopwatch.
2. Functional status of women's body systems (cardiovascular, respiratory systems, vestibular apparatus). We

Table I. Indicators and levels of evaluation of the functional status of women of the first period mature age engaged in health fitness

Indicators and measurement units	Levels				
	high	sufficient	medium	satisfactory	unsatisfactory
Muscle Strength (quantity)	> 40	32	28	26	<24
Flexibility (cm.)	> 20	18	16	14	<12
Ruffier test (units)	0-4	5-9		10-14	15 i >
Stange test (sec.)	50	30-50		20-30	<20
Romberg's test (sec.)	> 30			15-30	< 15
Step test (units)	> 90	86-90	77-85	61-70	<60
PWC 170 absol. (kgm/min)	850	750-849	550-749	450-549	<449
PWC 170 relat. (kgm/min)	21-23	19-20	17-18	15-16	14
MCK (ml/min/kg)	>40	36-40	35-30	29-23	<23

evaluated the condition of the cardiovascular system using the Ruffier test, the respiratory system was characterized by the Stange test, and the condition of the vestibular system was verified through the Romberg's test. Tools: stopwatch.

Ruffier test technology: after 5 minutes of calm state in sitting position, it was necessary to calculate the heart rate for 15 seconds (result 1 – R1), then for 45 seconds women performed 30 squats. Immediately after that we calculated the heart rate for the first 15 seconds (R2) and last 15 seconds (R3) of the first minute of the recovery period. The results were evaluated by the index determined by the formula: Ruffier index = $4 \times (R1 + R2 + R3) - 200/10$.

Stange test technology: after 5 minutes of calm state in standing position it was necessary to measure the heart rate for 30 seconds, then hold the breath in full breath, previously breathe 3 times at 3/4 depth. The delay time was fixed in seconds. Immediately after breath recovery, the heart rate was again counted for 30 seconds.

Romberg's test technology: it is necessary to stand straight, with legs tightly held together, arms forward, fingers spread apart. At first, the test subject stands in such a pose with open eyes, then with his closed eyes. With a stopwatch, we recorded the delay time of women's postures of standing with their eyes closed without shaking.

3. The level of general working capacity was determined on the basis of the PWC170 test with the calculation of absolute and relative indicators and the Harvard step test. Tools: cycle ergometer, stopwatch, 43 cm high step platform, metronome.

We calculated PWC170 according to the formula:

$$PWC170 = W1 + (W2 - W1) (170 - f1) / (f2 - f1),$$

where: PWC170 is the strength of physical effort on a cycle ergometer at which the heart rate of 170 beats/min is reached; W and W2 are the power of the first and second loads, kgm/ min; f1 and f2 are the heart rates at the end of the first and second loads.

Harvard step test technology: for 5 minutes at a steady tempo, a woman went up and down the platform. The tempo was set by the metronome with a frequency of 120 beats per minute. The number of cycles (ascent-descent)

were 30 per 1 minute. After finishing it was necessary to rest for a minute. At the second, third and fourth minutes, we measured heart rate within 30 seconds, that is, three times for 30 seconds, followed by 30-second breaks.

To calculate the index we used the formula:

$$IHST = t \times 100 / (f1 + f2 + f3) \times 2$$

where: t is the test time, i.e. 5 minutes, f1, f2, f3 are the heart rates at the first 30 seconds of the second, third and fourth minutes of rest.

Statistical processing of the empirical data was performed with the calculation of t that is the Student's t-t test, the difference between the sample averages was accepted with 95 % probability (p < 0.05). Indicators and level so fevaluation of the functional status of women of the first period mature age engaged in health fitness submitted by table I.

RESULTS

The analysis of professional scientific and methodological literature let to discover that fitness exercises completely satisfy the person's needs for physical activity, eliminate the effects of hypokinesia and are one of the most popular types of physical activity.

The most common classification of health fitness types is the systematization offered by Hawley E. and Franks B. Scientists divide health fitness into the following programs: aerobic and strength trainings; programs, which are based on the health types of gymnastics; water-based programs; recreational types of motor activity. The examination of fitness varieties proves that each of the programs contributes to the achievement of different goals (based on the formation of physical qualities): aerobic programs can increase overall endurance; programs, based on wellness gymnastics exercises (mental), influence on mobility of joints, relative static muscle strength; power programs contribute to the formation of power qualities and their derivatives; programs of recreational purpose help to realize the complex effect on the body, teach to combine the nutrition culture with healthy lifestyle. In accordance with the analysed classification, we can conclude that monodirectional classes do not hypothetically give the maximum result for health promotion, since a person requires the complex, system impact of physical

Table II. Comparative analysis of the condition of women of the first period mature age in the control (n = 26) and experimental (n = 26) groups before and after the experiment

Indicators, tests, measurement units	CG1 → CG2 M± m				EG1 → EG2 M± m				CG2 → EG2 M± m
	CG1	CG2	growth	P	EG1	EG2	growth	P	growth
Body weight (kg.)	67,6±2,1	65,0±1,96	3,8%	>0,05	68,1±2,15	57,0±1,0	16,3%	>0,05	12,4%
Chest girth (cm.)	94,1±3,8	93,6±3,7	0,5%	>0,05	95,9±4,15	94,6±3,9	1,3%	>0,05	0,8%
Waist girth (cm.)	76,3±2,7	74,5±2,1	2,3%	>0,05	78,5±2,95	67,7±0,82	13,75%	>0,05	11,4%
Pelvis girth (cm.)	97,8±4,2	94,3±3,9	3,6%	>0,05	97,9±4,2	92,7±3,6	5,3%	>0,05	1,7%
Strength indicator (times)	31,3±1,34	32±1,86	2,1%	>0,05	27±0,98	32,7±1,95	17,4%	>0,05	15,3%
Flexibility index (cm.)	12,6±0,95	13,2±0,78	4,5%	>0,05	14±0,86	15,4±0,96	9,0%	>0,05	4,5%
Ruffier test (units)	12,0±0,9	11,3±0,71	5,8%	>0,05	11,3±0,8	9,95±0,63	12,0%	>0,05	6,2%
Stange test (sec.)	33,2±1,9	41,6±3,06	12,0%	>0,05	36,5±1,7	42,4±3,1	13,9%	>0,05	1,9%
Romberg's test (sec.)	27,0±3,02	30,7±3,1	9,1%	>0,05	26,1±2,9	32,4±4,2	19,4%	>0,05	10,3%
Indicators of step test (units)	82,6±1,46	85,4±1,67	3,3%	>0,05	88,2±1,7	92±1,7	4,1%	>0,05	0,8%
PWC 170 absolute / relative (kgm/min)	707±74,7 / 17,2±4,06	805±78,3 / 21,4±6,2	12,2% / 19,3%	>0,05 / >0,05	726±76,8 / 17,4±4,2	810±79,8 / 21,1±5,9	10,2% / 17,5%	>0,05 / >0,05	-1,8% / -1,8%

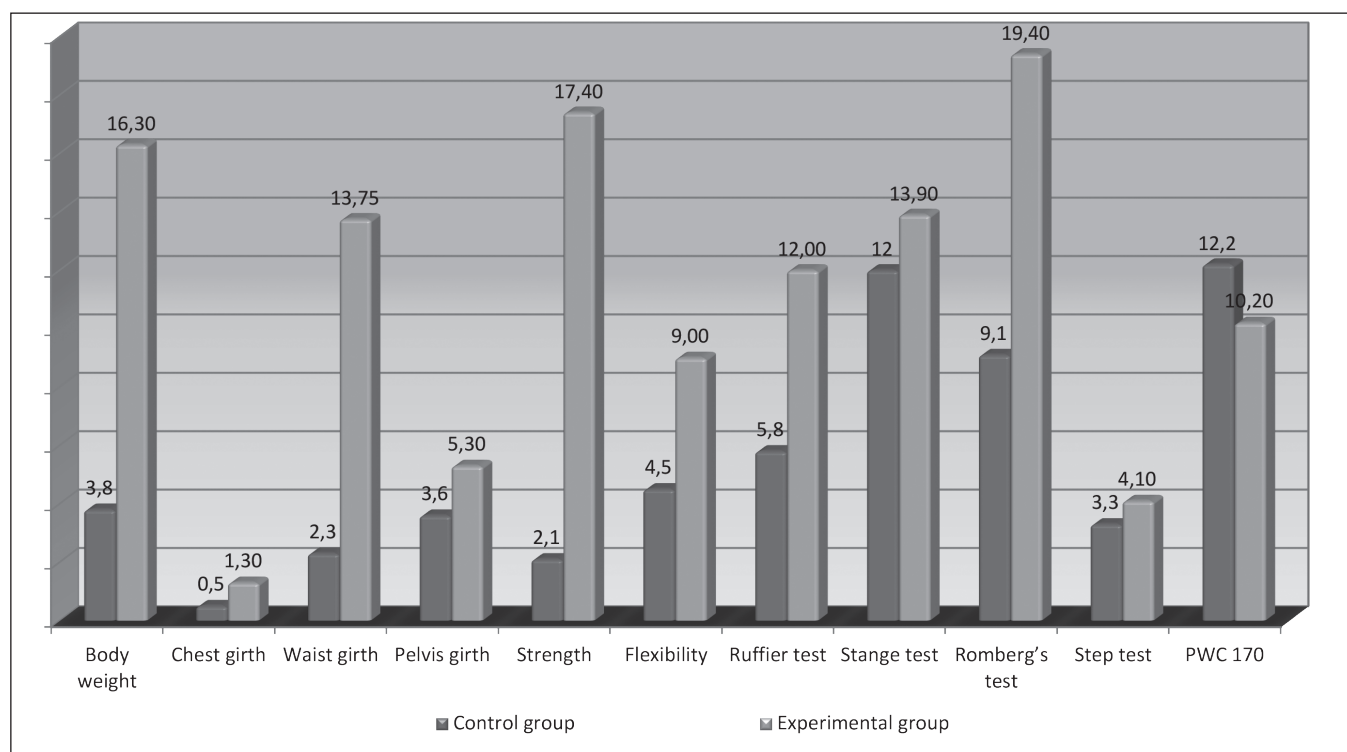


Fig. 1. Dynamics of women's indexes formation status after realization of experiment in percentage

activity on different body's organs and systems. This is ensured by various fitness programs (aerobic, strength, mental orientation), compulsory rationing of physical activity during the week, systematic attendance of trainings. In our opinion, it is also important to take into account the trainer's recommendations about exercise techniques and diet.

Using the modelling method, we have developed the experimental complex system of fitness trainings for

women of the first period mature age, which implies the implementation of following conditions:

1. Systematic attendance of trainings at fitness club (three times a week) during 16 weeks.
2. Attendance of 50-60 min. duration multidirectional programs during the week, such as:
 - one aerobic program of choice: *Fitball Aerobics*, *Step Aerobics*, *Zumba* (or other dance program), *Combat*,

etc. The aim is to improve aerobic endurance, respectively – general working capacity, weight loss, reduction of girth dimensions;

- one power program of choice: *Body Pump*, *Legs*, *Cross Fit*, trainings in gym with a trainer, etc. The goal is to develop strength, endurance, increase of muscle mass, improve of muscle tone, figure correction;
 - one mental orientation program to choose from: *Yoga*, *Pilates*, *Mind Body*, *Body Balance* and so on. The aim is to improve flexibility, posture, vestibular apparatus.
3. Taking into account the trainer's recommendations on exercise technique, nutrition.

The recommended program for the control group offers women to participate in wellness and fitness activities that do not need regulated physical activity. Women individually selected activities that met their subjective needs and capacities. They performed trainings at convenient time, without taking into account the time of doing exercises, without outside guidance. Such activities included: smooth running, cross country running, swimming in the pool or in the open water, cycling (cycling tours), power exercising, or exercising on flexibility in training grounds.

During the experiment, 52 women aged 21-35 years (median age – 23.7 years) who had satisfactory health (main health group) and physical development (mean height 167.2 cm) were divided into two homogeneous groups. The testing indicators of women's condition in the control and experimental groups before and after the experiment are presented in Figure.1. in Table II.

Symbols: CG1 – control group before the experiment; CG2 – control group after the experiment; EG1 – experimental group before the experiment; EG2 – experimental group after the experiment; n – sample size; M – arithmetic mean; m – standard error of arithmetic mean; P – reliability of differences after Student's t-test.

DISCUSSION

The criterion analysis of physical development, functional status and general working capacity of women of the first period mature age, that before the experiment did not have considerable motive experience, makes it possible to assert that the noted indexes can be found mainly on satisfactory and middle levels. After the end of experiment which was held (in the experimental group – the dosed, systematic, complex motive activity, guided by a trainer, and in the control group – individual trainings) for a long period of time (16 weeks), it was discovered, that positive changes in the status of women's health took place both in experimental (11.68 %) and in control (6.54 %) groups. In particular, the indexes of strength formation increased to the sufficient level both in experimental (17.4 %) and in control (2.1 %) groups; also positive changes took place and in the development of flexibility, with a preponderance of representatives of experimental group (9.0 %). Also positive changes can be seen in the functional status of the organism's systems of women, in particular most changes took place in the indexes of Stange test (CG2 – 12.0 %, EG2 – 13.9 %) and Ruffier test (CG2 –

9.0 %, EG2 – 19.4 %), that showed the improvement of the cardiovascular and respiratory systems' activity.

Differences in the formation level of physical capacity can be registered, in a greater measure, in the control group (PWC 170absolute – 12.2 %; PWC170relative – 19.3 %), comparatively with experimental (PWC 170absolute – 10.2 %; PWC170relative – 17.5 %). This fact can be explained by those women of control group, that were engaged in recreational types of fitness, elected mainly aerolateral types of motive activity such as running, swimming, wheeling, that assisted the increase of this index.

The decrease in body's parts sizes was also fixed both in control and in experimental groups: breast (CG2 – 0.5 %; EG2 – 1.3 %), waist (CG2 – 2.3 %; EG2 – 13.75 %), pelvis (CG2 – 3.6 %; EG2 – 5.3 %) and body weight (CG2 – 3.8 %; EG2 – 16.3 %), that assisted the correction of figure. In the course of investigation it was detected that technique, selected by us for verification of the condition of women's health turned to be suitable and effective.

CONCLUSIONS

In the process of investigation it was succeeded to model, to ground and to check experimentally the complex organized system of fitness trainings and system of individual health improving trainings of women of the first period mature age, to realize the examination of efficiency of both systems in relation to the improvement of the status of somatic health. In general both systems of training assisted the decline of weight, decrease in body's parts sizes, formation of physical characteristics (strength and flexibility), improvement of the cardiovascular and respiratory systems' work, vestibular apparatus, increase of general working capacity that proves the efficiency of system approach to organization of trainings in this age-related group. It is important to notice advantages of the fitness programs under the leadership of trainer above individual trainings, that was more considerably represented on the indexes of development of strength and flexibility, body's parts sizes and body's weight.

REFERENCES

1. Morales-Palomo F., Ramirez-Jimenez M., Fernando O.J. et al. Effectiveness of Aerobic Exercise Programs for Health Promotion in Metabolic Syndrome. *Medicine and Science in Sports and Exercise*. 2018; 51(9): 1876–1883.
2. Rustaden A.M., Gjestvang C., Bø K. et al. Body Pump versus traditional heavy load resistance training on changes in resting metabolic rate in overweight untrained women. *Journal of Sports Medicine and Physical Fitness*. 2018; 58(9): 1304–1311.
3. Tjønnå A.E., Lee S.J., Rognmo Ø. et al. Aerobic interval training versus continuous moderate exercise as a treatment for the metabolic syndrome: a pilot study. *Circulation*. 2008; 118(4): 346–354.
4. Serhiienko L.P. *Sportyvna metrolohiia: teoriia i praktychni aspekty* [Sporting metrology: theory and practical aspects]. Kiev: KNT; 2010. 776 p. (In Ukrainian).
5. Hawley E.T., Frenks B.D. *Ozdorovitel'nyj fitness* [Health-improving fitness]. Kiev: PH Olympic literature; 2000. 368 p. (In Russian).

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ORIGINAL ARTICLE

THE IMPACT OF OVERWEIGHT AND OBESITY ON THE QUALITY OF LIFE IN CHILDREN WITH BRONCHIAL ASTHMA

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ABSTRACT

The aim is to investigate if the overweight (OW) and obesity (OB) impact on the quality of life (QOL) of children with bronchial asthma (BA).

Materials and methods: The study included 73 children aged 7 – 17, with moderate BA. Depending on the body mass index, patients were divided into the three clinical groups: normal body weight (NW) – 30 children, OW – 28 children and OB – 15 children. QOL was conducted by the Pediatric Asthma Quality of Life Questionnaire (PAQLQ). The statistical processing was carried out using the IBM SPSS Statistics Base (version 22) and EZR version 1.32. Results were considered statistically significant when $p < 0.05$.

Results: Children with BA and OB had statistically lower QOL than children with BA and NW in all PAQLQ domains. The Kruskal-Wallis H-test revealed a statistically significant difference between the different weight groups of children with BA both for the general QOL: $H(2) = 37.51$, $p < 0.001$ and for each rating scale separately. Pairwise comparisons using Steel-Dwass test indicated that scores of NW were observed to be significantly different from those of OW and OB for rating Activity and Symptoms scales ($p < 0.001$).

Conclusion: Comorbid OW and OB reduce the specific QOL of children with BA. In assessing the effectiveness of specific approaches to treating BA in children with OW and OB, an assessment of the QOL of children should be added to the traditional common clinical and laboratory assessment.

KEY WORDS: bronchial asthma, overweight, obesity, quality of life, children

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INTRODUCTION

Bronchial asthma (BA) is an important medico-social problem of modern pediatrics, because today, according to WHO, it is the most common chronic pathology in the world among the child population [1]. One of concomitant pathologies that could burden the course of BA are overweight (OW) and obesity (OB), which are also spreading rapidly in the last decade [2]. Both processes, BA and OB, are chronic, complex and multifactorial in their nature.

Therefore, in the GINA materials, 2018, in the list of five major BA phenotypes, BA combined with OB is distinguished into a special phenotype characterized by low levels of eosinophilic inflammation and significantly more shown respiratory symptoms, and needs further study on the mechanisms of interaction and approaches to therapy [3].

Among the main pathogenetic mechanisms of interaction of BA with OW and OB: mechanical effect of adipose tissue on the chest, low-level chronic metabolic inflammation, influence of proinflammatory (leptin, resistin) and anti-inflammatory (adiponectin) hormones of adipose tissue, ox stress, additional co-morbidity, genetic factors. However, the question of a clear causal link between the impact of these mechanisms on the control of BA of this phenotype remains open.

According to the data of Center for Disease Control and Prevention (CDC) US in 2010 share (OB) among adults suffering from BA in this country was 38% [4]. Among the child population, according to Lang JE, 2018, in the

USA, between 23 and 27% of new cases of comorbide BA and OB are directly caused by OB, and in the absence of OW and OB, 10% of all cases of BA could be avoided [5]. Based on the analysis of the growth rate of the proportion of the combined course of these two pathologies, over time, BA caused by OB will become a major type of childhood BA [6].

Currently, there are many studies in the field of combination of these two pathologies, mainly among adults, most scientists have clearly identified the features of this combination: a more severe course, that can be seen in more frequent and severe exacerbations and reduced control of the disease, reduced response to treatment with inhaled corticosteroids and lower quality of life [7].

In GINA, 2019 for the management of patients with comorbidity BA-OB states that corticosteroids remain the main therapeutic agents (level of evidence B), although the response to treatment in such patients is weakend. Therefore, it would be desirable to add weight loss recommendations (level of evidence B). In addition, it is noted that scientific researches in this field are limited and insufficient [8].

Inadequate treatment of BA in children leads to an uncontrolled course with the preservation of inflammatory changes in the bronchi and the persistence of bronchial obstruction, which worsens both the physical and emotional state of the patient and significantly reduces the social activity. The chronic nature of BA and related phar-

macotherapy, sometimes physical and social limitations, emotional factors can be much more important for a child with BA than the symptoms of the illness itself.

Common clinical and laboratory assessment of respiratory tract and inflammatory markers provides valuable information about the condition of the affected organ system, but it does not capture the functional disorders (physical, emotional and social) that are important for patients with BA in their daily lives [9]. It is increasingly recognized that assessment of positive changes in the quality of life (QOL) of patients should be taken into account for the evaluation of therapeutic interventions in BA [10].

WHO defines QOL as individuals' perceptions of their lives in the context of the culture and value systems in which they live, and in accordance with their goals, expectations, standards and challenges [11]. The purpose of treatment of BA should be considered to increase the QOL of a sick child on the background of positive clinical dynamics.

Limited pediatric studies of QOL of children with BA combined with OB, compared to BA with NW contain findings that sometimes contradict each other [12, 13, 14].

It has been confirmed that concomitant OW and OB, which complicate the course of chronic pathological conditions of patients, significantly worsen QOL [15]. Considering the negative impact that OB has on the prevalence and course of BA, changes in QOL and in patients with BA should be expected. Therefore, it is advisable to conduct further studies to evaluate how the comorbide course of BA and OB affects the QOL of children with BA.

THE AIM

The aim of this study was to investigate if the overweight OW and OB impact on the QOL of children with BA.

MATERIALS AND METHODS

A one-year cross-sectional study was conducted (February 2019 – February 2020) 73 children aged 7 - 17 years with moderate BA who were treated in the allergic department of the children's hospital were examined. Depending on the body mass index, patients were divided into the following clinical groups: group I – 30 children with NW (body mass index ranged from 5 to 85 percentile according to age and sex), group II – 28 children with OW (body mass index from 85 to 94 percentile) and group III – 15 children with OB (body mass index greater than 95 percentiles).

A specialized PAQLQ (Pediatric Asthma Quality of life Questionnaire) questionnaire, developed for children with bronchial asthma aged 7 to 17 years [9], has been used to evaluate QOL in children with bronchial asthma, translated and linguistically validated by the Lyon Research Institute, France (MAPI Research Institute) in many languages, including Ukrainian [16].

The PAQLQ questionnaire contains 23 questions, grouped into 3 blocks (rating scale), that relate to the most relevant life spheres for children with asthma: asthma symptoms (10

points), emotional disturbance (8 points), and activity restriction (5 points). Depending on how often during the last week the patient experienced some or all of asthmatic symptoms assessment was made by the 7-point Likert scale from 1 (extremely worries/all time) to 7 (does not bother/never). The indicators for each block were obtained by calculating the average result. The total QOL score (QOL) was calculated as the average for all blocks. The number of points is directly proportional to the QOL, that is, the higher the score, the higher the QOL score. The questionnaire was filled in by the interview method according to the instructions for the application of the questionnaire.

The results of the questionnaire survey of patients on the PAQLQ were divided into 4 blocks: activity limitation (QOL activity), symptoms (QOL symptom), emotional disturbance (QOL emotion), and total QOL score (QOL). Each block contained scores in three compared groups of patients with BA (NW, OW, OB). The research database was systematized in Microsoft Excel.

The statistical processing of obtained results was carried out using the statistical package IBM SPSS Statistics Base (version 22) and EZR software version 1.32 (R graphical interface (version 2.13.0) [17].

For descriptive statistics, to determine if a data set is well-modeled by a normal distribution, was used by Shapiro-Wilk test. Because the distribution was different from normal (Gaussian), and therefore the statistical sample was heterogeneous, methods of nonparametric statistics were used. Median and interquartile ranges [first; third] – Me (QI;QIII) were determined to describe the variance of the compared variables (quantitative QOL scores for each block, and respectively, for each group in blok). Results were considered statistically significant when $p < 0.05$.

The Kruksal-Wallis H-test (or one-way ANOVA on ranks) was used to determine if there are statistically significant differences in QOL scores between three comparison groups (NW, OW, OB). This criterion reveals whether there is a statistically significant change in the level of trait (QOL score) when moving from one weight group to another.

In confirming statistical significance, post hoc analysis was performed to assess which groups actually differ from each other. For pairwise comparisons of the quantitative indices the nonparametric Steel-Dwass test was used.

As for clinical significance of the difference between the mean values of the compared indicators of the questionnaire, the value of 0.5 unit was accepted as the minimal difference accordance to recommendations of PAQLQ developers Juniper et al [18] and the experience of PAQLQ evaluation in clinical studies [10].

The present work meets the requirements of the Declaration of Helsinki. The research was carried out in compliance with the modern principles of bioethics. The design of this study was approved by the commission on bioethical expertise and ethics of scientific research at the National Medical University named after O.O. Bogomolets, the research does not present an increased risk for the subjects of the study and was implemented in view

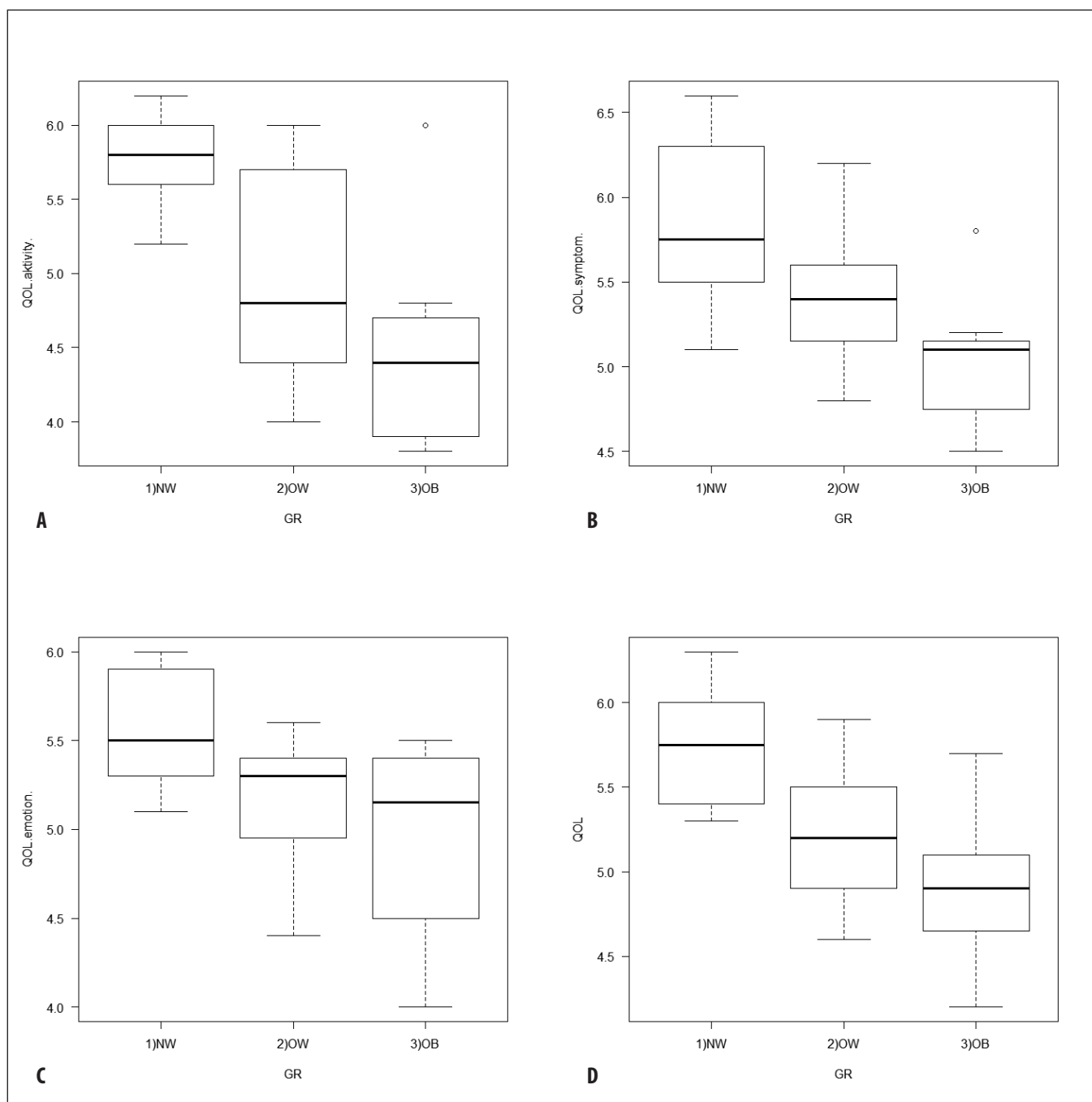


Fig. 1. Comparative characteristics of QOL for different weight groups of children with BA (NW, OW, OB) on each scale of the PAQLQ questionnaire: A - activity (QOL.activity), B - symptoms (QOL.symptom), C - emotions (QOL.emotion), and D is the total QOL score.

of existing bioethical norms and scientific standards for conducting clinical trials involving patients. All patients signed a written informed consent form.

RESULTS

Figure 1, A to D, present graphically the results of the Kruskal-Wallis H-test for change in the level of the trait (QOL score) from one weight group (NW, OW, OB) to another for different domains of QOL.

The Kruskal-Wallis H-test revealed a statistically significant difference between the different weight groups of

children with BA both for the general QOL: $H(2) = 37.51$, $p < 0.001$; and for each rating scale separately: activity: $H(2) = 36.238$, $p < 0.001$; symptoms: $H(2) = 30.009$, $p < 0.001$; and emotions: $H(2) = 15.855$, $p < 0.001$.

Table I shows the calculated average values (as Me [QI;QIII]) of QOL for each of the studied groups of children with BA (NW, OW, OB) and the result of post-hoc comparisons of these groups by the Steel-Dwass Test on the statistical significance of the difference between weight groups.

BA had the least negative impact on QOL in children with NW, which was confirmed by fairly high rates. Pairwise comparisons using Steel-Dwass Test indicated that

Table 1. QOL indicators of children with BA with different body weights according to the PAQLQ questionnaire, Me [QI; QIII]

Rating scale	Groups of patients with BA			Statistical significance of the difference between groups *
	NW, n = 30	OW, n = 28	OB, n = 15	
	1	2	3	
Activity restrictions	5,8 [5,6; 6]	4,9 [4,4; 5,8]	4,4 [3,8; 4,6]	$p_{12}<0,001$ $p_{13}<0,001$ $p_{23}=0,048$
Symptoms	5,75 [5,5; 6,3]	5,4 [5,15; 5,65]	5,1 [4,5; 5,1]	$p_{12}<0,001$ $p_{13}<0,001$ $p_{23}=0,003$
Emotions	5,5 [5,3; 5,9]	5,3 [4,95; 5,4]	5 [4,5; 5,4]	$p_{12}=0,006$ $p_{13}=0,001$ $p_{23}=0,4$
Overall QOL score	5,75 [5,4; 6]	5,25 [4,9; 5,5]	4,8 [4,6; 5,1]	$p_{12}<0,001$ $p_{13}<0,001$ $p_{23}=0,016$

* the result of pairwise comparisons of groups among themselves according to the Steel-Dwass Test, the difference is considered significant at $p < 0.001$

group NW scores were observed to be significantly different from those of group OW ($p < 0.001$) and group OB ($p < 0.001$) for rating scales "Activity" and "Symptoms".

The difference between the OW group and the OB group was not statistically significant. On the Emotions scale, the difference was significant only when comparing the NW group and the OB group.

As for the clinical interpretation of the difference between average values of the NW group and the OB group, according to the data in Table 1, the threshold of minimal clinical significance is 0.5 is exceeded for each rating scale, so the results obtained show that the difference between QOL indices of a NW group of children and a group of OB are not only statistically but also clinically significant.

DISCUSSION

In our study, we evaluated the relationship between BA with concomitant OW or OB and QOL in children measured by trusted and well-known specialized questionnaire PAQLQ.

With regard to the use of questionnaires for the assessment of QOL, it is known [10] that specialized questionnaires have a higher specificity and sensitivity to detect the smallest differences in groups of patients with regard to the characteristics of the disease being studied. Unlike specialized, general questionnaires are usually designed to assess the significant impact of chronic diseases on QOL, making them less sensitive to the small differences between the study groups.

Results of the use the PAQLQ questionnaire in clinical trials are presented in over 46 scientific publications) [10] but it should be noted, the number of studies on the QOL of children with comorbide course of BA and OB is quite small. In addition, a significant limitation of the study is the size of the sample and the criteria for inclusion in the study, so the results of existing studies sometimes contradict each other, especially regarding the impact on different scales of QOL assessment [12, 13, 14].

In our study, it was shown that the total negative impact of BA and comorbide OW or OB on the QOL of children was greater than the isolated impact of BA. Children with BA and concomitant OB had statistically and clinically significant lower rates of overall QOL compared with children with BA with normal-weight. It has also been found that the negative impact of OW and OB becomes greater as BMI increases.

Declines in QOL scores on different PAQLQ scales were associated with some limitations in children's daily activities and interactions with adults and peers. Thus, the decrease in QOL indicators on the activity limitation scale in children with BA with OW and OB, indicated their lower physical activity compared to children with asthma who had a NW. Such a decrease in physical activity in children with BA with OW or OB is associated with difficulties in performing daily physical activities such as cleaning, lifting and carrying small objects, moving on stairs and during inclinations and squats. It should be noted that the difference between the weight groups was the most significant on this scale.

The decrease in QOL indices on the scale of "Emotions" in the children of the main group was due to the negative impact of physical and psycho-emotional problems associated with limiting the life activity of children with BA with concomitant OW or OB. Thus, the daily activities of children in the main group were accompanied by physical difficulties caused by OW or OB, and these difficulties created an additional negative impact on the emotional state of children. The emotional state of children suffering from BA with concomitant OW or OB, compared to patients with isolated course of BA, hindered the daily activity of children, requiring more time to perform their usual tasks. These emotional experiences of children also worsened compliance with them, making the treatment process more complicated.

At present, population data about the impact of OW or OB on QOL in children with BA are quite limited and

need further study. Our findings for children are consistent with the results obtained in numerous studies with adult patients with BA who have shown a significant connection between BMI and quality of life.

CONCLUSIONS

The impact of OB on the indicators of QOL of children with BA is statistically and clinically significant.

Comorbid OW and OB reduce the disease-specific QOL of children with BA in all PAQLQ domains.

These comorbidity requires the development of specific treatment regimens of BA, the effectiveness of which should be evaluated taking into account the QOL of children.

The PAQLQ is a sensitive tool for the assessment of QOL in children with BA combined with OW and OB, and can be recommended as an additional tool for evaluating the effectiveness of treatment regimens.

REFERENCES

1. WHO. Asthma. Global prevalence (online) [download: 24 November 2019]; <http://www.who.int/news-room/q-a-detail/asthma>
2. UNICEF (2019). The State of the World's Children 2019. Children, Food and Nutrition: Growing well in a changing world. UNICEF, New York. (online) [download: October 2019]; <http://www.unicef.org/media/63016/file/SOWC-2019.pdf>
3. GINA 2018. (online) [download: April 2018]; http://ginasthma.org/wp-content/uploads/2018/04/wms-GINA-2018-report-tracked_v1.3.pdf
4. CDC. Centers for Disease Control and Prevention. Asthma and Obese. (online) [Page last reviewed: August 9, 2013]; http://www.cdc.gov/asthma/asthma_stats/asthma_obesity.htm
5. Lang J., Bunnell H., Hossain J. et al. Being overweight or obese and the development of asthma. *Pediatrics*. 2018;142(6):e20182119. doi:10.1542/peds.2018-2119.
6. Rastogi D. Quantifying the contribution of obesity to incident childhood asthma: it's about time. *Pediatrics*. 2018;142(6):e20182979. doi:10.1542/peds.2018-2979.
7. Di Genova L., Penta L., Biscarini A. et al. Children with obesity and asthma: which are the best options for their management? *Nutrients*. 2018;10(11):1634. doi:10.3390/nu10111634.
8. GINA 2019. (online) [download: June 2019]; <http://ginasthma.org/wp-content/uploads/2019/06/GINA-2019-main-report-June-2019-wms.pdf>
9. Juniper E.F., Guyatt G.H., Feeny D.H. et al. Measuring quality of life in children with asthma. *Qual Life Res*. 1996;5:35-46. doi:10.1007/bf00435967.
10. Wilson S.R., Rand C.S., Cabana M.D. et al. Asthma Outcomes: Quality of Life. *J Allergy Clin Immunol*. 2012;129(30):88-123. doi:10.1016/j.jaci.2011.12.988.
11. WHO. Health statistics and information systems. WHOQOL: Measuring Quality of Life. (online) <http://www.who.int/healthinfo/survey/whoqol-qualityoflife/en/>
12. Manion A.B., Velsor-Friedrich B. Quality of life and health outcomes in overweight and non-overweight children with asthma. *J Pediatr Health Care*. 2017; 31(1):37-45. doi:10.1016/j.pedhc.2016.01.005.
13. Van Gent R., van der Ent C.K., Rovers M.M., et al. Excessive body weight is associated with additional loss of quality of life in children with asthma. *J Allergy Clin Immunol*. 2007; 119 (3): 591-596. doi: 10.1016/j.jaci.2006.11.007.
14. Lang J.E., Hossain M.J., Lima J.J. Overweight children report qualitatively distinct asthma symptoms: analysis of validated symptom measures. *J Allergy Clin Immunol*. 2015; 135(4): 886-93.e3. doi: 10.1016/j.jaci.2014.08.029.
15. Karyani A.K., Matin B.K., Gebru A.A. et al. Life and health satisfaction and their association toward health-related quality of life, body mass index and chronic diseases in Iran. *J Edu Health Promot*. 2019;8:71. DOI: 10.4103/jehp.jehp_204_18.
16. Measurement of Health-Related Quality of Life&Asthma Control. Cultural adaptation and linguistic validation. (online) https://www.qoltech.co.uk/language_lists.html
17. Kanda Y. Investigation of the freely available easy-to-use software 'EZR' for medical statistics. *Bone Marrow Transplant*. 2013; 48(3):452-8. doi: 10.1038/bmt.2012.244.
18. Juniper E.F., Guyatt G.H., Willan A. et al. Determining a minimal important change in a disease-specific quality of life questionnaire. *J Clin Epidemiol*. 1994;47(1):81-87. doi:10.1016/0895-4356(94)90036-1.

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The Authors declare no conflict of interest.

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COMPARATIVE QUALITY ASSESSMENT OF ROOT CANAL PREPARATION WITH DIFFERENT SYSTEMS OF ENDODONTIC INSTRUMENTS

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ABSTRACT

The aim: To compare the quality of root canal system preparation with the use of manual K-files, machine Protaper Universal and Silk files by *in vitro* studies.

Materials and methods: Root canals preparation in 45 extracted premolars was performed in three groups with 15 teeth in each with K-files, Protaper Universal and Silk files. Transverse sections of the dental root were prepared. Histologically were assessed: amount of sawdust and predentin remaining, the purity degree of root canal walls.

Results: When calculating the sawdust amount at the distance of 3 mm from an apex, a high degree of contamination was observed in the manual K-file group: 53.3% versus 33.3% in the Protaper Universal group and against 20.0% in the Silk file group. The amount of predentin after root canal treatment with manual files reached 25-30%. At the distance of 5 mm from the apex the root canals with high and medium purity degree were detected in 86.7% with Silk files and 80.0% with Protaper Universal files used. All predentin was removed when working with Protaper Universal and Silk files.

Conclusions: In the histological sections of the root canals treated with K-files, the larger amount of dentine particles and predentin has been revealed than when using machine tools. The largest amount of predentin and dentine were removed with Protaper Universal files. Silk endodontic system is better for treatment of the root canals dentine surface in the apical area compared to Protaper Universal and K-files.

KEY WORDS: root canals, endodontic treatment, K-file, Protaper Universal, Silk

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INTRODUCTION

Dental health is one of the most important components of the population health, which is largely related to the quality and success in the person's social life [1]. Although endodontics is one of the most developed field of dentistry, the problem of endodontic dental treatment is relevant in Ukraine, as there is no tendency to reduce the prevalence of pulp and apical periodontal diseases [2]. With the development of the dental services, patient demands are increasing, high costs and frequent complications are leading to conflicts and lawsuits. Under such conditions, the search for new effective methods of treatment for endodontic patients is increasingly important.

Proper preparation of the root canal system is an important stage in clinical endodontic practice. The task of the dentist at this stage is to remove the biofilm and smear layer from the root canal system, minimal removal of the parietal dentin, observing the anatomical shape of the root canal during its enlargement and formation, as well as preserving the unaffected dentin as much as possible during the tooth recure [3,4].

Despite the great variety of endodontic instruments, proper preparation of the root canal walls is not achieved in all cases [5]. This is due to the peculiarities of the anatomical and morphological root canals structure in different groups of teeth, the shape of endodontic instruments, the method of their use and the doctor's manual skills. According to numerous clinical studies, in the root canal system, the most accessible area for

instrumentation and drug treatment is the apical zone, where 90% of the root canal orifice open [6].

It is promising to use modern nickel-titanium machine systems that permit proper processing of the root canal apical part, maintain its shape, prevent the apex transportation and removal of infected masses into the periapical tissues, accelerate the dentist's work [3, 5]. The better formed and cleaned the canal walls are, the more smear layer of dentin and organic residues is removed from it, which significantly affects its sealing [4,7,8]. Therefore, it is promising to study the quality of root canal preparation with different systems of endodontic instruments.

THE AIM

The aim of the study was to compare the quality of root canal system preparation with the use of manual K-files from "Many", machine nickel-titanium Protaper Universal tools from "Dentsply / Maillefer", and Silk files from "Many" by *in vitro* studies.

MATERIALS AND METHODS

To achieve this purpose, the preparation of buccal root canals in 45 extracted upper premolars was performed. Palatine root canals were the control. All teeth were main-

tained in 5.25% sodium hypochlorite solution for 2 hours, then placed in saline to prevent them from drying and brittleness during preparation. Instrumental processing was performed by a single specialist with the X-Smart endomotor from “Dentsply / Maillefer” according to the “Crown-down” method. Torque and rate of preparation were set according to the manufacturer’s recommendations. All teeth were divided into three groups with 15 teeth in each. In the first group of teeth, buccal canals were dissected with manual K-files made of stainless steel by the “Step-back” technique, in the second – Protaper Universal machine files, in the third – Silk machine files were used.

K-file No. 10 was used to determine the working length and patency of the root canals. In all tooth groups, saline was used to eliminate the chemical effects of endodontic agents on the canal wall for irrigation and lubrication. After preparation, the root canal entry was completely closed with glass ionomer cement, X-ray image were obtained. The teeth were then immersed into a 10% room temperature formalin solution for 24 hours and in a 10% hydrochloric acid solution for decalcification. To neutralize hydrochloric acid, the teeth were placed in lithium bicarbonate for 5 minutes. Then, transverse sections of the dental root were prepared at a distance of 3 mm and 5 mm from the anatomical apex and stained with hematoxylin-eosin solution [9].

X-ray images were studied for the smoothness and fluency of the canal walls contour, maintained root canal anatomical shape, the presence of shoulders in the root canal, maintained apical narrowing. Histological examination was performed on the basis of the Vinnytsia Regional Anatomic Pathology Bureau laboratory. Under the “LOMO” light microscope and Digital Camera for Microscope ScienceLab DCM520 (USB 2.0) Resolution 5.0 M pixels (magnification x40; x100; x400) the following parameters were assessed: amount of sawdust and pre dentine remaining in the root canal after preparation, as well as the purity degree of prepared and control canal walls, lack of organic conglomerates. Infected dentine and pulp residues covering the root canal wall were taken for the sawdust.

To assess the sections, each canal was divided into 4 quadrants according to Maryam Ehsani [9]. Grades 1 to 4 were used to reflect changes in each quadrant: number 1 in the presence of sawdust from 0 to 25%, number 2 – from 26 to 50%, number 3 – from 51 to 75%, number 4 – from 76 to 100%. The presence of dentin sawdust in only one quadrant (up to 25%) indicates a high degree of root canal wall cleaning, in two quadrants (up to 50%) – a medium degree, more than two (51-100%) – low degree.

RESULTS AND DISCUSSION

The histological structure of the root canal consists of the pulp, a layer of odontoblasts, pre dentin and dentin with a complex tubular system. In case of the pulp death, the dentinal tubules are dehydrated, microorganisms that localize mainly in the region of the pre dentin easily migrate into their lumen. To improve long-term results of endodontic treatment, this infected layer should be mechanically re-

moved. Figure 1 shows histological sections of a prepared root canal and those of a control untreated canal.

In group I of root canals, prepared by manual K-files, deviations from the anatomical shape of the canal and the presence of shoulders were observed in X-ray images in 26.7% of cases (4/15). The root canal walls were uneven, with furrows in 33.3% of teeth (5/15). In histological examination, the smear layer was preserved around the perimeter of the root canals (fig. 2). In the apical part, organic fibers and dentine sawdust were found. When calculating the sawdust amount at the distance of 3 mm from the root canal apex, a high degree of contamination was observed in the manual K-file group: 53.3% (8/15) versus 33.3% (5/15) in the Protaper Universal group and against 20.0% (3/15) in the Silk file group (table I). The high degree of the root canals contamination in teeth group I with sawdust, infected dentin and pulp tissue remains further impedes the effective removal of microorganisms from the root canal lumen and non-leaking filling of the apical area.

The amount of pre dentine after standard root canal treatment with manual files reached 30% at the distance of 3 mm and 25% at the distance of 5 mm from the apex. Subsequently, the root canal system required more sophisticated methods of cleaning and disinfection. Confirmation of poor root canal walls treatment in the samples of group I is the presence of local parietal oval calcificates, remnants of the pulp vessels, organic fibers at the distance of 3 and 5 mm from the apical zone (fig. 3).

In group II specimens prepared with Protaper Universal files, the root canal surface was clean and smooth enough. Among the 15 treated teeth, X-ray images of the root canal walls’ internal surface revealed single roughs, furrows and shoulders in 26.7% of cases (4/15).

As a result of histological examination of the cross sections in this group of teeth at the distance of 3 mm from the apex, the degree of the root canals cleaning was uneven: canals with a high cleaning degree were found in 26.7% of cases (4/15), with a medium degree – in 40.0% (6/15), with a low degree – in 33.3% (5/15). The best indices of machine processing were observed at the distance of 5 mm from the apical narrowing of the root canals (fig. 1). This is due to the larger diameter of the canal at the distance of 5 mm from the apex, as well as due to the variable taper of the Protaper Universal files, which improves the removal of dentin sawdust during preparation.

The amount of residual pre dentin was the lowest after treatment with machine files Protaper Universal: 10% at the distance of 3 mm from the apex of the root canal, 0% at the distance of 5 mm (table I). In addition to pre dentin, which was completely removed, significant root canal dentin removal was observed in the individual root canals.

Protaper Universal tools are more aggressive to hard tooth tissues, so it is advisable to use them in the clinic for well patent canals with sufficient volume of parapulpal dentin, namely the palatine and distal molar canals, palatine root canals of the premolars, maxillary cuspids and incisors. Due to the progressive taper of the Protaper Universal tools, the action of each tool is limited to a specific section

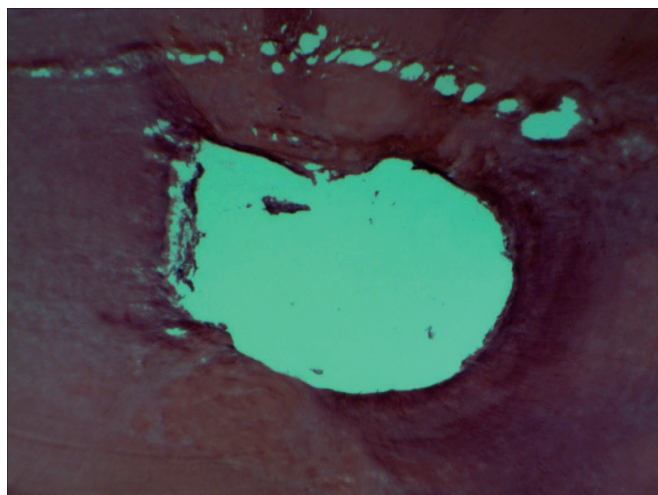


Fig. 1. Histological section of the 14th tooth roots at the distance of 5 mm from the apex (x40): to the left – root canal after preparation with Protaper Universal files, to the right – control root canal.

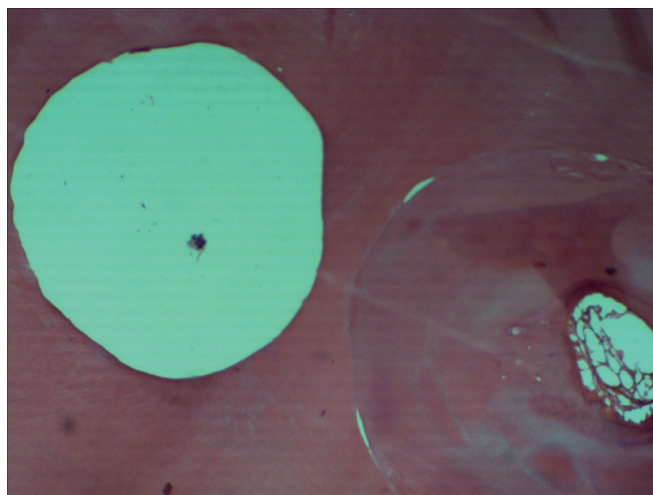


Fig. 2. Histological section of the root canal after instrumental processing with manual K-files at the distance of 3 mm from the apex (x40)

of the root canal, which permits using a shorter sequence to reproduce the shape of the canal according to Schilder.

In the study of group III samples, prepared with Silk files, the root canal walls were smooth, the anatomical shape of the canal was preserved after its formation. Histological assessment of the determined sawdust amount in the samples of this group at the distance of 3 mm from the apical opening revealed the best quality of preparation compared to the previous groups: sawdust and disorganized root dentine were not detected, although destructed organic fibers were observed (fig. 4). The amount of residual pre dentin was 15%.

Maintaining the primary anatomy of the root canal curvature is ensured by the increased flexibility of the tool, which improves the safety of narrow curved canals and the rate of preparation. The design feature of the Silk files in the form of an elongated droplet eliminates the effect of screwing into the canal walls and permits to avoid dentin transportation and perforation. In addition, it is enough

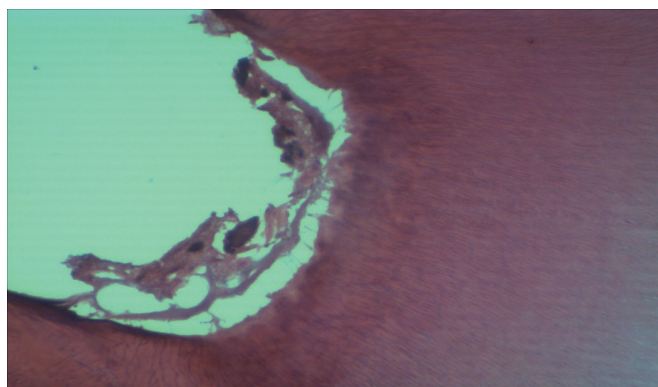


Fig. 3. Histological section of the root canal wall prepared with manual K-files at the distance of 5 mm from the apex (x400)

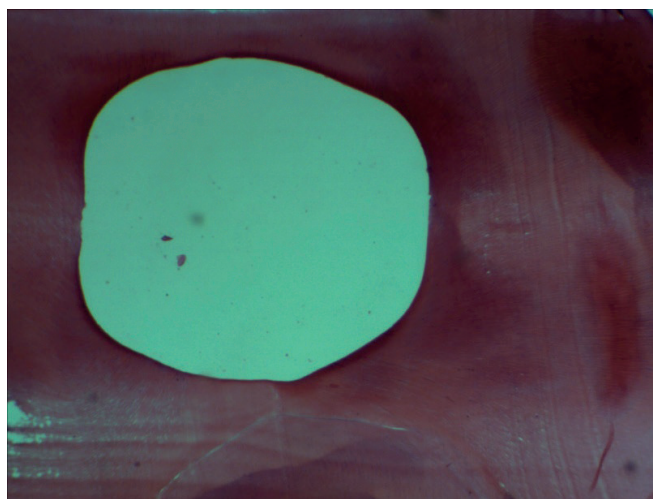


Fig. 4. Histological section of the root canal after preparation with Silk files at the distance of 3 mm from the apex (x100)

Table I. Root canals purity degree and the amount of pre dentine after preparation with various systems of endodontic instruments

	3 mm from the apex			5 mm from the apex		
	K-files n=15	Protaper n=15	Silk n=15	K-files n=15	Protaper n=15	Silk n=15
High degree	3/20.0%	4/26.7%	7/46.7%	4/26.7%	6/40.0%	9/60.0%
Medium degree	4/26.7%	6/40.0%	5/33.3%	6/40.0%	6/40.0%	4/26.7%
Low degree	8/53.3%	5/33.3%	3/20.0%	5/33.3%	3/20.0%	2/13.3%
amount of pre dentin	30%	10%	15%	25%	0	0

to use three Silk files to form a root canal, versus 5-6 tools when working with manual files.

The Silk and Protaper Universal machine files showed a virtually equivalent result in the amount of sawdust and pre-dentin removed at the distance of 5 mm from the apex. High and medium purity canals were detected in 86.7% (13/15) with Silk files and 80.0% (12/15) with Protaper Universal files used. All pre-dentin was removed at the distance of 5 mm from the apex when working with both groups of instruments.

In general, our results agree with the data obtained by other authors [6,9]. Understanding the morphology of dentin for preparation with different tool systems is of great practical importance. The design of all modern rotating nickel-titanium files involves the formation of a canal with a circular cross-section. Therefore, in the slit root canals untreated areas are left in small and large curvature, and in the premolars they are also found in the isthmus. Even if the root canal is shaped correctly, there may still be areas filled with sawdust and loose connective tissue inside it (fig. 3). The minimum number of untreated areas in the root canals remained when using Silk files, and the maximum number – when working with K files.

CONCLUSION

The machine type of preparation has considerable advantages over the methods of using hand tools. The smallest amount of sawdust in the apical area was found in the group of teeth treated with Silk files, then in the group treated with Protaper Universal machine files and with manual K-files. The largest amount of pre-dentin and dentin are removed by Protaper Universal files. Thus, it is appropriate to recommend Protaper Universal for root canal treatment in its upper and middle thirds, and Silk files – for apical area treatment, as well as for narrow and curved root canals.

Histological examination of the tooth root dentine with the combined application of instrumental and medical root canal system treatment is promising compared to the laser preparation.

REFERENCES

1. Lyakhova N., Kasinets S. The preexposure prophylaxis of stomatological diseases among the population of Ukraine in the practice of the family doctor and the pediatrician. *Wiad. Lek.* 2017;70(3):470-473.

2. Barylo O., Kanishyna T., Shkilniak L. The effects of diabetes mellitus on patients' oral health. *Wiad. Lek.* 2018;71(5):1026-1031.
3. Peters O., Boessler C., Paque F. Root canal preparation with a novel nickel-titanium instrument evaluated with microcomputed tomography: canal surface preparation over time. *J. Endod.* 2010; 36 (6):1068-1072.
4. Solomonov M. Smazannyi sloi. Teoreticheskie vykladki i prakticheskie rekomendatsii. *Klinicheskaya endodontiya.* 2009; III (3-4):60-61.
5. Gutmann Dj., Dumsha T., Lovdel P. Reshenie problem v endodontii. *InMedpress-inform.* Moskva: 2014, p. 166-206
6. Santarkanjelo F. Irrigatsiya v sovremennoi endodonii: ot standartnykh algoritmov do slojnykh sluchaev. *Dental Times.* 2011; 3 (10):1-13.
7. Gadjula N., Fedik T. Otsinka metodu trivimirnoi obturatsii sistemi korenykh kanaliv pri likuvanni hronichnogo periodontitu. *Novini stomatologii.* 2018; 4(97):72-76.
8. Kurtzman G. Positive versus negative pressure irrigation. *Roots.* 2012; 3:16-22.
9. Ehsani Maryam. Sravnenie in vitro sposobnosti nikel-titanovykh rotatsionnykh instrumentov RaCe i Mtwo, a takje ruchnykh instrumentov K-Flexofile iz nerjaveyushey stali ochischat kornevyie kanaly. *Endodonticheskaya praktika.* 2010; 2(5):24-27.

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USING OF ENDOVASCULAR CATHETER METHODS IN SURGICAL TREATMENT PATIENTS WITH LUNG BLEEDING

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ABSTRACT

The aim: Improve the results of the treatment of patients with pulmonary bleeding.

Materials and methods: We examined 57 patients with lung bleeding different etiology, who were hospitalized in the department of Thoraco-Abdominal Surgery. All patients were divided into two groups – of the main group 27 patients and the comparison group 30 patients, depend of ages, sex, nosological form, level of lung bleeding. Patients aged from 27 to 78 years, including 34 men (62,5%) and 23 women (37,5%). The test diseases includes: bronchiectasis disease – in 21 (37,1%), pulmonary fibrosis with malformation BA – in 14 (24,7%), abscess of the lung – in 9 (15,9%), polycystic lung disease – in 6 (12,7%), chronic obstructive pulmonary disease – in 5 (9,6%).

Results: As a result of complete physical examination of patients with LB, it has been established that hemorrhage was the result of obstructive bronchitis in 14 patients (42%), there was chronic obstructive pulmonary disease in 7 (21%) and bronchiectasis was diagnosed in 6 (18%) patients. In 2 (6%) patients pulmonary hemorrhage was caused by community-acquired pneumonia. Central lung cancer was detected in 4 (12%) patients.

Conclusions: Bronchial artery angiography gives high efficiency in solving the problem of hemostasis in oncological and nonspecific lung diseases. Endovascular occlusion of bronchial arteries permits: to elaborate diagnosis because of the presence of specific angiographic signs of malignant tumor; to perform effective endovascular hemostasis.

KEY WORDS: embolization of bronchial arteries, hemostasis, pulmonary bleeding

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INTRODUCTION

Treatment of pulmonary bleeding is still one of the most pressing problems in surgery. Pulmonary bleeding is the most dangerous complication of a number of diseases [1,2]. There are 40 nosological forms that can be complicated by pulmonary hemorrhage (PH), some authors describe PH as a complication in more than 100 diseases [3,4]. Over the last decade, the role of obstructive and purulent pulmonary diseases, which significantly suppressed pulmonary tuberculosis, has increased in the emergence of LB [5,6].

Pulmonary bleeding is often a complication of various respiratory system diseases that are associated with the inflammatory process, which are found in 8-17% of hospitalized patients [7, 8]. Most authors believe that in 95-98% of observations the source of pulmonary bleeding in patients is bronchial arteries, which depart from the aorta and pleura [9, 10]. A considerable amount of surgical remedies to combat this threatening complication, often complicates the choice of optimal treatment tactics and leads to the expansion of indications for the further implementation of surgical interventions, which may adversely affect the expected results of treatment and rehabilitation of patients in the early and long periods. [11]. Despite certain advanc-

es in surgical treatment of pulmonary hemorrhage, which is associated with the use in the treatment of endovascular technologies, the mortality rate is still quite high, according to various authors, ranges from 15,1% to 57,0% [12, 13].

To date, X-ray vascular occlusion (REO) of the bronchial arteries allows patients to avoid surgery at the height of bleeding. Despite the fact that this method has been used in clinical practice for more than 30 years, the questions concerning the tactics of interventions and the choice of embolizing materials [14,15]. Efficiency of the method in the long-term period is devoted to the publications. In particular, in young patients, pulmonary hemorrhage may be the first sign of the disease, while the lungs may lack morphological changes in the lung tissue. [16, 17].

Currently, a large number of researchers believe that urgent surgery should be performed at the height to PB in the absence of the effect of conservative treatment. X-ray vascular occlusion (REO) of the bronchial arteries allows patients to avoid surgery at the height to bleeding [18]. A significant addition to the arsenal of methods of surgical treatment of pulmonary hemorrhage was made by intervention radiology. Among these treatments, traumatic X-ray and vascular interventions are becoming increasingly important [19].

The use of the achievements of interventional radiology and the use of modern endovascular catheter technologies in surgery in the late XX – early XXI centuries allowed to introduce a more advanced approach to the diagnosis and treatment of pulmonary bleeding [20]. Based on the level of development of interventional radiology in Ukraine, X-ray and vascular therapies for the treatment of pulmonary hemorrhages of different etiology have not yet become widespread due to the lack of angiographic equipment in most clinics to provide highly qualified X-ray surgical care. The aim of the study. Improving the treatment of patients with pulmonary hemorrhage through widespread use of hemostasis for endovascular surgery [21].

THE AIM

The aim of research – improve the results of the treatment of patients with pulmonary bleeding through widespread use of endovascular surgery methods for hemostasis.

MATERIALS AND METHODS

The study was conducted in the department of Thoraco-Abdominal Surgery V.T. Zaytsev Institute of General and Emergency Surgery of NAMS of Ukraine. We examined 57 patients with lung bleeding different etiology, who were hospitalized in the department of Thoraco-Abdominal Surgery. All patients were divided into two groups – of the main group 27 patients and the comparison group 30 patients, depend of ages, sex, nosological form, level of lung bleeding. Patients aged from 27 to 78 years, including 34 men (62,5%) and 23 women (37,5%). The test diseases includes: bronchiectasis disease – in 21 (37,1 %), pulmonary fibrosis with malformation BA – in 14 (24,7 %), abscess of the lung – in 9 (15,9 %), polycystic lung disease – in 6 (12,7 %), chronic obstructive pulmonary disease – in 5 (9,6 %).

Roentgen-endovascular embolization of bronchial arteries was performed using and Phillips IntegrisAllura 12C (Holland). Bronchial artery angiography consists of the following: femoral catheterization is done by Seldinger technique under topical anesthesia (0,25% solution of novocaine). Catheterization is performed by Cobra catheter with flexure 45 – 65 degrees. Catheter was inserted at T4-T5 level under control of monitor and then it is fixed in the bronchial artery or intercostal artery mouth by rotational movement of guide. 1 ml of contrast agent is added for monitoring of catheter location in required vessel. Polyurethane emboli having diameters of 450 – 720 μ m were used for embolization. Emboli in combination with microembols were inserted at a big diameter of pathologically changed vessel that enhances effect of embolization. Absence of inflow of contrast agent and enhancement of distal part of bronchial arteries were considered as criteria of effective embolization.

Statistical comparisons were conducted using Student's t-test statistically significant at $p < 0.05$. Fisher's angular transformation. The calculations were performed using software STATISTICA for Windows and Microsoft Excel 10.0.

RESULTS

Immediate positive full effect of endovascular embolization bronchial artery in the form of a complete stop bleeding and was observed in 46 (80,8% \pm 1,2, $p \leq 0,05$) of patients. Similar efficiency endovascular hemostasis of the other authors also perceive. Late relapses of lung bleeding and blood coughing was observed in 12 (20% \pm 2,1, $p \leq 0,05$) of patients.

Treatment of patients was started from the hemostatic therapy: 5% solution of EACA, solution of ethamsylate, dicynone, vicasol, tranexamic acid. In patients with pulmonary hemorrhage of II grade performed hemostatic therapy was added with introduction of albumin solution, fresh frozen plasma. Packed red cell transfusion was prescribed patients with pulmonary hemorrhage of III severity. Pulmonary hemorrhage was stopped in 17 (29,8% \pm 2,9, $p \leq 0,001$) with the use of roentgen-endovascular hemostasis of bronchial arteries. High efficiency of roentgen-endovascular occlusion in pulmonary hemorrhage of different etiology was noted by majority of authors. Recurrence of bleeding in the long period after REO appeared in 2 (3,5% \pm 1,1, $p \leq 0,001$) inoperable patients with bronchiectasis disease.

Classification of pulmonary hemorrhages proposed by Grigoryev E.G., 1983 1 grade – hemoptysis: 1a – 50 ml per day; 1b – 50 – 200 ml per day; 1c – 200 – 500 ml per day. 2 grade – massive pulmonary hemorrhage: 2a – 30 – 200 ml per hour; 2b – 200 – 500 ml per hour. 3 grade – profuse pulmonary hemorrhage: 3a – 100 ml per saltum; 3b – more than 100 ml per saltum + obstruction of tracheobronchial tree, asphyxia. Classification depending on the extent of blood loss: 1. minor pulmonary hemorrhage – from 50 to 100 ml per day; middle pulmonary hemorrhage – from 100 to 500 ml per day; 2. severe pulmonary hemorrhage – more than 500 ml per day; 3. extra severe, profuse pulmonary hemorrhage – more than 500 ml per day; 4. bleeding arising per saltum or for a short period.

Small LB and blood coughing was detected in 15 (26,3% \pm 2,2, $p \leq 0,001$) of patients, medium and massive with highlight more than 200 ml of blood – in 9 (15,9% \pm 1,8, $p \leq 0,001$). Full treatment after REE of bronchial arteries radical no operation was possible in 1 (1,7%) patient. Required complex examination of patients turned on a computer tomography of organs of the chest cavity and bronchofibroscopy. The use of these methods allowed pain most observations set side of defeat.

Upon identification pathologically effected BA (bronchial artery), by exercising neck their blood supply, in BA to the conductor as distally as possible a working catheter was inserted. A catheter was inserted through polyurethane emboli with a diameter 400 – 750 microns. Embolysis control on was carried out by contrast BA, revealed its stump and 40 lack of admission contrast substance in the distal sections. With a pathological change in BA, increase in diameter, availability malformations polyurethane embolis, gelatine embolis combined with the introduction of microspirals whose use allowed to reliably close the extended BA test. With the powered by lung parenchyma view and the presence of clots in the respirator paths after

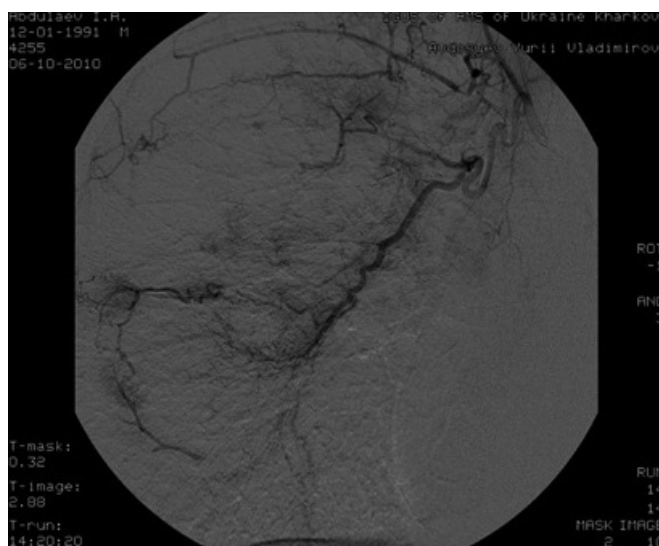


Fig. 1. Angiography of patient with bronchiectatic disease complicated by lung bleeding from bronchial artery before embolization of bronchial arteries.

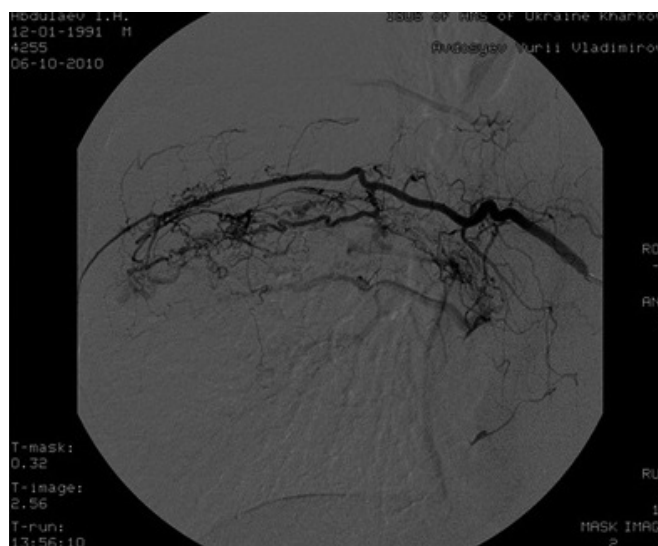


Fig. 2. Angiography of patient with bronchiectatic disease complicated by lung bleeding from bronchial artery after embolization of bronchial arteries.

roentgen-endovascular embolization of bronchial arteries carried out rehabilitation bronchofibroscopy combined with a short course antibacterial therapy and prescribe drugs to relieve pain.

DISCUSSION

The materials used by the department of Thoraco- Abdominal Surgery the State Institution «Institute of General and Emergency Surgery. V.T. Zaitsev NAMS of Ukraine. In accordance with the set tasks, complex clinical and laboratory, instrumental examination and treatment of 57 patients with pulmonary hemorrhages of different etiology were performed. When analyzing the data obtained from the examination and treatment of patients in the main group and the comparison group, it can be noted that properly organized conservative treatment of pulmonary hemorrhage using minimally invasive technology is, in most cases, quite effective and avoids severe, sometimes lethal, complications that are almost inevitable for surgery performed at the height of pulmonary hemorrhages. Our studies have allowed us to determine the following indications for X-ray vascular occlusion in pulmonary hemorrhage: 1. Pulmonary bleeding in inoperable patients with inflammatory diseases of the lungs and bronchi. 2. Pulmonary hemorrhage in operable patients to stabilize the patient, in-depth clinical examination and reduce operative blood loss. 3. Pulmonary hemorrhage in limited fibrotic processes, clinical manifestations of which are expressed only by hemorrhage, and resection surgery is ineffective because of the possible risk. 4. Prolonged postoperative intra-pleural bleeding with undetected source localization, recurrent hemorrhages from operated lungs to preserve lung function and to prevent recurrent operations.

The absolute contraindications to the performance of radiographic occlusion were considered: cerebral coma, severe degree of hepatic-renal failure, unreliable catheter

fixation in the vessel, incompatibility of the occlusive substances and anatomical features of the vessels to be excluded. The relative contraindications were: pronounced intolerance of iodine-containing drugs, doubtful REO at high risk of intervention, age of the patient.

CASE PRESENTATION

We present the case of a 72-year-old man, was admitted in department of Thoraco- Abdominal surgery of ST V.T. Zaitsev Institute of General and Emergency Surgery of NAMS of Ukraine. He had been medicated for haemoptysis with more 80 ml twice daily since 2 months ago. Anamnesis vitae – non-smoker, retired from a cran master. He presented after 8 days of haemoptotic productive cough, bilateral posterior thoracic pain, fever and fatigue. Physical examination showed pale skin, afebrile and tachypnea of 20 cycles per min. Laboratory studies showed anaemia with decrease haemoglobin of 90 mmol/L, normal white cell and platelet count; elevated C reactive protein 23 mg/L. On the first day of hospitalisation, clinical features occurred with dyspnoea and an episode of haemoptysis. The diagnosis of bronchiectatic disease complicated by lung bleeding from bronchial artery was stand after angiography. Flexible bronchoscopy with bronchoalveolar lavage (BAL) was performed 2 days after admitted in clinic. Bacteriological revealed no endobronchial lesions or active bleeding. Bacteriological cultures were negative for bacteria, mycobacteria and fungi. Cytology was negative for malignant cells. The patient underwent conservative hemostatic therapy for the first 3 days after hospitalization. In connection, with the increase in pulmonary hemorrhage, the patient perform minimally invasive intervention in the form of embolization of bronchial arteries.

45 patients with pulmonary hemorrhages, 16 (28,1%) were treated only conservatively. One of the main components of conservative treatment of pulmonary hemorrhage

in patients of the main group was artificial controlled hypotension, whose main purpose was to reduce the initial blood pressure by 90-60 mm Hg century, which in turn reduced the intensity of blood loss and increased the effect of hemostatic drugs.

Thus, the majority of patients admitted to the clinic with different types of pulmonary hemorrhages were cured by a complex of conservative measures without resorting to surgical methods of treatment. This group consisted mainly of patients with small short-term bleeding, which was not accompanied by a decrease in blood pressure and a decrease in the amount of hemoglobin (pulmonary bleeding I – II severity).

Our research suggests that bronchoscopic examination of patients with pulmonary hemorrhages is one of the leading and reliable diagnostic methods. The results of diagnostic and therapeutic bronchoscopies in 53 patients indicate the safety and high informative content of this study.

In our opinion, endobronchial occlusion is an important step in the preoperative preparation of the patient. Due to the filling of the bronchus, it is possible to achieve a temporary discontinuation of the LB, which makes it possible to fully examine the patient, to determine the cause and source of bleeding, to correct disorders caused by the main disease and blood loss, to choose the optimal timing and type of further surgical treatment. Bronchial occlusion in our observations was performed by 12 (19.1%) patients and lasted from 5 to 7 days, the maximum term – 9 days. We did not observe any complications in the form of exacerbation of the inflammatory process, respiratory failure or migration of the filling of the obturator in the airways. After removal of a filling in a bronchus local changes of a mucous in the form of its hyperemia and edema, which were inverse character, were noted. In all 12 (19.1%) cases, when the patient's condition allowed to perform surgery, this technique made it possible. The study was conducted in 34 (53.9%) patients, with 32 (50.8%) patients undergoing bronchial arteriography and 2 patients with angiopulmonography (3.2%) with stopped bleeding. EBA was done to 28 (44.4%) patients with COPD complicated by LB. The indication for embolization of the bronchial artery was the detection of direct or indirect signs of bleeding during angiography. In 13 (20.6%) patients endovascular embolization was performed at the "height of bleeding" due to inefficiency of conservative hemostasis. In 5 (7.9%) patients, REO was performed after conservative hemostasis due to the high risk of recurrence of hemorrhage. In 4 (6.4%) patients with bilateral inflammatory process and unspecified source of pulmonary hemorrhage at bronchoscopy, the technique of delayed embolization of bronchial arteries was used. All patients with unilateral localization of the pathological process after REO achieved a stable hemostatic effect. In the future, 14 (22.2%) patients underwent routine lung surgeries within 4 to 10 days. 12 (19.1%) patients of the main group were operated on and endovascular occlusion of the bronchial arteries was the main and definitive method of treatment of pulmonary bleeding [27,28]. Mortality in the main group was 3.5% (2 patients with chronic lung abscess, which was complicated by profuse pulmonary hemorrhage.

Patients for temporary hemostasis were performed endovascular embolization of the left bronchial artery at the height of bleeding with subsequent pneumonectomy. Total recurrence of pulmonary hemorrhage was observed in 4 (6.4%) patients. The non effectiveness of conservative therapy in the comparison group served in patients with severe blood loss indications for external surgery – thoracotomy with lobo- or pneumonectomy. Planned surgical interventions were performed in 10 (12.8%) patients, 14 (17.9%) patients were operated on urgent at the height of pulmonary bleeding, and 54 (69.2%) patients were treated only conservatively. Of the 36 patients in the comparison group, 5 (6.4%) died, with a lethal outcome in the group of conservatively treated outbreaks in 2 (3.7%) patients as a result of recurrent profuse bleeding, and 2 (14.3%), among planned ones – 1 (10%) patient. Total recurrence of pulmonary hemorrhage was noted in 16 (29.5%) patients.

Bronchial arteriography and angiopulmonography are the most reliable methods of detecting the source of pulmonary hemorrhage, and therapeutic embolization of the bronchial arteries is one of the most effective, low-traumatic and reliable methods of stopping pulmonary bleeding. This method can be both independent and final, as well as the stage of preparation of the patient for further radical surgery. However, our studies have shown that endovascular interventions in the area of the bronchial arteries in the period of bleeding, especially profuse, are extremely complex and require careful training both from the operational and technical point of view, and in terms of preparation of the patient.

CONCLUSIONS

1. In our observations non effective REE of bronchial arteries activity with repeated exposure of LB and hemoptysis observed in 20% of patients, early in 8.3% of them. Repeated LB at a later date. The timing appeared in 13.5% pain, which required repeated implementation of REEA. Causes of REELB are different. Roentgen-endovascular embolization of bronchial arteries is the method of choice for the treatment of LB and hemoptysis in most patients with chronic lung diseases.
2. Bronchial artery angiography gives high efficiency in solving the problem of hemostasis in oncological and nonspecific lung diseases, for determination of localization and source of bleeding. To perform effective endovascular hemostasis; – to gain time for stabilization the patient with the aim of planned surgical treatment.

REFERENCES

1. Zener R., Bottoni D., Zaleski A., Fortin D., Malhaner R.A., Inculet R.I. (2017). Transarterial embolization of intralobar pulmonary sequestration in a young adult with hemoptysis. *J Thorac Dis.* 2017; 9 (3): E188–E193. doi: <http://doi.org/10.21037/jtd.2017.02.82>
2. Kim T.E., Kwon J.H., Kim J.S. (2014). Trans-catheter embolization massive hemoptysis from an intralobar pulmonary sequestration: a case report. *Clin Imaging.*; 38:326–329. doi: <http://doi.org/10.1016/j.clinimag.2012.07.002>

3. Cardenas-Garcia J, Feller-Kopman D. (2018)POINT: Should All Initial Episodes of Hemoptysis Be Evaluated by Bronchoscopy? Yes. *Chest* 2018; 153:302. doi: <http://doi.org/10.1016/j.chest.2017.09.036>
4. Mohapatra M., Mishra S., Jena P. (2012). Massive hemoptysis in a case of intralobar pulmonary sequestration associated with pulmonary hypoplasia and meandering right pulmonary vein: diagnosis and management. *Case Rep Pulmonol.* 2012; Article ID 960948. doi: <http://doi.org/10.1155/2012/960948>
5. Ojha V., Samui P.P., Dakshit D. (2015). Role of endovascular embolization in improving the quality of life in a patient suffering from complicated intralobar pulmonary sequestration – a case report. *Respir Med Case Rep.* 2015; 16 : 24–28. doi: <http://doi.org/10.1016/j.rmcr.2015.02.011> [6] Antonio Borzelli, Andrea Paladini, Francesco Giurazza. (2018). Successful endovascular embolization of an intralobar pulmonary sequestration. *Radiol Case Rep.* 2018 Feb; 13(1): 125–129. doi: <http://doi.org/10.1016/j.radcr.2017.10.003>
7. V. Bhargavi, I. Subbanna; Bangalore/IN. (2018). Hemoptysis: an endovascular rescue. *ECR 2018. C-1467.* doi: <http://doi.org/10.1594/ecr2018/C-1467>
8. Clément Marcelin. (2018). Outcomes of Pulmonary Artery Embolization and Stent Graft Placement for the Treatment of Hemoptysis Caused by Lung Tumor. *ECR 2018 / C-1467.* doi: <http://doi.org/10.1183/09031936.001>
9. Amar Gupta, Mark Sands, NikunjRashmikant Chauhan. (2018). Massive hemoptysis in pulmonary infections: bronchial artery embolization. *European Respiratory Journal* 2015 45: 601-603; doi: <http://doi.org/10.1183/09031936.00199914>
10. Fruchter O, Schnee S, Rusanov V, et al. (2015). Bronchial artery embolization for massive hemoptysis: long-term follow-up. *Asian CardiovascThorac Ann* 2015;23:55-60 doi: <http://doi.org/10.1177/0218492314544310> [12] Ketai LH, Mohammed TL, Kirsch J, et al. (2014). ACR appropriateness criteria® hemoptysis. *J Thorac Imaging* 2014; 29:W19. doi: <http://doi.org/10.1097/RTI.0000000000000084>.
11. David R. Sopko, M.D. and Tony P. Smith, M.D. (2011). Bronchial Artery Embolization for Hemoptysis. *Semin Intervent Radiol.* Mar; 28(1): 48–62. doi: <http://doi.org/10.1055/s-0031-1273940>
12. Mohapatra M., Mishra S., Jena P. (2012). Massive hemoptysis in a case of intralobar pulmonary sequestration associated with pulmonary hypoplasia and meandering right pulmonary vein: diagnosis and management. *Case Rep Pulmonol.* 2012; Article ID 960948. doi: <http://doi.org/10.1155/2012/960948>
13. Zener R., Bottoni D., Zaleski A., Fortin D., Malthaner R.A., Incullet R.I. (2017). Transarterial embolization of intralobar pulmonary sequestration in a young adult with hemoptysis. *J Thorac Dis.* 2017; 9 (3) : E188–E193. doi: <http://doi.org/10.21037/jtd.2017.02.82>
14. Boyko V. V., Ponomarova K. V., Krasnoyarskiy A. G., Korolevska A. Yu., Avdosjev Yu. Our experience of bronchial artery embolization in patients with pulmonary bleeding. *Europeansurgery / V. – 60th Annual Meeting of the Austrian Society of Surgery Schnittmengen – Innsbruck, June 19–21. 2019.* 51: 72. doi: <https://doi.org/10.1007/s10353-019-0600-2>
15. Ojha V., Samui P.P., Dakshit D. (2015). Role of endovascular embolization in improving the quality of life in a patient suffering from complicated intralobar pulmonary sequestration – a case report. *Respir Med Case Rep.* 2015; 16 : 24–28. doi: <http://doi.org/10.1016/j.rmcr.2015.02.011>
16. Hosman AE, de Gussem EM, Balemans WAF, et al. (2017). Screening children for pulmonary arteriovenous malformations: evaluation of 18 years of experience. *PediatrPulmonol.* 2017;52(9):1206-1211. doi: <http://doi.org/10.1002/ppul.23704>.
17. Antonio Borzelli, Andrea Paladini, Francesco Giurazza. (2018). Successful endovascular embolization of an intralobar pulmonary sequestration. *Radiol Case Rep.* 2018 Feb; 13(1): 125–129. doi: <http://doi.org/10.1016/j.radcr.2017.10.003>
18. V. Bhargavi, I. Subbanna; Bangalore/IN. (2018). Hemoptysis: an endovascular rescue. *ECR 2018. C – 1467.* doi: <http://doi.org/10.1594/ecr2018/C-1467>
19. Kateryna Ponomarova (2019). Possibilities of using miniinvasive catheter technologies in the treatment of lung bleeding. («EUREKA: Health Sciences» Number 6 (2019), P. 41-48, DOI: 10.21303/2504-5679.2019.001087.
20. Antonio Borzelli, Andrea Paladini, Francesco Giurazza. (2018). Successful endovascular embolization of an intralobar pulmonary sequestration. *Radiol Case Rep.* 2018 Feb; 13(1): 125–129. doi: <http://doi.org/10.1016/j.radcr.2017.10.003>
21. Balch H, Crawford H, McDonald J, O'Hara R, Whitehead K. (2017) Long-term treatment outcomes of embolotherapy in pulmonary arteriovenous malformations in children with hereditary hemorrhagic telangiectasia. *Ann Vasc Med Res.* 2017;4(4):1064. doi: <http://doi.org/10.24296/jomi/249>

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ORIGINAL ARTICLE

CLINICAL FEATURES OF ADJUSTMENT DISORDER IN INTERNALLY DISPLACED WOMEN

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ABSTRACT**The aim:** To study the clinical features of internally displaced women with adjustment disorders.**Materials and methods:** Clinical features of internally displaced women with adjustment disorders are investigated. Comprehensive clinical psychopathological and psychodiagnostic assessment of 58 women have been conducted, their medical history data have been analyzed.**Results:** According to the analysis of the questionnaire severity of psychopathological symptoms prevalence of phobic anxiety, somatization with the presence of distress were observed in internally displaced women. In the clinical presentation of psychopathological disorders, the following symptoms of anxiety-depressive syndrome complex prevailed: mental fatigue $93.1 \pm 3.9\%$; decrease in working capacity in $89.7 \pm 4.2\%$ of women; decrease in mood $79.3 \pm 6.9\%$; anxiety $75.7 \pm 3.8\%$; decrease in libido in $65.7 \pm 4.9\%$; physical fatigue – $51.7 \pm 4.4\%$ of the examined.**Conclusions:** Analysis of clinical and psychopathological symptoms of women with adjustment disorder indicates the dominance in the structure of symptoms of anxiety and depressive symptoms in mixed and isolated forms. According to the analysis of the questionnaire of severity of psychopathological symptoms, in internally displaced women, the prevalence of phobic anxiety, somatization with the presence of distress was observed.**KEY WORDS:** adjustment disorder, psychosocial maladjustment, internally displaced persons

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INTRODUCTION

The problem of various states of psychosocial maladjustment has been addressed in psychiatry for quite some time. In particular, attempts were made to describe them in the form of the following categories: nostalgia, psycho-emotional stress syndrome, premorbid forms of emotional stress, mental maladjustment, psychosocial maladjustment, prenosological states, maladjustment, or non-pathological neurotic manifestations. This list can be continued [1,2,3].

In this context, the concept of the mental adaptation barrier is extremely important and is an individual functional-dynamic formation that prevents overstrain of the mechanisms of mental maladjustment, which can result in the formation of a state of mental maladjustment and mental disorders, in particular neuroses.

The barrier of mental maladjustment is dynamic, and in the state of mental stress it approaches its individual critical value. At the same time, a person uses all his reserve capabilities and, in the case of a harmonious psychological attitude to a stressful situation, he sometimes becomes able to perform particularly complex activities without experiencing anxiety, fear and confusion, which impede the most adaptive behavior.

But the prolonged and especially sharp stress of the adaptation barrier functional activity leads to its overstrain, which manifests itself as a state of maladjustment [4]. If

the pressure on the mechanisms of mental adaptation increases, and the reserve capacity is exhausted, then there is a “barrier tear” and the formation of borderline mental pathology [5].

Schematically, the process of maladjustment occurs according to the principle of a “vicious circle”, where the releasing mechanism, as a rule, is a sharp change in living conditions, habitual environment, and the presence of a stable traumatic situation. And further, maladjustment exacerbates the existing mental and somatic disorders, leading to even greater maladjustment and subsequent deviations in functioning [6]. Numerous neurotic and psychosomatic symptoms accompanying psychosocial maladjustment are described in sufficient detail in the literature.

This problem has recently become particularly relevant in Ukraine, which in the context of a hybrid war faced a sharp increase in social tension caused by the fighting in the antiterroristic operation zone and a large number of migrated persons [7]. There are significant gender differences in crisis situations; in particular, women are the most vulnerable in a significant part of stressful situations [8,9].

THE AIM

Considering this, the aim of the research is to study the clinical features of migrated women with adjustment disorders.

MATERIALS AND METHODS

The study involved 58 women with diagnosed adjustment disorders (F43.2), who sought advice from the Cathedra of Psychiatry, Narcology and Medical Psychology of the “Ukrainian Medical Stomatological Academy”. They all agreed to participate in the study.

They were given a comprehensive clinical, psychopathological and psychodiagnostic examination, and their anamnestic data was analyzed.

The scale of adaptation / maladjustment, or questionnaire for the severity of psychopathological symptoms (Symptom Check List-90-Revised-SCL-90-R), adapted by N. V. Tarabrina in co-authorship., 2001 – was used to assess the psychopathological status of women with adaptation disorders. This technique makes it possible to assess the presence and severity of a spectrum of psychopathological manifestations and individual symptoms in a patient.

RESULTS AND DISCUSSION

According to the obtained results, anamnestic among the comorbid pathologies the most common in the examined women were depression, anxiety-depressive reactions, diseases of the cardiovascular system (hypertension, atherosclerosis), and acute reactions to stress.

20 (34.5%) women had suicidal statements in their past histories, and 2 (3.4%) had incomplete suicidal attempts. At the time of the survey, all women did not have pronounced suicidal tendencies.

Hereditary factors analysis showed that the predispositional factors for the development of the corresponding neurotic pathology and psychosocial maladjustment in the women we examined were mainly hereditary factors (mental pathology in parents), dystontogenetic factors (pregnancy pathology), as well as manifestations of neurotic behavior in childhood.

The most important and most common factors of psychotrauma were the frustration of health needs, love, and happy family life. Maladjustment developed as a result of the discrepancy between expectations and the actual situation in family relations, the inability to remain in the current state of relations and the inability to find effective ways to resolve conflicts. In some patients maladjustment of family relations reached the degree of aversion, which covered both psychological and sexual spheres with the involvement of both conscious and unconscious mechanisms.

In the clinical presentation of psychopathological disorders, the following symptoms of anxiety-depressive syndrome complex prevailed: mental fatigue 93.1 ± 3.9%; decrease in working capacity in 89.7 ± 4.2% of women; decrease in mood 79.3 ± 6.9%; anxiety 75.7 ± 3.8%; decrease in libido in 65.7 ± 4.9%; physical fatigue – 51.7 ± 4.4% of the examined.

Clinical and psychopathological presentations detected in women, who suffer from adaptation disorders, are systematized in Table I.

According to the given table, such manifestations as memory disorders, lethargy, obsessions, mannerisms, dysuria were relatively atypical for the patients examined.

Table I. Clinical and psychopathological presentations in women suffering adaptation disorders

Clinical sign	(n=58) % ± m %
1. Physical fatigability	51,7 ± 4,4
2. Mental fatigability	93,1 ± 3,9
3. Decreased working capacity	89,7 ± 4,2
4. Irritability	29,3 ± 4,9
5. Tearfulness	36,5 ± 3,7
6. Insomnia	34,5 ± 4,0
7. Memory disorders	12,1 ± 2,1
8. Attention disorder	24,1 ± 4,1
9. Decrease in mood	79,3 ± 6,9
10. Low self-esteem	41,4 ± 3,0
11. Lethargy	8,6 ± 1,9
12. Emotional lability	46,5 ± 3,7
13. Anxiety	75,7 ± 3,8
14. Obsessions	10,3 ± 1,4
15. Meteosensitivity	15,5 ± 2,7
16. Aggravation	12,1 ± 3,0
17. Hypochondria	47,2 ± 4,1
18. Paresthesias	20,6 ± 3,9
19. Ideational lethargy	10,3 ± 2,9
20. Headache	42,5 ± 4,2
21. Dizziness	29,3 ± 2,6
22. Cardialgia	17,2 ± 3,7
23. Blood pressure fluctuation	43,1 ± 4,1
- hypertension	18,9 ± 3,2
- hypotension	6,9 ± 3,3
- lability	20,7 ± 3,9
24. Suffocation	12,1 ± 3,9
25. Nausea, vomiting	22,4 ± 3,1
26. Dysorexia	33,8 ± 1,2
27. Indigestion	31,0 ± 3,9
28. Dysuria	6,9 ± 1,8
29. Hyperhidrosis	41,4 ± 2,8
30. Vegetovascular paroxysms	45,5 ± 5,5
31. Decreased libido	65,7 ± 4,9
32. Dysmenorrhea	18,9 ± 2,4

Table II. Psychopathological syndromes in women with adjustment disorders

Syndromes	(n=58) % ± m %
1. Anxiety-depressive	53,4 ± 4,9
2. Asteno-depressive	18,9 ± 3,7
3. Anxious	20,6 ± 2,9
4. Depressive	25,8 ± 4,1
5. Astheno-agripnic	12,0 ± 3,5

The most significant and common clinical signs for women with adaptation disorders were: mental fatigue, decreased working capacity, tearfulness, insomnia, reduced self-esteem, paresthesias, headaches, dizziness, blood pressure fluctuation, nausea and vomiting, dysorexia, dyspepsia, decreased libido, hyperhidrosis, vegetovascular paroxysms.

More detailed clinical and psychopathological analysis of the structure of clinical symptoms in patients with adaptation disorders showed that emotional disorders in patients in this group were characterized by a predominance of horror (53.4%), fears (44.8%), dissatisfaction with themselves (32.7%). Anancastic (56.8%) and asthenic (36.2%) components with pronounced motor restlessness (39.6%) were observed in the behavior.

Thinking disorders were manifested in the form of hypochondriacal thoughts (55.2%) and exhaustion of mental activity (53.4%). Somato-vegetative disorders were recorded as sexual dysfunctions (67.2%) and headache (46.5%).

Subjective state of mild depression of situational genesis was diagnosed in 36.2% of the examined women, and in 24.1% a moderate depressive episode was diagnosed.

In general, the clinical picture of adaptation disorders in the women examined was characterized by the predominance of anxiety-depressive symptoms with diverse manifestations of somatization.

The revealed patterns of clinical psychopathological features in women with signs of psychosocial maladjustment were confirmed by syndromic analysis. The results of the syndromic analysis of clinical manifestations are summarized in table II.

Analysis of the data obtained indicates that in women with adaptation disorders, the syndromic structure of the clinical picture is characterized by the predominance of mixed anxiety-depressive and pure anxiety and depressive clinical variants of psychopathological syndromes.

The results of the clinical examination were confirmed by the results obtained using the questionnaire on the severity of psychopathological symptoms (Simptom Check List-90-Revised-SCL-90-R). Phobic anxiety (62.1%), somatization (39.6%) with distress (77.5%) prevailed in the structure of anxiety disorders.

CONCLUSIONS

In general, an analysis of the clinical and psychopathological symptoms of women with adaptation disorders indicates that anxiety and depressive manifestations dominate in the structure of symptoms in mixed and isolated variants.

According to the analysis of the questionnaire of severity of psychopathological symptoms, in internally displaced women, the prevalence of phobic anxiety, somatization with the presence of distress was observed.

The obtained data can be used to build an effective system of psychotherapeutic correction of the manifestations of psychosocial maladjustment in migrated women and rehabilitation work with them.

REFERENCES

- Goldberger L. Handbook of stress. Theoretical and clinical aspects. N.Y.: The Free Press; 2012. 804p.
- Breslau N., Kessler R., Howard D. Et al. Trauma and posttraumatic stress disorder in the community. *Arch. Gen. Psychiatry.* 1998 Jul; 55(7): 626-32.
- Herasymenko L.A. Nova metodyka diahnozyky psykhosotsial'noyi dezadaptatsiyi [A new method of diagnosis of psychosocial maladjustment]. *Likars'ka sprava.* 2018;1:2: 82-88 (Ua).
- De Jong J.T., Komproe I.H., Van Ommeren M. Mental disorders in postconflict settings. *Lancet.* 2003; 361(9375): 2128-2130.
- Andreyeva G.M. Sotsial' naya psykholohiya [Social Psychology]. Moscow, Moscow State University; 1980. 280 p. (Ru).
- Soeteman D.I. The economic burden of personality disorders in mental health care. *The Journal of Clinical Psychiatry.* 2008; 69: 259.
- Herasymenko L.O., Isakov R.I. Maskovani depresii v zagal'no-somatichnii praktitsi [Masked depression in general somatic practice]. *Aktual'ni problemy suchasnoyi medytsyny: Visn. Ukr. med. stomat. akad.* 2013;13: 80-82. (Ua).
- Israelashvili M. Should adjustment disorder be conceptualized as transitional disorder? In pursuit of adjustment disorders definition. *Journal of Mental Health.* 2012; 21(6): 579-88.
- Herasymenko L.O. Diahnozyka psykhosotsial'noyi dezadaptatsiyi u zhinok z depresyvnymy rozladamy sotsiumi [Diagnosis of psychosocial maladaptation in women with depressive disorders]. *World of Medicine and Biology.* 2019;1 (67): 34-38. (Ua).
- Maruta N.V., Yavdak I.O., Kalens'ka G.M., Al'ohina S.L. Kontseptsyia formuvannya nevrotychnih depresii u suchasnomu sotsiumi [The concept of formation of neurotic depression in modern society]. *Arhiv psichiatriji.* 2003; 9(1): 17-20. (Ua).
- Rahman L.V., Markova M.V., Kozhina G.M. Rol' stresovih faktoriv v sindromogenezi terapevtichno rezistentnih depresii [Role of stress factors in syndromogenesis of therapeutically resistant depression]. *Ukrayins'kii visnik psihonevrologiyi.* 2015; 23(3):163-164. (Ua).
- Breslau N., Kessler R., Howard D. Et al. Trauma and posttraumatic stress disorder in the community. *Archives of General Psychiatry.* 1998; 55: 626-632.
- Skrypnikov A.M., Herasymenko L.A., Isakov R.I. Psykhosotsial'na dezadaptatsiya pri posttravmatychnomu stresovomu rozladi u zhinok [Psychosocial maladjustment in post-traumatic stress disorder in women]. *Poltava: TOV «ASMI»;* 2016. 168p.
- Wittchen H.U., Jacobi F. Size and burden of mental disorders in Europe: a critical review and appraisal of 27 studies. *Eur. Neuropsychopharmacol.* 2005; 15 (4): 357-76.
- Herasymenko L.A. Psychosocial aspects of adjustment disorders in women. *Psychiatriya, psychotherapiya and clinical psykholohiya.* 2018; 1: 40-45. (Ua).
- Kozhina G.M., Markova M.V., Mihailov V.B., Fel'dman DA. Klinichni osoblivosti nevrotychnih rozladiv u vnutrishn'o peremishchenih osib [Clinical features of neurotic disorders in internally displaced persons]. *Ukrayins'kii visnik psihonevrologiyi.* 2015; 3(84): 129-130. (Ua).
- Halchenko A.V. Suchasni vidminnosti psykhosotsial'noyi dezadaptatsiyi u vnutrishn'o peremishchenykh osib za nayavnosti nevrotychnoyi patolohiyi [Modern differences of psychosocial disadaptation in internally moved persons with neurotic pathology]. *Aktual'ni problemy suchasnoyi medytsyny: Visn. Ukr. med. stomat. akad.* 2019; 1(65): 7-11 (Ua).
- Al-Baldawi R. Migration-related stress and psychosomatic consequences. *International Congress Series.* 2002 Sept. 1241: 271-78.19. Shieds J. (1973) Handbook of abnormal psychology, London: Pitman medical publishing.

20. Maruta N., Pan'ko T., Fedchenko V., Kutikov O. Rol' psikhotravmatyzatsiynykh faktoriv u formuvanni tryvozhno-fobichnykh rozladiv [The role of psycho-traumatization factors in formation of anxious-phobic disorders]. 2012; 4: 25-28. (Ua).

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ORIGINAL ARTICLE

MODEL OF MANAGEMENT BY THE QUALITY OF LIFE OF OBESE CHILDREN

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ABSTRACT

The aim of the work is medical and social substantiation and development the model of management by the quality of life of obese children.

Materials and methods: Material processing was performed by using of mathematic-statistical methods: variance, correlation and regression analysis, mathematical prediction, modeling; the relative, average values and their errors were calculated as well as the predictive coefficients, and the odds ratios, which made it possible to obtain reliable data.

Results: It was found that the real prevalence of obesity among children and adolescents in Kharkiv was significantly different from the official statistics in Kharkiv region (15,0 per 1,000 of infant population). The general level of excess weight in 2016 was $151,0 \pm 5,2\%$.

It was developed a technique for predicting the risk of excess body weight in children based on a heterogeneous sequential recognition procedure, which with 95% of probability can determine the patient's belonging to a particular risk group.

Conclusions: The model of management by the quality of life for obese children was developed. Offered model of management allows to eliminate the managed factors of development of this pathology, to conduct comprehensive monitoring of the state of children's health, to eliminate certain shortcomings of the health care organization, in particular at the primary level, to raise the awareness of the population on methods of prevention, to apply innovative medical technologies, which in turn will help to improve the quality of life for obese children.

KEY WORDS: obesity, overweight, quality of life, risk factors, model of management

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INTRODUCTION

Topicality of presented theme is obvious. Obesity is one of the serious medical and social problems of the present in view of the increasing prevalence among the population of the majority of countries irrespective of sex, race, and social identity, complex effects on health, increasing the cost of medical care for obese people, decrease of their working capacity and reduction of overall life expectancy [1,2]. Some authors notice that there are evidences of the presence of a link between obesity in childhood and adulthood [3].

Negative impact of obesity on physical as well as psycho-emotional problems (such as depression, anxiety, aggression, and feeling of insecurity) and their consequences (low self-appraisal and social isolation) that affect health and patients' quality of life were investigated [4,5,6].

The importance of this problem is increasing in states with low and medium level of income. Overweight and obesity in those countries are widely spread [7].

The study of obese patients' health status needs comprehensive characteristics in frames of generally recognized techniques of quality of life assessment. In modern medicine as well as in pediatrics this methodology has proven to be a simple, reliable, and sensitive method used both in healthy and ill children of all ages [8,9].

Today, in Ukraine, the quality of life for obese children as a complex research problem has not been investigated

yet, and scientifically grounded approach to the application of this methodology in theoretical and practical pediatrics is not formulated, which hinders its widespread adoption.

Therefore, the primary task is to study the features of overweight among children and adolescents through the comprehensive assessment of their health and planning the priority actions to improve the quality of life of obese children. Ensuring the effectiveness and efficiency of appropriate measures requires the application of basic regularities of the management process and the development of a model focused on the optimization of main parameters of quality of life and social adaptation of children with this pathology.

THE AIM

The aim is to study the way of life of obese children and the state of medical aid for them at the primary level as well as working out and introduction to the medical practice of optimized model of management by the quality of life and social adaptation of obese children.

MATERIALS AND METHODS

Biblosemantic method was used for study of home and foreign experience in this problem; sociological one – for

investigation of risk factors, quality of life, conditions of medical aid for children with overweight and obesity; statistical one – for collection, the processing and evaluation of received information; method of prognostication was used for the development of a methodic of forecasting of risk of excess weight and obesity in children and prognostic matrix of quality of life for obese children; conceptual modeling was used for the working out the main components of the model for managing the quality of life of obese children; method of expert assessments to evaluate a valid and developed model for managing the quality of life of obese children. Statistical processing and data registration were carried out using computer statistical software packages Statistica 8, Microsoft Excel. The conclusion of ethical commission of KhNMU recognized methods of investigation adequate for such kind of research.

RESULTS

Complex medico-social research has revealed and proved the necessity of the working out of an effective management model by the quality of life of obese children. Moreover, low level of registration the low level of incidence of overweight and obesity in the child population, poor health care and the lack of widespread use of complex approaches to assessing the health status of obese patients, which is a cause of late diagnosis of the disease and a significant deterioration in the quality of life of children and needs substantiation of appropriate means of optimizing. Special programme of investigation was developed.

Kharkiv city children's outpatient clinic № 2 and the endocrinological outpatient department of municipal hospital № 2 were the basic institutions for the observation.

At the next stage the prevalence of obesity and overweight in a representative sample of children and adolescents in Kharkiv in 2016 was examined.

General and special relative indicators per 1,000 of infant population were calculated. After that some risk factors of children's overweight and state of their health were investigated with the use of dispersion analysis. The power of influence of factors and the ratio of chances were defined. The identified factors were categorized into major influential factors 3 % or more than ($\eta \geq 3\%$) and minor ones with the influence less than 3 % ($\eta < 3\%$). All the factors were the basic ones for the development of a methodic of prognostication the risk factors for accumulation of excess child's body weight based on a heterogeneous sequential procedure involving parental surveys according to prognosis tables and determining the likelihood of overweight development in children.

Evaluation of the quality of life of children with obesity implies the use of special techniques and carried out in two phases: the first phase was conducted individually written survey of children with obesity created by questionnaire. The second stage involved direct analysis of the quality of life index and limitations of life activity in physical, psycho-emotional spheres, public and everyday life. The relative quality of life index was calculated using a special

formula. A model of the main components (life spheres) and a prognostic matrix of the quality of life of obese children were constructed. The individual components of each selected restriction sphere were determined.

At the next stage of investigation the quality of care for obese children was evaluated. The following parameters were studied: the state of the medical-diagnostic process (timeliness of the detection of obesity, completeness of the minimum necessary for the disease diagnostic observations, obtaining recommendations on diet and adequate physical activity, regular observation by specialists) coverage of dispensary supervision, visitation and satisfaction by the results of specialists' activity, and parental awareness of obesity.

Based on the results obtained in the previous stages of the study, at the final stage of the study a model for managing the quality of life of obese children was substantiated and developed.

Evaluation of the effectiveness of the proposed model was carried out through the introduction of some elements of the model and the method of expert evaluation.

In frames of this investigation there was a study of the prevalence of overweight and obesity in children and adolescents in Kharkiv (Ukraine). According to the obtained results, it was determined that the overall prevalence of overweight and obesity was 151,0±5,2%. It was noted that the level of pathology under study was higher in boys than in girls 164,5±7,6% and 136,3±7% relatively.

It was found that obesity was detected in 58,4±3,4% children, there were 43,6±4,2% girls and 73,4±5,3% boys out of them. The highest prevalence of overweight and obesity in boys and girls was observed in the 6-9 year-age group (189,9±9,6%), and the lowest one was in the group of 14-17 years (109,5±9,0%). It was revealed that the prevalence of obesity in boys and girls was the highest in 6-9 year-old children 97,1±10,1% and 59,3±8,2% relatively, lower in the group 10-13 year-old children 73,9±9,2% and 47,5±6,9% relatively, and much lower in the group of 14-17 adolescents 38,8±7,9% and 7,3±5,1% relatively.

During the assessment of the risks of excess weight in children it was found that 22 risk factors had a significant effect on the development of excess body weight. Biological and social hygienic ones were the main risk factors for the formation of overweight. Socio-economic and psychological ones had a secondary impact on the development of the pathology under study.

The group of biological factors includes family tendency to overweight ($\eta=9\%$; $p<0,001$; OR=3,5; CI=2,3–4,6), burdened heredity for type 2 diabetes and hypertension ($\eta=6\%$; $p<0,001$; OR=2,8; CI=2,1–3,7), perinatal (pathological course of pregnancy) ($\eta=3\%$; $p<0,001$; OR=2,1; CI=1,6–2,9), burdened obstetric anamnesis ($\eta=2\%$; $p<0,001$; OR=2,2; CI=1,5–3,1), and postnatal factors (overweight during the first year of life) ($\eta=3\%$; $p<0,001$; OR=2,2; CI=1,7–3,1), peculiarities of baby's nutrition in the first year of life (artificial, mixed or early additional feeding) ($\eta=3\%$; $p<0,001$; OR=2,4; CI=1,7–3,3). It was defined that among the leading socio-hygienic factors there were poor nutrition (daily consumption

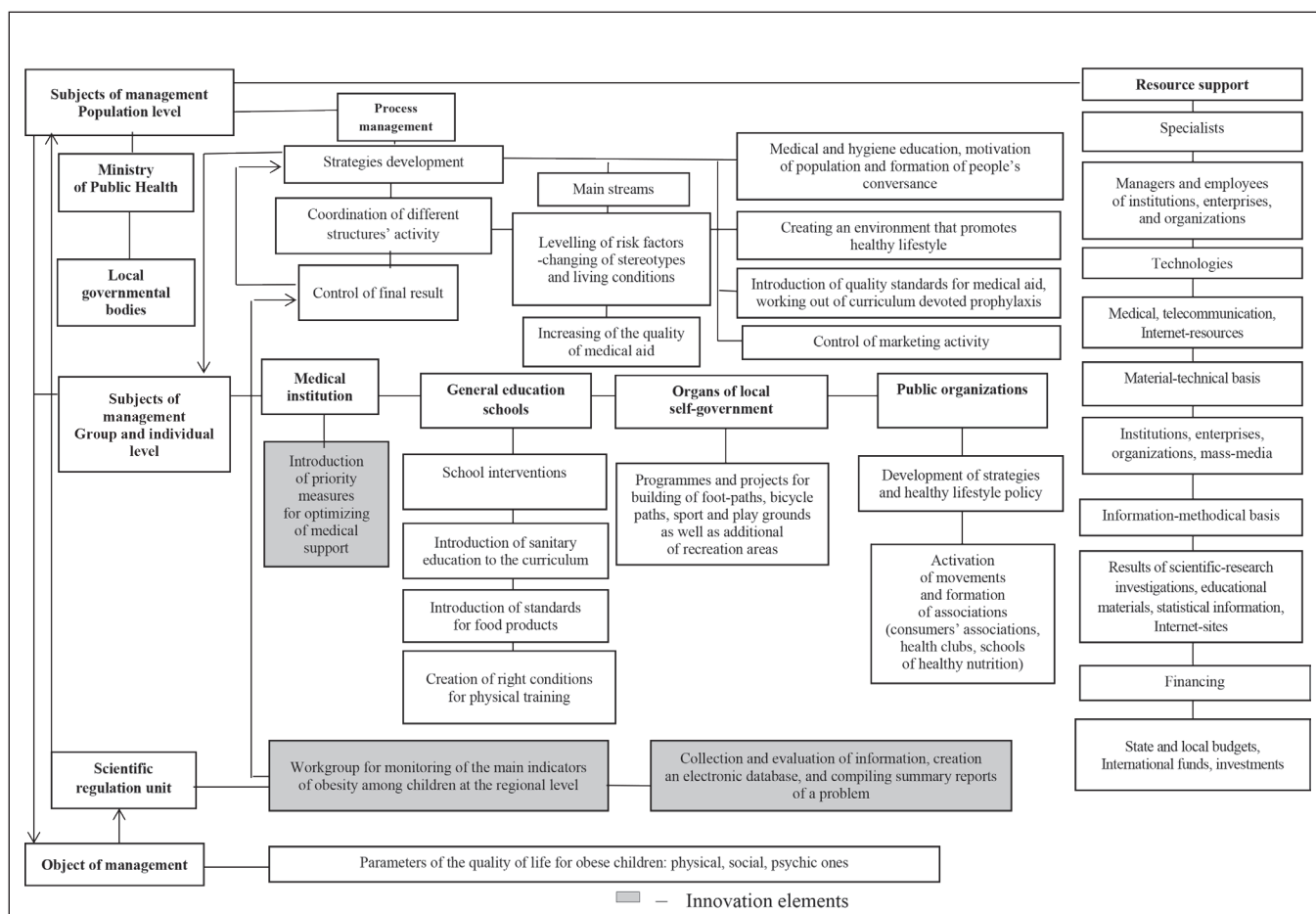


Fig. 1. Functional and structural model of the quality of life for obese chil.

of food containing easy digestible carbohydrates and fats) ($\eta=7\%$; $p<0,001$; $OR=3,0$; $CI=2,2-4,0$), malnutrition (lack of time and frequency of eating or eating less than three times a day) ($\eta=7\%$; $p<0,001$; $OR=3,0$; $CI=2,2-3,9$), reduced physical activity ($\eta=5\%$; $p<0,001$; $OR=2,6$; $CI=2,0-3,5$), eating a large amount of food ($\eta=5\%$; $p<0,001$; $OR=2,7$; $CI=2,0-3,6$), daily e-gadgets stay more than three hours a day ($\eta=4\%$; $p<0,001$; $OR=2,2$; $CI=1,6-2,9$) and visiting fast food businesses more than twice a week ($\eta=4\%$; $p<0,001$; $OR=2,4$; $CI=1,7-3,4$).

In the study of the health of children and adolescents with excess body weight and obesity, compared to the control group it was revealed the pathology of the gastrointestinal tract ($37,2\pm2,4\%$ vs. $13,4\pm1,7\%$; $p<0,001$), respiratory diseases ($26,3\pm2,2\%$ vs. $9,2\pm1,5\%$; $p<0,001$), spine curvature and flat feet ($42,5\pm2,4\%$ vs. $14,6\pm1,8\%$; $p<0,001$), hypertension ($31,4\pm2,3\%$ vs. $11,4\pm1,6\%$; $p<0,001$), neurological pathology (vegetative dis-regulation, neurosis) ($46,2\pm2,5\%$ vs. $23,4\pm2,1\%$; $p<0,001$) was significantly higher in the main group than in the control one.

A method for predicting the risk of developing the overweight among children and adolescents involved interviewing the patient's parents using prognostic tables based on the identified factors and determining the risk of the disease (the first group was the one in which there was not risk of developing excess body weight; the second

group with uncertain clinical prognosis; the third one with high risk of overweight).

It was defined that the relative average of the quality of life of obese children and adolescents was $60,7\pm0,5\%$ being in frames from 39,3 up to 90,6% and corresponded to the average level of variability (12,9%). This index was much lower in patients with complicated forms of disease than without such ones and it was $48,3\pm1,04\%$ and $62,6\pm0,43\%$ ($p<0,001$) respectively.

According to the separate analysis of physical sphere components it was defined that the most part of respondents had limitations in performing of heavy physical activity ($67,9\pm3\%$), moderate exercises ($46,4\pm3,2\%$), in climbing up the stairs ($56,1\pm3,2\%$), had complaints for the rapid fatigue ($37,8\pm3,2\%$), and shortness of breath and heartbeat ($55,7\pm3,2\%$). It was noticed that the significant impact on the life quality in psycho-emotional sphere had such factors: feeling of anxiety ($39,7\pm3,2\%$), depression ($41,4\pm3,2\%$), irritability ($36,3\pm3,1\%$) and low self-esteem ($51,5\pm3,3\%$). Among the main factors that limited the quality of life in children and adolescents in social life there were difficulties (misunderstanding) in communication with coevals ($30,4\pm3\%$), solitude ($22,8\pm2,4\%$) and lack of attention from surrounding people ($15,6\pm2,4\%$).

Organization of the medical aid to obese children was also among the big points of this investigation. It was de-

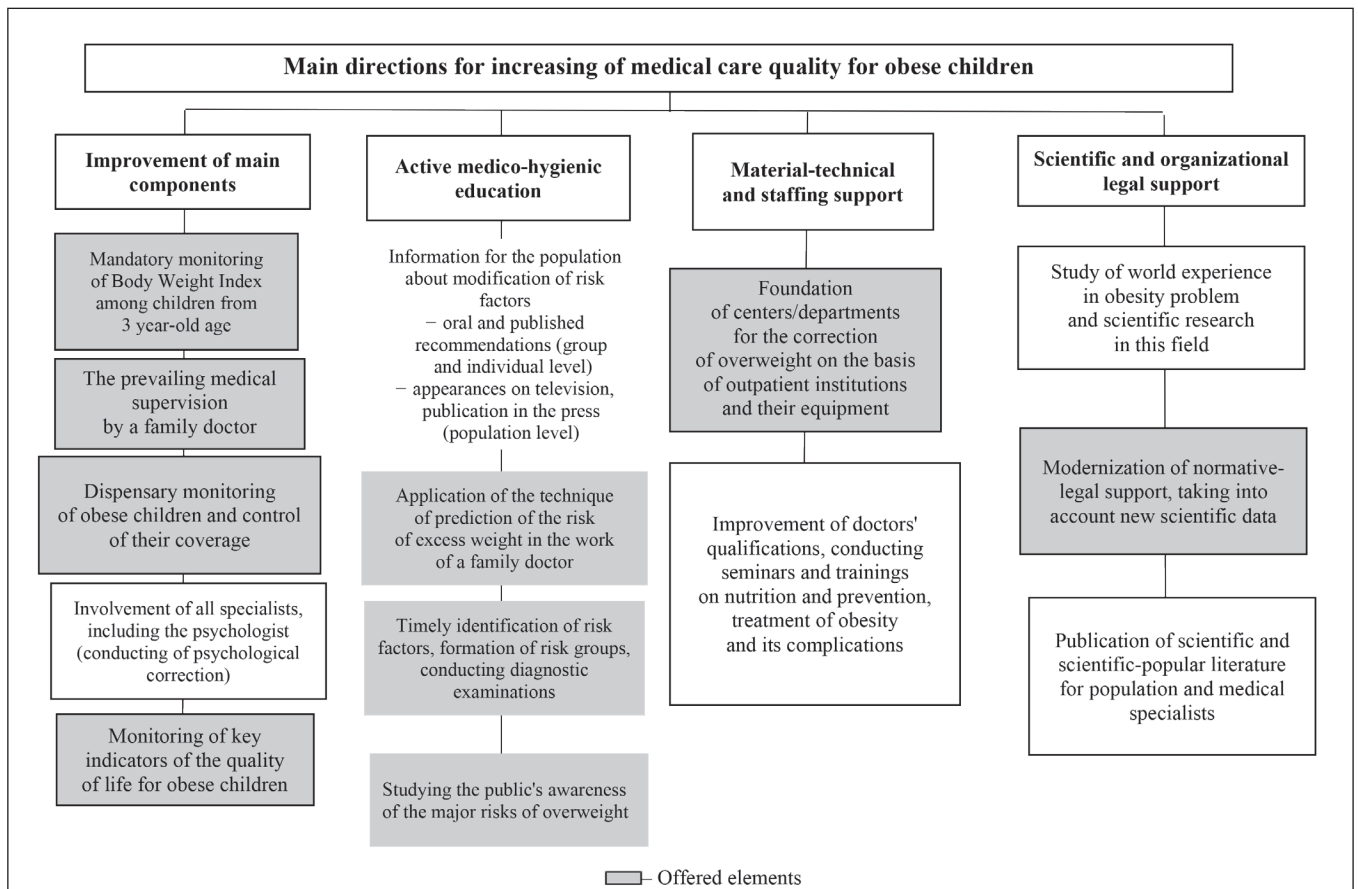


Fig. 2. Components of functional-optimized structure of medical-prophylactic aid for obese children

tected that the diagnosis “obesity” in the child’s medical history (form № 112/o) had just 61,7±2,7% adolescents, including 36,1±2,9% cases, when this diagnosis was detected after the self-conversion to endocrinologist, and in 14,5±2,1% cases of inpatient care. It was found that after the setting of diagnosis 51,4±3,6% of children had regularly endocrinological check ups, 35,7±3,4% was under the family doctor’s observation, 12,9±2,4% of children were not observed by any specialist. In 73,4±2,7% cases parents got recommendations (written or oral ones) for proper nutrition and adequate physical exercises. In 28,1±2,7% cases these recommendations were given by family doctor, in 34,2±2,8% cases by endocrinologist or the other specialist and in 11,1±1,8% cases by the group of specialists. In 12,9±2% cases patients did not have any laboratory examinations (0%); 22,8±2,5% (25%) were examined partially; 31,1±2,8% and 18±2,3% of patients had the half of examinations (50%) and nearly the full examination (75%) respectively. Just 15,0±2,1% of children and adolescents had results of minimal examination. The coverage of dispensary surveillance in the study group of children was only 29,6±2,7%. The structure of referrals to specialists for the disease was presented as follows: 3 and more times to the district pediatrician 21,9±2,7% of children and adolescents, to the endocrinologist 34,9±2,6%, to the cardiologist 16,4±2,2%, to the gastroenterologist 11,5±1,9%, to the neurologist 10,9±1,7%, and to the oth-

er specialists 9,4±1,7% respectively. It was revealed that according to the questionnaire of parents, the average assessment of the work of the district pediatrician on a five-point scale was 3.7, the endocrinologist and other specialists 4.1 and 3.9 respectively.

According to the results of the investigation the model for managing the quality of life for obese children was developed (Fig. 1). This model consists of the subjects of management at the population level (local governmental bodies at the regional level, Ministry of Public Health, Regional Center of Public Health), at the group and individual levels (health institutions, organs of local self-government, educational institutions and public organizations), a block of scientific regulation (monitoring group of the main indicators of obesity among children at the regional level), the quality of life for obese children and adolescents was an object of management, as well as resource support (specialists, material-technical, information-methodical basis, technologies and financing) included main directions for this problem solution. The main purpose of the management model was the creation the necessary conditions that will help to optimize the quality of life for obese children and adolescents.

Subjects of management at the population level have to plan the main strategies, coordinate the activity of different structures and control them.

Strategies that will improve the quality of life of children with the pathology being investigated, serve as the primary

management mechanisms should be tailored to the monitoring data (summary reports), use of world experience, standards, recommendations, WHO principles, including preparing and adoption of laws, targeted programmes, and normative basis that cover different sectors (health care, education, agriculture, food industry, catering, trade, marketing, ecological planning, mass-media, etc.).

According to the research it was proved that the initial measures have to be directed on the modification of risk factors namely: changing of stereotypes and habitat that impacts the formation of pathology and increasing of medical care quality. Because of that conducting of medical-hygiene education of population through mass-media, motivation and raising awareness related to healthy lifestyle, formation of stereotypes of the attitude of public health system and the society to obese people, introduction of standards, programmes of prophylactic of non-transmissible diseases, increasing the quality of medical aid, creation of environment that encourages healthy lifestyle (availability of physical activity and healthy food), control of marketing activity (promotion of food sales and non-alcoholic beverages, introduction of standard system of food labeling).

In order to implement the main strategies at the group and individual level, administrative decisions in different fields should be adopted and appropriate optimization measures be planned. This requires the involvement of structures such as local self-government institutions, public health institutions and public organizations.

Health care facilities should be implemented to improve the quality of care. To emphasize the value of the proposed model for the health care system, a functionally optimized structure of care for obese children was identified (Fig. 2).

Effective interaction between main elements of offered model of management can be implemented through the functioning of a monitoring group of key indicators of obesity in children (scientific regulation unit) at the regional level, which should perform the following functions: collection and evaluation the necessary information about obesity (prevalence, eating patterns, physical activity of children and adolescents in different socio-economic groups, quality of life, etc.) using standard techniques, creation a common electronic database (patient registry) and compiling consolidated reports, which provides feedback and enables timely identification of key areas for optimization.

Introduction of some elements of the proposed model into the practical activity of the city children's outpatient clinic №2 in Kharkiv has proved its medical and social efficiency. Thus, during the study period (2016–2018 years), in processing of anthropometric data of a representative sample for children from 6 up to 17 years old and calculating the relevant prevalence rates, it was found that the overall prevalence of overweight and obesity among children decreased from 151,0±5,2‰ in 2016 to 142,2±4,1‰ in 2018.

According to experts, the model of quality management of life of children with obesity has the following characteristics: preventive orientation (9,2±0,21), economic feasibility (8,34±0,28), compliance with current international

experience (7,9±0,24), efficiency (8,2±0,25), accessibility (8,3±0,26), and corresponds to such concepts as complexity and systematic (8,3±0,27). All the experts (100%) expressed a positive attitude towards putting the proposed model into practice. The largest number of experts (85,2±6,8%) noted the likelihood of improving the quality and length of life. Major part of experts is convinced that patients and their parents are well-informed (74,1±8,4%) of referrals (77,8±8,0%), and of satisfaction with the quality of care (63,0±9,2%). According to experts, implementation of management model can enhance efficiency (74,1±8,4%) and rational distribution of workload and efficiency (66,7±9,1%) health care.

DISCUSSION

Authors achieved the aim. Methodology and complex of measures for investigation were developed. In addition, charts for the copying the necessary information, as well as questionnaires for sociological research and expert evaluation maps of the proposed model were formed. Collection, analysis of received information, computer database and statistical processing of material were carried out. The authors summarized the results of the prevalence of overweight and obesity, taking into account age, sex and complications, risk factors for the formation and development of overweight, quality of life and condition of medical and preventive care for children with this specified pathology, which became the basis for substantiation and development of the model of management by the quality of life of obese children. The results of the study, the scientific provisions and conclusions had been published before. Results of the work are original. In frames of further investigations it is necessary to control body weight in schoolchildren regularly and create an electronic database with constant updating. Each local physician has to be skillful in measuring of body weight and height of patients as well as determining of BMI. It is compulsory to use the integrated approach of medical and non-medical institutions to the formation of healthy environment for obese children. It is compulsory to study the quality of life of such children in dynamics and correct in the case of necessity. Moreover, it is significant to form the appropriate attitude of society to these children, because it affects their quality of life.

CONCLUSIONS

Authors worked out the model of management which allows eliminating the factors of development of this pathology. It was also offered to conduct comprehensive monitoring of the state of children's health to eliminate certain shortcomings of the health care organization, in particular at the primary level, to raise the awareness of the population on methods of prevention, to apply innovative medical technologies, which in turn would help to improve the quality of life of obese children. It was defined that biological and social-hygienic factors were the leading ones for the formation and development of overweight in

children and adolescents. Among the biological ones there was family tendency to overweight and weighted heredity for type 2 diabetes and hypertension, peri-natal and post-natal-factors. In the group of social-hygienic ones there were found poor food, eating disorders, reduced motor activity, overeating, daily use of electronic devices for more than 3 hours, and visits to fast food establishments more than twice a week.

1. It was substantiated and developed a two-staged method of estimation of the quality of life of the patients with complicated and non-complicated forms of this disease.
2. It was proved that the medical care of obese children nowadays is not very effective, so the ways of optimizing of medical aid at the primary level are offered, such as compulsory monitoring of body mass index for 3-year-old children and upwards, observation of overweight and obese children by a family doctor, monitoring of health condition for these group of patients, and active complex approach for treatment of such pathology by different specialists (including psychologist), monitoring of the main indexes of the quality of life of obese children, active prophylactic work, adequate technical and staff support as well as scientific and legal provision.
3. The model for management by the quality of life of obese children was developed. It includes the main variants for the solution of this problem. It also has innovation elements for the defining of the significant parameters of the quality of life: physical, psychic and social (object of management); creation of the monitoring group (unit of scientific regulation), which can collect and process the information using standard approaches. Functional-optimized structure of the medical care for obese children was developed.

Introduction of some elements of this model to the practical public health proved their medical and social efficiency. All the experts noticed positive attitude to the introduction of this model to the practical public health.

REFERENCES

1. Gahagan, S. et al. Overweight and obesity. Nelson textbook of pediatrics (20th ed.). Philadelphia: Saunders/Elsevier. 2016.
2. Todurov I.M., Perekhrestenko O.V., Kalashnikov O.O et al. Prohnozuvannya operatsiino-anesteziolohichnoho ryzyku v bariatrychnii khirurgii za shkaloiu P-POSSUM [For predicting of operative-anesthesia risk in bariatric surgery on a scale P-POSSUM]. International Medical Journal. 2018;24(1):39-42. (In Ukrainian).
3. Nechytaylo Y.M., Kovtyuk N.I. Overweight and obesity in school-age children. Bukovyna Medical Bulletin. 2016;20(3):132-135.
4. Korzun V.N., Harkusha S.L., Bolokhnova M.V. et al. Profilaktyka ta likuvannya ozhyrinnia yak osnovnoi skladovoi metabolichnoho syndromu u naselennia [Prevention and treatment of obesity as a major component of the metabolic syndrome in the population]. Problems of Aging and Longevity. 2015;24(3-4):408-419. (In Ukrainian).
5. Tsyunychuk Yu.H. Klinichne znachennia psykhoemotsiinykh faktoriv pry ozhyrinni u ditei [Clinical significance of psycho-emotional factors in obesity in children]. Modern Pediatrics. 2016;5:98-101. (In Ukrainian).
6. Solnceva A.V., Volk Yu.V. Sakharnyj diabet I tipa i celiakiya v detskom vozraste: osobennosti klinicheskogo techeniya i diagnostiki u pacientov s «dvojnym diagnozom» [Type 1 diabetes and celiac disease in children: clinical features and diagnosis in patients with “double diagnosis”]. Ukrainian Journal of Pediatric Endocrinology. 2017; 1: 4-10. (In Russian).
7. Zelinska N.B., Rudenko N.H. Dytiacha endokrynolohiia v Ukraini: statystychni pokaznyky za pidsumkamy 2016 roku ta yikh dynamika [Pediatric endocrinology in Ukraine: statistical indicators based on 2016 results and their dynamics]. Ukrainian Journal of Pediatric Endocrinology. 2017;2:5-17. (In Ukrainian).
8. Styne DM, Arslanian SA, Connor EL et al. Pediatric Obesity – Assessment, Treatment, and Prevention: An Endocrine Society Clinical Practice Guideline. J Clin Endocrinol Metab. 2017;1;102(3):709-757. doi: 10.1210/jc.2016-2573.
9. Chumak L. I., Pomogaybo K. G. Using of medical documents to identify the true prevalence of obesity and overweight in schoolchildren 6–17 years. Inter Collegas. 2015;2(3): 244–252.

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ORIGINAL ARTICLE

MOTIVATION AS ONE OF THE CONSTITUENT COMPONENTS OF THE MODEL OF THE SYSTEM OF MEDICAL AND PSYCHOLOGICAL SUPPORT FOR THE PROCESS OF ADAPTATION OF MEDICAL COLLEGE STUDENTS TO WORK IN PRIMARY POSITIONS

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ABSTRACT

The aim: Based on previous studies, develop medical and psychological recommendations to increase the motivation for the work of nurses and medical assistants.

Materials and methods: During 2015–2018 Students of the Kharkov Regional Medical College (100 experimental people and 100 control groups) studied the types of motivation of medical personnel to work in key positions. The article analyzes the relationship between motivation and the individual – typological characteristics of the person using the psychodiagnostic methodology of the individually – typological questionnaire L.N. Sobchik and author's profile A.V. Grishnyaeva.

Results: After analyzing the above data, we can say that a combination of motivation or its absence with certain individual and typological characteristics of individuals leads to different results of adaptation to the primary positions of future medical workers. The imbalance of individual–personality structures and motivation leads to an accentuation of character, which contributes to maladaptation and professional burnout.

Conditions: Given the connection between motivation and individual – typological characteristics of the personality, it is possible to make the correct personnel distribution and prevent the professional burnout of employees.

KEY WORDS: material and non material motivation, students, adaptation, individually-typological features, medical workers

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INTRODUCTION

During the reform of the healthcare system in Ukraine, first of all, attention should be paid to the education and training of medical personnel. That is, we can say that the reform must be read from the educational process, which includes a multi-factor approach: psycho-physiological, methodological, managerial.

This article discusses the types of motivation of medical personnel to work in primary positions. The relationship of motivation and individually – typological characteristics of the personality of students. This relationship, many students and their employers often do not take into account when choosing a specialization after graduation. The information, working methods, types of manipulations, approaches to the prevention and treatment of patients, and the requirements that patients make to medical personnel are very fast changing. Therefore, it is important not only to learn and prepare a specialist, but also to motivate you to learn throughout your life. An important requirement

when applying for a job is the ability to quickly learn new information, skills and adapt as painlessly as possible to changing working and living conditions. If we consider the life of a person from the perspective of his development as a whole person, we must ask ourselves the question of what drives the actions of this person and what is their meaning. What motivates and motivates him to any action?

Why are these issues important and significant? The answer is simple: for a more productive, non-conflicting communication, it would be optimal to learn to recognize the motives of actions, the methods of teaching and accepting information by a person, taking into account his individually – typological characteristics of the personality. Motivation is a dynamic psychophysiological psycho-physiological process that controls the behavior of a person and determines his organization, orientation, stability and activity.

Since ancient times, the main probability of the motives of human behavior has been simple and true. People just

tried to survive. With the formation of a more complex society, goals changed, motivation and society put forward new requirements for people who should have certain individual psycho-physiological characteristics. Behavior and actions of a person began to be considered not just as a set of biological motives with innate personality traits [1].

Abraham Maslow opened a new direction in psychology – humanistic psychology, which questioned the idea that human behavior depends only on meeting basic needs (in particular, food and safety) in the fifties of the last century. From this moment begins a new stage in the search for incentives and motivations of a person to achieve goals. In 1960, Douglas Mac Gregor, a professor of management at the University of Massachusetts, successfully applied some ideas of A. Maslow's theory in business. But, the healthcare sector has always been seen as an unprofitable industry and has been funded by the state [2]. With the development of the economy and society as a whole, the medical industry is partly on the rails of self-financing and self-sufficiency. It would seem that material interest will become a determining factor in choosing a profession, working in a particular medical institution and personnel issues to be decided by themselves. But A. Maslow was right in this case too: such motivation is not enough for a person. The result that we observe in Ukraine both in medical educational institutions and medical institutions is a low motivation for mastering theoretical and practical skills and a lack of staff both in private and state medical institutions.

THE AIM

Based on previous studies, develop medical and psychological recommendations to increase the motivation for the work of nurses and medical assistants.

Tasks: 1. Identify the types of motivation. 2. To identify priority types of motivation for nurses and medical assistants in choosing the profession of a medical worker. 3. To determine the most effective types of motivation as a structural component of the model of the system of medical and psychological support for the process of adaptation of medical college students to work in primary positions. 4. To develop structural logical scheme to increase the motivation of students to choose specialization and the fastest adaptation in practical activities.

MATERIALS AND METHODS

In psychology, the following types of motivation are distinguished: *external motivation* – not associated with any type of activity, but due to some external circumstances (receiving a certain award); *internal motivation* – related to the content of the activity, but not with external circumstances (receiving positive emotions); *positive motivation* – based on positive incentives (if I do it nice, then I do it nice too); *negative motivation* – based on negative incentives (if I do not create problems for people, then they also do not create problems for me); *sustainable motivation* – based on the natural needs of the person; *unstable motivation* – requires constant external support.

The studies were approved by the commission on ethics and bioethics of the Kharkov National Medical University and were carried out in accordance with the requirements prescribed in the Helsinki Declaration of the International Medical Association “Ethical Principles of Medical Research with the Participation of People as the Object of Study”, the Law of Ukraine On Personal Data Protection.

RESULTS AND DISCUSSION

There are additional types of motivation: individual, group, cognitive. In addition, they distinguish individual motives that drive people's actions: motive of self-affirmation; identification motive; motive of power; procedural – substantive motives; motive of self-development; prosocial (socially significant) motives; accession motive [2; 3; 4].

According to the general classification, all motives can be divided into tangible and intangible. It would seem simple enough: a high salary should ensure the high quality of the employee's work. However, such a moment comes in the robot when material methods become completely insufficient. You can recall the Abraham Maslow pyramid, which explains that after satisfying basic needs, we want to satisfy the needs of communication, communication, self-esteem, respect from others, recognition, success and high marks, career growth, self-expression, self-identification.

Of course, until the needs of a lower level are satisfied, the needs of a higher level, the needs of a higher level for a person simply will not matter. In the work of medical personnel of medical institutions of Ukraine, both public and private, material motivation plays a relative role. Because if we talk about material motivation, we will still return to the pyramid of A. Maslow. Therefore, in the article we paid more attention to the methods and methods of non-material motivation, which, from our point of view, are not used sufficiently or competently by managers to increase labor productivity and maintain a constant staff. For training and adaptation of a new employee, we use the additional cost of time (from 6 months to 1 year), labor and emotions. We tolerate inconvenience in the work associated with a low level of professionalism and the lack of adaptation of the employee to the fullest. Therefore, to create comfortable conditions and motivation for the quality work of an employee is one of the important tasks of the leader [5; 6]. Intangible motivation of staff is a powerful team management tool. There is a set of measures that will increase: employee loyalty; improve working conditions; maintain a healthy atmosphere; increase the corporate spirit of the team.

Methods for selecting non-material motivation of staff should take into account the mentality, psychotypes and emotional state of employees.

Intangible types of motivation include: 1) Personal public praise (show the value of the employee's work). 2) Competition: the best employee of the month, contests, quests. The result can be a super prize (a trip to a significant event for a person), a forum, a conference or a tourist trip... 3) Career ladder and future prospects. It is unlikely that high-quality,

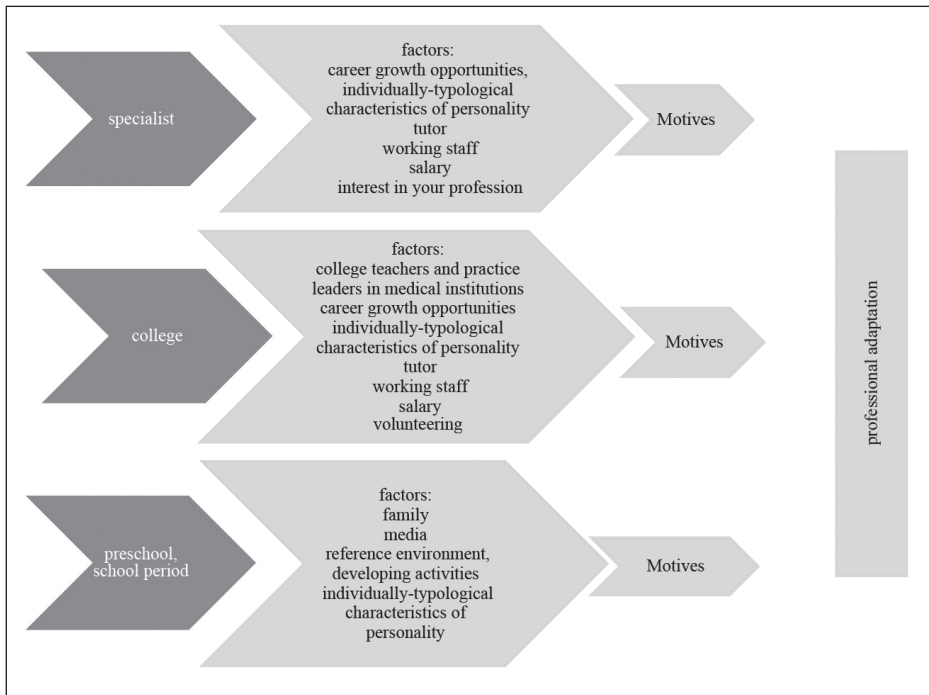


Fig. 1. Stages of the formation of personal adaptation to professional activities

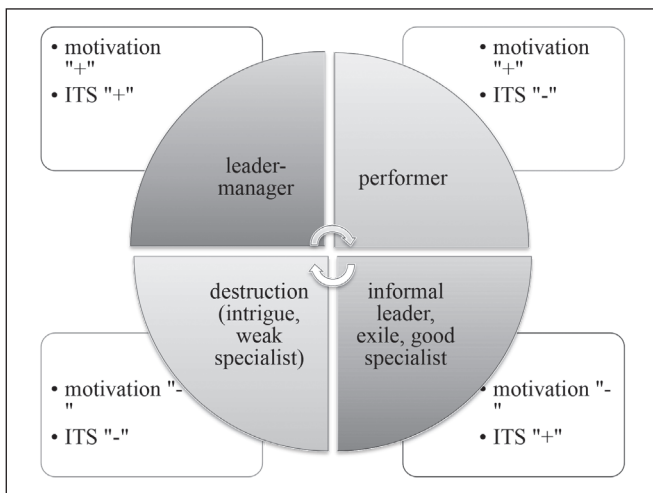


Fig. 2. The result of medical-psychological adaptation

promising and ambitious cadres will come to medicine without the possibility of career growth, an incentive for recognition and material interest. Such personalities can come, but only until the end of motivation, and then they will look for more interesting proposals in terms of motivation. 4) Training and professional development can contribute to the retention and cohesion of the team, and also makes it possible to attract promising employees. 5) Congratulations by individual, original ways to employees with significant dates. 6) Creation of the interior of the working area taking into account the peculiarities of the work of the personnel, their individual typological features, desires and national preferences. 7) Maintenance by own example and participation of a corporate spirit (corporate parties, tourist trips, sports competitions). 8) Using a flexible work schedule encourages a person to

complete the task as quickly and efficiently as possible in order to get more free time. 9) Extra days off. 10) Freedom of action is the ability to evaluate the result, not the process of completing a task.

Sometimes a motivated specific employee needs non-material stimulation in the form of attention and gratitude or a competent leader with whom it is interesting and reliable to work or timely delegation of authority to the leader. The use of any kind of motivation without taking into account individually typological personality traits reduces the entire process of psychological support of an employee during the period of adaptation to work at low rates.

With increased sensitivity of the employee, motivation should be expressed in the form of support and warmth from the environment. Such employees are prone to neurosis and rapid burnout (Figure 1).

With increased spontaneity as an individual typological feature of the employee's personality, a tendency to respond quickly arises. With a well-designed step-by-step program of medical and psychological adaptation, we observe a quick, comfortable adaptation of the employee both in the team and in work. At the same time, such an employee may manifest conflicting character traits: rigidity, persistence turning into stubbornness, categorical in decision-making, impulsiveness in communication and a decrease in empathic qualities [7; 8].

For employees with a high level of emotional lability, who are very dependent on the reference group, the friendly atmosphere in the team, the ability to receive feedback, and incentive events (team-building games) can serve as non-material motivation.

Persons of this type are not only affected by the environment, but they themselves have a strong effect on the emotional state of others. This is a mixed response with erratic motivation. In a state of maladaptation, a hysterical type of behavior is possible.

Employees with a high rigid type of response, which are characterized by stiffness of the nervous processes of both excitation and inhibition, are not relevant material type of motivation is support from the staff, the possibility of further training and feedback, informing about achievements and evaluating distinguished employees.

If we consider extroverts and introverts, then: extroverts – for them, a good motivation is the recognition of their achievements, which other people could see and evaluate. This may be a wall newspaper, praise before the whole team, a joint visit with the leader of a significant event. On the one hand, the sociability of such people is conducive to communication, but on the other hand, their communication can be superficial. Extroverts do not always know how to show empathic qualities, because the focus of their attention is often directed to a common group of people and they are waiting for reciprocal attention to themselves.

For introverts, motivation for work may be an interest in the work or study, internship; incentives in the form of time off or material incentive in any of its manifestations.

As a rule, each activity is always prompted by a complex, a combination of procedural – substantive (intrinsic – internal) and extrinsic (external) motives. Circumstances that exercise pressure and control (pressure from the doctor, patient, and patient's relatives), emphasize their incompetence, do not provide clear, adequate information regarding their progress in school and career, only weaken internal motivation. Figure 2 shows a diagram of the stages of the formation of personal adaptation to professional activity, taking into account different motivation at certain stages of personality formation.

In this article, we did not consider the effect of motivation on an employee depending on the degree of his professional maturity. Although, when choosing ways and methods of motivation, it is necessary to take into account the level of professional competence of the employee. Not material motivation is not effective if we do not take into account individually – typological characteristics of employees, age and their preferences.

CONCLUSIONS

After analyzing the above data, we can say that the combination of motivation or its absence with certain individual and typological characteristics of individuals leads to different results, which we displayed in our drawings. If the motivation is positive and ITF is consistent with the profession of a medical professional, then we have a chance to get a leader – a leader. If the student has a high enough motivation for mastering the profession, but the ITF does not quite correspond to the chosen profession, we can get a good performer. If ITFs correspond to mastering the profession of a medical specialist, but there is no motivation, we can get an informal leader, a rebellious, but competent specialist. However, it can also develop in a destructive way (to leave the profession). If there is no motivation and the ITF does not correspond to the profession of a medical worker, but the reference environment or circumstances

independent of it lead such people to medicine, we get a destructive personality, an intriguer and a weak specialist.

An imbalance of individual – personality structures leads to the strengthening of individual character traits (accentuation), which contributes to maladaptation and professional burnout. The correct combination of material and non-material types of motivation, based on individual – typological characteristics of a person, allows achieving the most effective results in the process of adaptation and further work of medical personnel.

SUGGESTIONS

The result of this study is recommendations to parents, future specialists, teachers of educational institutions and heads of medical institutions.

Earlier studies of individual typological characteristics of a person, motivation, formation of leadership qualities, as well as ways and methods of their formation allow us to state the following: the sooner you begin to form internal motivation in a child, the less difficulties and higher the effectiveness of training, upbringing, education and adaptation both in society and in specialty.

Properly individually selected forms and the degree of combination of internal and external motives for a particular person facilitate the process of choosing a profession, adapting to it, as well as obtaining moral and material satisfaction.

The medical psychologist's accompaniment of the stages of personality formation and the creation of appropriate motivation during the formation of professional identification will help to avoid the occurrence of psychosomatic pathology, a change in the type of activity and a decrease in personality self-esteem.

Introduction to the staffing table for the selection and work with medical personnel in medical institutions of the rate of a medical psychologist will prevent unprofessional selection and placement of personnel. For a medical institution, this is an opportunity to retain a talented employee, to reduce the time, material and personal costs of selecting and training a new candidate.

REFERENCES

1. Pink D. Driyv. Dyvovyzhna Pravda pro te, shsho nas motyvuye [The Surpris Truth About What Motivates Us]. Kharkiv, 2016:208. (UA)
2. Sobchuk L.N. Upravliynnya personslom i psishodiagnostika: prakticheskoe rukovodstvo [Personnel management and psychodiagnostics: practical guide]. Moscow, 2010:186. (RU)
3. Novikova E.A., Ostrovskaya I.V. Adaptaziya sestrinskoho personala na rabochem meste [Adaptation of nursing staff in the workplace. The successes of modern science]. The successes of modern science. 2014;6:132-138. (RU)
4. Anzupova V.V., Hryshnyaeva O.V., Hryhoruk V.V. et al. Samostiyna robota studentiv vyshshsykh navchalnykh zakladiv Ukrainy yak ody z etapiv yikh adaptaziyi do roboty v likuvalno-profilaktychnykh zakladakh [Independent work of students of higher educational establishments of Ukraine, as one of the stages of their further adaptation to work in health care establishments]. Clinical and experimental pathology. 2017;16(2):124-127. (UA)

5. Hryshnyaeva O.V. Liderstvo v medsestrynstvi yak skladova shvydkoyi adaptatsiyi do roboty v likuvalno-profilaktychnykh zakladakh [Leadership in nursing as a component of rapid adaptation to work in health care settings]. *Medical psychology*. 2018;13(3):42-46. (UA)
6. Dirksen D. Iskustvo obuchat: kak sdelat lyuboe obuchenie neskuchnym i effektivnym [The art of teaching: how to make any learning fun and effective]. Moscow, 2015:276. (RU)
7. Voss K. Perehovory bez kompromisov. Vedi perehovory tak, slovno ot nikh zavisit tvoya zhyzn [Negotiations without compromise. Negotiate as if your life depends on them]. Moscow, 2017:320. (RU)
8. Sobchuk L.N. Psikhodiagnostika v meditsine [Psychodiagnostics in medicine]. Moscow, 2007:415. (RU)
9. Zelenin V.V. Mezhdru velichiem i travmoi: traktat o selektivnoy psikhodiagnostike v kouchinhe: monohrafiya [Between greatness and trauma: A Treatise on Selective Psychodiagnostics in Coaching]. Kyiv, 2015;1:272. (UA)

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ORIGINAL ARTICLE

PREVALENCE OF CHLAMYDIA-RELATED ORGANISMS WITH ZONOTIC POTENTIAL IN FARMS OF THE POLTAVA REGION

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ABSTRACT

The aim of our work was to survey private farms in the Poltava region on the prevalence of Chlamydia-like organisms *Waddlia chondrophila* and *Parachlamydia acanthamoebae*.

Materials and methods: The PCR research was conducted in 2018–2019 at the Institute of Pig Breeding and Agro-industrial production of the NAAS. The study materials were 300 vaginal scrapings of cows and 28 samples of clinical material of pigs and boars with a suspicion of a chlamydial infection, which were selected at private farms in the Poltava region.

Results: Chlamydia-like bacteria *Waddlia chondrophila* DNA was detected in 132 (44%) samples taken from cows and 8 (28.6%) samples from pigs and boars. *Parachlamydia acanthamoebae* DNA was not detected in pig samples. However, 43 (14.3%) clinical samples taken from cows were found to be *Parachlamydia acanthamoebae* – positive. 9 (3%) cows and 2 (7.14%) pigs turned out to be *Chlamydia spp.* – positive (the samples contained DNA of bacteria of the family Chlamydiaceae).

Conclusions: Our data indicate a relatively high prevalence of Chlamydia-like bacteria in problematic as to chlamydial infection farms in the Poltava region. Chlamydial infection carry a zoonotic threat, therefore it is necessary to observe safety and personal hygiene measures when working with animals. In addition, it is necessary to carry out periodic screening among the population with reproductive disorders and in occupational risk groups, periodic monitoring in livestock farms, to avoid the consuming the unpasteurized milk, and thermally unprocessed meat.

KEY WORDS: *Parachlamydia acanthamoebae*, *Waddlia chondrophila*, PCR, cattle, pigs

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INTRODUCTION

Chlamydial infection is a group of infectious diseases caused by Gram-negative obligate bacteria of order *Chlamydiales*, differ in the source of infection, transmission mechanism, pathogenesis and clinical manifestations. Zoonotic chlamydial infection is an important public health problem and has clinical and epidemiological significance both in humane and veterinary medicine throughout the world, for its global distribution, negative impact on public health and the associated economic losses. 70 years of searching for an effective vaccine have not given the intended effect [1], therefore periodic screening researches followed by treatment with antibiotics are the main prevention of chlamydial infection. The species laboratory diagnosis of zoonotic chlamydial infection remains unsatisfactory, as commercially available tests are focused solely on the detection of bacteria of the genus *Chlamydia*, leave out of consideration Chlamydia-like bacteria. However, the State Statistics Service of Ukraine reports that during a preventive examination and other types of dispensary work in 2018, the number of patients identified among the first-ever established chlamydial infection diagnosis was 47.5%, which indicates a high prevalence of chlamydial infection among the population of Ukraine. According to the State Statistics Service, the level of diagnosed female and male infertility in the regions of Ukraine by 2018

ranges from 19.31% (female) and 14.05% (male) in the Zaporizhzhia region to 1.34% (female) in the Luhansk region, and to 0.08% (male) in the Kyiv region, such a range of fluctuations indicates the incomplete registration of data [2].

Waddlia chondrophila [3–5] and *Parachlamydia acanthamoebae* [6–10] are the most well-known and best-studied representatives of Chlamydia-related bacteria that associate with reproductive disorders and diseases of the respiratory system in both humans and animals. In addition, *Waddlia chondrophila* has a negative impact on reproductive system of men, in particular, on human spermatozoa [11]. It is believed that consuming thermally untreated milk and meat, contact with animals may be potential routes of infection for *W. chondrophila* and *P. acanthamoebae*, as well as possible transmission from mother to child (during pregnancy, childbirth and breastfeeding) [12, 13]. The Chlamydia-related bacteria *W. chondrophila* and *P. acanthamoeba* are endosymbionts of amoebas that is their feature. The ability to infect free-living amoeba makes these species extremely resistant to environmental stress factors and disinfectants. The prevalence of free-living amoeba can lead to Chlamydia-related bacteria *W. chondrophila* and *P. acanthamoebae* and amoeba entering the water supply system [14, 15, 15, 16, 16]. All this should cause concern due to the fact that in Ukraine there is a

tradition of consuming thermally unprocessed lard of pigs and unpasteurized “fresh” milk, and people living in small localities do not have access to central water supply and sanitation.

Products of pig and dairy cattle breeding are of great importance for society, it is the main source of meat, milk, dairy products, clothing, and fertilizers for crops. The hybrid war and the associated economic instability increased the level of impoverishment of the population of Ukraine, led to the growth of socially vulnerable groups and the spread of the illegal street trading [17]. The State Service of Ukraine on Food Safety and Consumer Protection in different regions is sounding the alarm, however, a significant difference in food prices in supermarket chains and the illegal street markets makes such markets attractive for rapidly growing socially vulnerable groups of the population.

THE AIM

The aim of our work was to survey private farms in the Poltava region on the prevalence of Chlamydia-like bacteria *Waddlia chondrophila* and *Parachlamydia acanthamoebae*.

MATERIALS AND METHODS

Experimental researches were carried out during 2018 – 2019 in the Animal Health Laboratory and the Laboratory of Genetics and Breeding of the Institute of Pig Breeding and Agro-industrial production of the NAAS (Certificate of compliance of the measuring system state No. 021-19 dated 31 January, 2019). The researches materials were 300 clinical samples of biological material (vaginal scrapings) of cows and 28 samples of biological material of pigs and boars (epithelial scrapings from the rectum or prepuce from males and vaginal scrapings from females), suspected of chlamydial infection and selected at private farms in the Poltava region. Animals for research were selected by agreement of farmers for diagnostic purposes. Manipulations with animals were carried out in accordance with the European Convention for the Protection of Vertebrate Animals used for Experimental and other Scientific Purposes, and the General Ethical Principles of Animal Experiments. The permission to use animals is approved by the Bioethics Committee of the Poltava State Agrarian Academy.

Samples were tested by polymerase chain reaction using “Thermo Fisher Scientific” (USA) kits according to manufacturer’s instructions. The oligonucleotide primers used in research were made to our order by Metabion international AG, (Federal Republic of Germany) (Table I).

DNA was isolated by “DNA express” kit, Lytech Ltd (Russian Federation). A programmed Tercic-2 thermostat (DNA Technology, Russian Federation) was used to amplify DNA with annealing conditions of 60 °C. A horizontal electrophoresis system (Clever Scientific Ltd, United Kingdom) was used to separate PCR products using 2% agarose gel electrophoresis in 1 × TBE buffer at a current of 50 mA. The gel was stained with an ethidium bromide

solution (10 mg/cm³) and the result was documented using a gel documentation system (Clever Scientific Ltd, United Kingdom). The DNA of plasmid pUC19 hydrolyzed with *Msp I* endonuclease was used as molecular weight marker.

The control DNA samples of *Parachlamydia acanthamoebae* strain “Berg17” and “Bn9” kindly provided by Dr. Michel Rolf (Central Military Hospital Koblenz, Federal Republic of Germany, Dept. Pathology), DNA of *Parachlamydia acanthamoebae* strain Hall obtained from Prof. Gilbert Greub (l’Institut de Microbiologie Médecin chef des laboratoires de microbiologie diagnostique Institut de microbiologie de l’Université de Lausanne), and *Waddlia chondrophila* DNA samples obtained from Dr. Christiane Schnee (Institut für molekulare Pathogenese, Jena, Federal Republic of Germany) were used as positive controls.

The identity of the resulting PCR product was additionally verified by restriction analysis, which used the endonucleases produced by “Thermo Fisher Scientific” (USA) (table II), according to the manufacturer’s instructions:

RESULTS AND DISCUSSION

As a result of studies of 300 vaginal scrapings from cows and 28 samples of biological material from pigs and boars suspected of chlamydial infection, taken at private farms in the Poltava region, Chlamydia-like bacteria *W. chondrophila* DNA was detected in 132 (44%) samples taken from cows and 8 (28.6%) samples from pigs. *Parachlamydia acanthamoebae* DNA was not detected in pig samples. However, 43 (14.3%) clinical samples taken from cows were found to be *Parachlamydia acanthamoebae* – positive. 9 (3%) cows and 2 (7.14%) pigs turned out to be *Chlamydia spp.* – positive (the samples contained DNA of bacteria of the genus *Chlamydia*). (Table III).

Restriction analysis of PCR products using endonuclease *HinIII* and *DpnII* produced fragments of the expected size, proving the identity of the PCR products.

Waddlia chondrophila was first isolated by Dilbeck et al. in 1990 in the United States from aborted cow fetus research, after which the association of DNA presence in samples from humans and ruminants with reproductive disorders was proved [3–5, 24, 25]. *Parachlamydia acanthamoebae* was first isolated by Michel et al. in swab from a human nose [26], this species is associated with inflammatory processes of the respiratory system and the reproductive organs of humans and ruminants [6, 12, 25, 27, 28, 28]. Research on the prevention of Chlamydia-like bacteria in farms in Ukraine is carried out for the first time, so the results of our research can be compared only with the data of European researchers. Various scientists point at the different prevalence of Chlamydia-like organisms in cattle due to abortions in ruminants, for example, Barkallah, M., et al. found about 8% of *W. Chondrophila* positive samples [25, 29], and in 2007 Borel et al. found more than 60% of *P. acanthamoebae* positive samples taken from cattle with miscarriages [6]. The obtained data on the absence of *P. acanthamoebae* or it insignificant amount in samples from pigs coincide with the data of research conducted in Eu-

Table I. The structure of oligonucleotide primers used in research.

Species	Sequence	Product size
<i>Chlamydiaceae spp</i> [18]	CHMOSPF:AGGTGAGTATGAAAAAATC CHMOSPR:TCGAAAACATAATCTCCGTA	221 b.p.
<i>Waddlia chondrophila</i> [19]	WADCHOF:GAACGAAGTGTGCTCTTGAGT WADCHOR:CCTCTCTAGCACCATATCCGG	123 b.p.
<i>Parachlamydia acanthamoebae</i> [20]	PCHAF:CAAGGTAGCCCTATCGGAAG PCHAR:CTTGCCCAACCTCGGAAGAT	88 b.p.

Table II. Restriction endonuclease used in research.

Species	Restriction endonuclease	Restriction fragment, b.p.
<i>Waddlia chondrophila</i> (123 b.p.)	<i>Hin</i> III CATG↓	53 70
<i>Parachlamydia acanthamoebae</i> (88 b.p.)	<i>Dpn</i> II ↓GATC	31 57

Table III. Research results.

Animal species	Number of heads	<i>Chlamydia spp</i>	<i>Waddlia chondrophila</i>	<i>Parachlamydia acanthamoebae</i>	Chlamydia-like bacteria DNA detected %	Bacteria DNA of the genus <i>Chlamydia</i> detected %
Cattle	300	9	132	43	58,33	3
Pigs	28	2	8	0	28,57	7,14

rope [30, 31], however, information on the detection of *W. chondrophila* DNA in pig samples was not available to us.

Our research data differ from European scientists, this difference is most likely due to the difference in keeping conditions and different approaches for the prevention of chlamydial infection in pig and dairy cattle.

In 2014 the infection rate with chlamydial species belonging to the genus *Chlamydia* in Ukrainian pig breeding amounted to 71% [21, 22], in dairy cattle breeding – 28–43% [23]. The comparably lower prevalence of chlamydia in the under study farms among pigs at the level of 7.14% and cows 3% is associated with preventive measures to improve the livestock population, which consist of periodic screening aimed at detecting only bacteria of the *Chlamydiaceae* family, followed by culling or treatment of chlamydia-positive animals.

CONCLUSIONS

Our data indicate a relatively high prevalence of Chlamydia-like bacteria in problematic as to chlamydial infection farms in the Poltava region. Chlamydial infection carry a zoonotic threat, therefore it is necessary to observe safety and personal hygiene measures when working with animals. In addition, it is needed to carry out periodic screening among the population with reproductive disorders and in occupational risk groups, periodic monitoring in livestock farms, to avoid the consuming the unpasteurized milk, and thermally unprocessed meat.

REFERENCES

- Phillips S., Quigley B.L., Timms P. Seventy Years of Chlamydia Vaccine Research – Limitations of the Past and Directions for the Future. *Front Microbiol.* 2019;10:70. doi: 10.3389/fmicb.2019.00070
- Medical Statistics Center of Ukraine data for 2018. [accessed 2 Mar 2020] Available from: <http://medstat.gov.ua/ukr/MMXVIII.html>
- Baud D., Goy G., Osterheld M-C. et al. Role of *Waddlia chondrophila* Placental Infection in Miscarriage. *Emerg Infect Dis.* 2014;20(3):460–4. doi: 10.1093/cid/cir205
- Baud D., Goy G., Osterheld M-C. et al. *Waddlia chondrophila*: from bovine abortion to human miscarriage. *Clin Infect Dis Off Publ Infect Dis Soc Am.* 2011;52(12):1469–71. doi: 10.3201/eid2003.131019
- Baud D., Thomas V., Arafa A. et al. *Waddlia chondrophila*, a potential agent of human fetal death. *Emerg Infect Dis.* 2007;13(8):1239–43. doi: 10.3201/eid1308.070315
- Borel N., Ruhl S., Casson N. et al. *Parachlamydia spp.* and related Chlamydia-like organisms and bovine abortion. *Emerg Infect Dis.* 2007;13(12):1904–7. doi: 10.3201/eid1312.070655
- Greub G. *Parachlamydia acanthamoebae*, an emerging agent of pneumonia. *Clin Microbiol Infect Off Publ Eur Soc Clin Microbiol Infect Dis.* 2009;15(1):18–28.
- de Bary M., Greub G. *Waddlia chondrophila*: from biology to pathogenicity. *Microbes Infect.* 2013;15(14–15):1033–41. doi: 10.1111/j.1469-0691.2008.02633.x
- Verweij S.P., Kebbi-Beghdadi C., Land J.A. et al. *Waddlia chondrophila* and *Chlamydia trachomatis* antibodies in screening infertile women for tubal pathology. *Microbes Infect.* 2015;17(11–12):745–8. doi: 10.1016/j.micinf.2015.09.019

10. Haider S., Collingro A., Walochnik J. et al. Chlamydia-like bacteria in respiratory samples of community-acquired pneumonia patients: Chlamydia-like bacteria in CAP patients. *FEMS Microbiol Lett.* 2008;281(2):198–202. doi: 10.1111/j.1574-6968.2008.01099.x
11. Baud D., Vulliamoz N., Ammerdorffer A. et al. Waddlia chondrophila, a Chlamydia-related bacterium, has a negative impact on human spermatozoa. *Hum Reprod Oxf Engl.* 2018 01;33(1):3–10. doi: 10.1093/humrep/dex342
12. Ammerdorffer A., Stojanov M., Greub G. et al. Chlamydia trachomatis and chlamydia-like bacteria: new enemies of human pregnancies. *Curr Opin Infect Dis.* 2017;30(3):289–96. doi: 10.1097/QCO.0000000000000369
13. Baud D., Goy G., Gerber S. et al. Evidence of maternal-fetal transmission of Parachlamydia acanthamoebae. *Emerg Infect Dis.* 2009;15(1):120–1. doi: 10.3201/eid1501.080911
14. van Dooremalen W.T.M., Learbuch K.L.G., Morré S.A. et al. Limited presence of Waddlia chondrophila in drinking water systems in the Netherlands. *New Microbes New Infect.* 2020;34:100635. doi: 10.1016/j.nmni.2019.100635
15. Michel R., Steinert M., Zoller L. et al. Free-living amoebae may serve as hosts for the Chlamydia-like bacterium Waddlia chondrophila isolated from an aborted bovine fetus. *Acta Protozool.* 2004;(43(1)):37–42.
16. Dupuy M., Berne F., Herbelin P. et al. Sensitivity of free-living amoeba trophozoites and cysts to water disinfectants. *Int J Hyg Environ Health.* 2014;217(2–3):335–9. doi: 10.1016/j.ijheh.2013.07.007
17. Dzharfarova M.V., Shevchuk T.A., Kalinovskaya Y.O. et al. Economic Security Of Ukraine: Economic And Legal Aspect. *Financ Credit Act Probl Theory Pract.* 2019;3(30):78–84. doi: 10.18371/fcaptp.v3i30.179511
18. Ksonz I.M., Pocherniaiev K.F. Sposib vyznachennia dnk bakterii rodiny chlamydiaceae u polimeraznii lantsuhovii reaktsii shliakhom amplifikatsii frahmenta hena holovnoho bilka membrany (momp). [A method for determining DNA bacteria of the Chlamydiaceae family in a polymerase chain reaction by amplifying a fragment of a major membrane protein (MOMR) gene. UA 51635, 2010. p. 2. Ksonz I.M. Pochernyaev K.F.] [accessed 2 Mar 2020] Available from: <http://uapatents.com/2-51635-sposib-vyznachennya-dnk-bakterijj-rodini-chlamydiaceae-u-polimeraznijj-lancyugovijj-reakci-shlyakhom-amplifikaci-fragmenta-gena-golovnogobilka-membrani-momr.html> (In Ukrainian)
19. Zezekalo V.K., Pederer S.B., Buslik T.V. et al. PCR-test for identification and species differentiation of Waddlia chondrophila. *Sci Messenger LNU Vet Med Biotechnol.* 2019;21(93):143–8. doi: 10.32718/nvlvet9325
20. Zezekalo V.K., Perederer S.B., Buslik T.V. et al. PCR-test system specific identification Parachlamydia acanthamoebae. *Sci Messenger LNU Vet Med Biotechnol.* 2018;20(92):101–4. doi: 10.32718/nvlvet9220
21. Ksonz I.M. Epizootychnyi stan shchodo khlamidiinoi infektsii u pleminnomu svynarstvi. [Epizootic status of Chlamydial infection in pig breeding]. *Agricultural science journal.* 2014;(10):34–6. (In Ukrainian)
22. Ksonz I.M. Rol knuriv-plidnykiv u poshyrenni khlamidiinoi infektsii. [The role of producer boars in the spread of chlamydial infection]. *Agricultural science journal.* 2015;31–3. (In Ukrainian)
23. Milanko O.O., Avramenko N.O. Kliniko-epizootolohichni aspekty khlamidiozu velykoi rohatoi khudoby. [Clinical and epidemiological aspect of cattle chlamydia]. *Bulletin. Of Poltava state agrarian academy* 2011;(4):105–7. (In Ukrainian)
24. Dilbeck P.M., Evermann J.F., Crawford T.B. et al. Isolation of a previously undescribed rickettsia from an aborted bovine fetus. *J Clin Microbiol.* 1990;28(4):814–6. PMID: PMC267805
25. Barkallah M., Gharbi Y., Hassena A.B. et al. Survey of infectious etiologies of bovine abortion during mid- to late gestation in dairy herds. *PLoS One.* 2014;9(3):e91549. doi: 10.1371/journal.pone.0091549
26. Michel R., Hauröder-Philippczyk B., Müller K-D. et al. Acanthamoeba from human nasal mucosa infected with an obligate intracellular parasite. *Eur J Protistol.* 1994;30(1):104–10.
27. Barati S., Moori-Bakhtiari N., Najafabadi M. et al. The role of zoonotic chlamydial agents in ruminants abortion. *Iran J Microbiol.* 2017;9(5):288–94. PMID: PMC5748448
28. Wheelhouse N., Longbottom D., Willoughby K. Chlamydia in cases of cattle pneumonia in Scotland. *Vet Rec.* 2013 Jan 26;172(4):110. doi: 10.1136/vr.f469
29. Dilbeck-Robertson P., McAllister M., Bradway D. et al. Results of a New Serologic Test Suggest an Association of Waddlia Chondrophila with Bovine Abortion. *J Vet Diagn Invest.* 2003;15(6):568–9. doi: 10.1177/104063870301500609
30. Van Gils M., Aeby S., Vanrompay D. et al. Absence of Chlamydia-like organisms in pigs. *New Microbes New Infect.* 2015;7:31–2. doi: 10.1016/j.nmni.2015.04.007
31. Di Francesco A., Baldelli R., Donati M. et al. Evidence for Chlamydiaceae and Parachlamydiaceae in a wild boar (Sus scrofa) population in Italy. *Vet Ital.* 2013;49(1):119–22. PMID: 23564593

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ADVERSE FACTORS THAT CAN AFFECT ON THE COURSE OF CHRONIC PARENCHIMATIC PAROTITIS IN CHILDREN

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ABSTRACT

The aim: The study of the presence of disorders in the ante- and postnatal periods of development of children from 2 months to 15 years with chronic parenchymatic parotitis, which may affect its course.

Materials and methods: It has been examined and treated 88 children, aged from 2 months to 15 years with chronic parenchymatic parotitis, and their mothers were interviewed, who indicated the pathological course of pregnancy, childbirth and indicated the type of breastfeeding babbies. The scope of the survey included general, additional methods, consultations by related specialists and statistical processing of results.

Results: 88 children with the exacerbation of chronic parenchymatic parotitis were examined (42 – (47%) with active course and 46 – (53%) with inactive). The exacerbation occurred on the background of acute infectious processes or coincided with the exacerbation of one of the chronic diseases. The first manifestations occurred in spring (55%) and autumn (36%) periods, 44% of children were hospitalized with other diagnoses. The presence of pathological conditions during pregnancy and birth defects in their mothers were recorded more often 3,5 and 3,3 times, respectively, compared with control. 70% of children received mixed and artificial feeding and were more likely to become ill.

Conclusions: The severity of clinical manifestations of inflammation and disorders of the general condition depended on the activity of the course of chronic parenchymatic parotitis and were more pronounced when active. During the remission period, no apparent clinical manifestations were detected in 72% of observations, however, in 28%, the identified signs indicated a latent course, which required additional treatment and rehabilitation measures.

KEY WORDS: children, chronic parenchymatic parotitis, adverse factors, clinical signs

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INTRODUCTION

Children's doctors of all specialties deal with the body of a child that has not yet fully formed, is dynamically changing and improving. As a result of these circumstances, more and more age-old anatomical and physiological features are revealed, which greatly affect the formation and course of all pathological processes in them. Both internal and external factors cause in the body of the child, in essence, reactions due to the state of their functional and morphological maturity and the peculiarity of metabolic processes [1,2,3,4].

Recently, more and more attention is being paid to pregnancy disorders, hereditary diseases and birth defects that can be caused by chromosomal, gene and genomic mutations. It is believed that diseases with hereditary predisposition occur mainly in individuals who have certain genetic disorders and who are realized under the influence of adverse factors. [2,5].

Chronic parenchymatic parotitis (CPP) in children, which account for 87,6% of all forms of chronic sialadenitis, is not an exception, which a professor Rybalov O.V. (1987) referred to the primary chronic lesion of the parotid gland, because it can be clinically manifest even immediately after the birth of a child. That is, it may be about the possibility of its heredity. For this disease there is a chronic course with frequent recurrence, which worsens the quality of life

of the child and adds significant worries to the relatives, who have to spend time for treatment and money for medicines [6,7,8,9].

THE AIM

The aim of the study was to study the presence of abnormalities in the ante- and postnatal periods of development of children with chronic parenchymatic parotitis, which may affect its course.

MATERIALS AND METHODS

The reason for writing this work was the examination and treatment of 88 children with CPP from 2 months to 15 years of age and a survey of their mothers who indicated the most important events related to pregnancy, childbirth and the type of breastfeeding. There were 52 boys and 36 girls. The control group consisted of 50 mothers in whom pregnancy and childbirth proceeded physiologically with their children of the same age. The work was carried out in the conditions of the Poltava regional dispensary center for patients with pathology of salivary glands.

Depending on clinical manifestations, data of private and additional methods of research of patients were divided

into two groups – with active and inactive course. In children with active course, the frequency of exacerbations ranged from 4 to 9 per year, and they were accompanied by pronounced manifestations of inflammatory reaction in the parotid glands and a significant deterioration of general health. The group with inactive course included persons in whom the exacerbation occurred 1 – 3 times a year and proceeded without pronounced clinical manifestations and a slight disturbance of the general condition. [2,5,9]

The scope of the studies included general examination methods (medical history, life, visual examination, palpation, determination of peripheral blood cellular composition and general urine analysis) and private (sialometry, sialography, cytological and microbiological examination of paratid secretion) [5,7].

Additional methods of examination and consultation of related specialists were used as needed. Medical-statistical processing of the obtained results was carried out.

RESULTS AND DISCUSSION

During the exacerbation of CPP, we examined 88 children, accounting for 8% of the total number of inpatients. Of these, 42 patients (47%) had an active disease course, and 46 (53%) were inactive (Fig. 1). From the anamnesis of the disease, it was found that 13 children (15%) had 7 – 9 exacerbations a year, 13 – (18%) had 5 – 6, 12 – (14%) had 4, 21 – (24%)) at 3, at 16 – (18%) at 2 and at 18 – once a year (11%).

The overwhelming number of patients (67 – 76%) turned for help in the first three days from the onset of symptoms of exacerbation in the parotid glands. In 39 cases (44%), they were referred for hospitalization with other diagnoses. The distribution of patients observed by age and activity is presented in the table. Most often, with initially diagnosed exacerbation in the parotid glands, relatives of children turned with active flow in toddler and preschool age, with inactive in preschool and primary school. The occurrence of the first manifestations of the disease was observed in 48 children (55%) in spring, in 32 – (36%) in autumn, and in 8 children (9%) it was observed in other seasons.

Analysis of pregnancy data from mothers of the surveyed children showed that pathological disorders in them were much more common than in the control group and were 62 cases (70%), against 5 – (20%), respectively. In the structure of pathology, anemia was the first place (23 cases – 37%), the second threat of pregnancy failure (16 cases – 26%), against 4 cases (8%) in the control group, the third place was occupied by nephropathy of pregnant women (12 cases – 19%), against 2 – (4%), on the fourth – toxicosis of the first half of pregnancy (11 cases – 18%, against 2 – 4% in the comparison group) (Table I).

The disturbance of childbirth activity was noted in 23 cases (26%), in the comparison group 4 – (8%). Hypoxia of newborns (21 cases – 48%) and weakness of childbirth activity (23 cases – 43%) were most frequently observed, which required delivery of maternity measures.

After the birth of the baby, signs of intrauterine hyp-

trophy were detected in 33 observations (38%), versus 4 – (8%). With a large body weight (more than 4 kg) of children were 21 – (24%), versus 6 – (12%).

32 children (36%) received natural feeding for the year, compared to 28 (56%) in the control group. The number of infants receiving mixed diets from the 1st and 6th months was equal to 15 (17% each) compared to 4 (8%) in the comparison group. There were 17 children (19%) against 6 months of age (12%) and 24 months (27%), compared to 8 – (16%) of them from month to month. More frequent cases of decreased lactation among mothers with complicated pregnancy and childbirth (49 out of 88 – 56%) should be noted.

Among children who were in mixed and artificial feeding at the age of one month, 35 were often ill with 47 – (74%) versus 18 – (36%). Among children transferred to mixed and artificial feeding after 6 months, patients were often slightly less than 17 out of 47 – (36%) versus 14 – (28%) in the control group.

In 54 patients (61%), out of all 88, concomitant chronic diseases were revealed, which were distributed as follows: gastrointestinal tract of 13 children (24%), bronchopulmonary system of 11 children (20%), ENT pathology revealed in 11 children (20%), genitourinary system in 10 children (18%), cardiovascular system in 7 children (12%), skin disease was found in 2 children (4%), nervous system diseases in 1 person (2%). The number of concomitant chronic diseases was predominant in the group of patients with active course of CPP (32 children – 59%). While in the group with inactive course concomitant somatic pathology was detected in 22 children (41%).

We found that exacerbation of the chronic process in the parotid glands occurred in 33 patients (38%) against the background of SARS, in 19 – (22%) coincided with the course of acute tonsillitis, in 18 – (20%) occurred on the background of exacerbation of one of the above chronic diseases and in 9 – (10%) it was combined with herpetic stomatitis. In 11 children (12%) the presence of two nosological forms of somatic diseases was observed and in 8 – (9%) external and internal provoking causal factors could not be determined.

At the time of treatment, during exacerbation of the chronic process in the software, patients complained of pain and swelling in the area of one gland (83 children – 94%) or two (5 children – 6%), with a slight restriction of mouth opening followed in 35 children (40%). In 16 patients (18%) headache, nausea, salty taste of mouth fluid were noted. The general condition and appetite worsened to a different extent in all children. Body temperature varied between 37 – 39 °C in 41 children (47%), while in the rest 47 – (53%) it remained within the physiological norm.

On external examination, all patients had a swelling in the parotid-chewing area that went beyond the anatomical location of the gland (28 patients – 32%), was limited to the contours of the gland (38 patients – 43%), or its individual lobes (22 patients – 25%).

A sufficient amount of turbid, foamy, viscous mouth fluid was identified in the oral cavity, and the oral mucosa had



Fig. 1. Facial appearance of the patient D., 7 years old, ambulatory card № 45. A slight swelling of soft tissues in the area of anatomic projection of the parotid gland is determined. Diagnosis: exacerbation of chronic parenchymatic parotitis on the right, inactive.



Fig. 2. The appearance of secretions from the parotid gland of the patient M., 6 years old, ambulatory card № 32. Near the mouth of the excretory duct a "protein strand" is defined – the imprint of the main duct with impurities of pus. Diagnosis: exacerbation of chronic parenchymatic parotitis on the right, active course.

Table I. Distribution of patients with chronic parenchymatic parotitis by age and disease activity

№	Age groups	The course of the disease and the number of patients					
		Active		Inactive		Total	
		Number	%	Number	%	Number	%
1	Breast - from 1 month to a year	1	2	1	2	2	2
2	Nursery - from 1 to 3 years	11	26	6	13	17	19
3	Preschool - from 3 to 7 years	23	54	22	49	45	51
4	Junior school - from 7 to 12 years	7	17	15	33	22	25
5	The senior school - from 12 to 15 years	42	-	2	3	2	3
6	Total	42	100	46	100	88	100

pink color in 69 patients (78,4%). In patients with herpetic stomatitis and some children with SARS, the mucous membrane was pasty and slightly hyperemic (17 patients – 19,3%).

The mucous membrane at the mouth of the excretory ducts of the glands involved in inflammation was swollen in all patients, hyperemic in 66 cases (75%), and in 37 patients (42%) the mouth was radiated. When massaging the glands from the ducts, all patients were given a viscous secret with impurities of whitish flakes of different sizes in different amounts and purulent «plugs» (Fig. 2).

The clinical and laboratory characteristics of patients with chronic parenchymatic parotitis in remission period were examined on the basis of examination of the same group of children, which was formed during the treatment of exacerbation of inflammation in parotid glands. It was carried out 6 months after the last exacerbation.

In the survey of 88 children at this time, 63 – (71,6%) had no complaints. The examination and palpation of the parotid glands were within the normal range, were mild and painless. The other 25 patients (28,4%) complained of low-intensity pain, most commonly associated with food intake and periodic slight swelling of the affected glands. Examination of these children revealed a pronounced localized swelling of the soft tissues in the location of the parotid glands, which was due to the presence of infiltrative changes in separate lobes of the gland. In 65 children (74%) it was found out a slight increase in regional lymph nodes on the side of the parotid gland involved in chronic inflammation. The skin over their projection was unchanged and easily folded.

The oral mucosa had a pale pink color and was well moisturized in all patients, however, in 21 children (23,9%), the oral fluid was high in viscosity, foamy, and had a salty taste. The

mucous membrane at the mouth of the excretory ducts of the affected glands was swollen in 33 children (37,5%), the crown of hyperemia around the mouth was determined in 19 patients (21,6%), and in 17 – (18,3%) the mouth remained gaping.

When massaging the glands from the ducts, 62 patients (70,5%) exhibited a viscous secret, 43 of them (69%) identified single small whitish flakes. The secret was transparent in 11 patients (12,5%) and was not received at all in 8 patients (9,1%).

CONCLUSIONS

Thus, in children with chronic parenchymatic parotitis, the presence of pathological conditions in their mothers during pregnancy exceeds the control indexes by 3,5 times, and the disturbance of childbirth was observed more than 3,3 times, which required additional maternity measures. Only 36% of children were in natural feeding for a year, and among those who were mixed and artificially nourished, the number of sick people was 2 times higher than in the comparison group. Exacerbation in software in 91% of children was triggered or coincided with acute infectious processes, or with exacerbation of chronic somatic diseases, which caused the clinical severity of their combined effect on the general condition and manifestations of inflammation directly in the glands themselves. During the remission period, the explicit clinical data on the presence of the chronic process were not determined in 72% of the observations, but in the other 28%, a detailed in-depth examination revealed signs indicating a hidden course of inflammation in the parotid glands.

Prospects for further developments in this direction. Establishing cooperation with pediatricians and specialists in related profiles will reduce the frequency of exacerbations of chronic parenchymatic parotitis and extend the remission period.

REFERENCES

1. Tkachenko P.I., Starchenko I.I., Bilokon S.O. et al. Dobroiakisni novoutvorennia miakykh tkanyn shchelepno-lytsevoi dilianky ta slynykh zaloz u ditei [Malignant neoplasms of soft tissues of maxillofacial area and salivary glands in children]. Poltava: TOV «ASMI»; 2015. 80. (Uk)
2. Tkachenko P.I., Starchenko I.I., Bilokon S.O. et al. Nespetsyfnchni limfadenity shchelepno-lytsevoi dilianky u ditei (kliniko-morfologichni aspekty) [Non-specific lymphadenitis of the maxillofacial area in children (clinical and morphological aspects)]. VDNZU «UMSA». - Poltava: TOV «ASMI»; 2018. 120. (Uk)
3. Tkachenko P.I., Popelo Yu.V., Bilokon S.O. Reaktsiia pryvushnykh zaloz i bukal'noho epiteliu u ditei zi zloyakysnymy pukhlynamy cherevnoi porozhnyny na tli otrymannia khimioterapii [Response of parotid glands and buccal epithelium in children with malignant tumors of the abdomen against receiving chemotherapy]. Svit medytsyny ta biolohii. 2017; 1(59): 83-87. (Uk)
4. Tkachenko P.I., Popelo Yu.V. Korektsiia sekretornoj aktyvnosti slynykh zaloz ta yakysnykh vlastyvoitei rotovoi ridyny u ditei zi zloiakysnymy pukhlynamy cherevnoi porozhnyny yaki otrymuyut' tsytostatychni preparaty [Correction of secretory activity of salivary glands and qualitative properties of oral fluid in children with malignant tumors of the abdominal cavity receiving cytostatic drugs]. Svit medytsyny ta biolohii. 2016;1 (55):88-92. (Uk)
5. Tkachenko P.I., Bilokon S.O., Lokhmatova N. et al. Statystychni vidomosti pro zapal'ni protsesy shchelepno-lytsevoi dilianky u ditei [Statistics on inflammatory processes of the maxillofacial area in children]. Wiad. Lek. 2018;3(II):621-624. (Uk)
6. Tkachenko P.I., Korotych N.M., Lokhmatova N.M. Ekonomichnyi efekt vid zastosuvannia riznykh likuval'nykh skhem u ditei z hostryim zapal'nym protsesamy shchelepno-lytsevoi dilianky ta khronichnym parenkhimatozным parotyto [The economic effect of the use of various therapeutic regimens in children with acute inflammatory processes of the maxillofacial area and chronic parenchymatic parotitis]. Svit medytsyny ta biolohii. 2015; 1(48): 77-80. (Uk)
7. Tkachenko P.I., Belokon S.A., Dobroskok V.A. et al. Informatyvenost ultrasonohrafii ta sialodenhografii v aktyvni klinichni kursy khronichnoy parenkhimatoznoy parotyty u ditei. The new Armenian medical journal. 2017;11(3):37-42.
8. Tkachenko P.I., Dobroskok V.O., Korotych N.M. et al. The role of microbial component in the progression of the acute suppurative inflammation of tissues of maxillofacial area in children. Svit medytsyny ta biolohii. 2018;1(63):83-86.
9. Tkachenko P.I., Lokhmatova N.M., Korotych N.M. Kompleksne likuvannia zahostrennia khronichnoho parenkhimatoznoho parotyty u ditei, neaktyvnyi perebih [Complex treatment of exacerbation of chronic parenchymatic parotitis in children, inactive course]. Visnyk problem biolohii i medytsyny. 2014; 2(44):83-87. (Uk)

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ORIGINAL ARTICLE

PREVALENCE OF POSTPARTUM ENDOMETRITIS AND ANTIMICROBIAL RESISTANCE OF RESPONSIBLE PATHOGENS IN UKRAINE: RESULTS A MULTICENTER STUDY (2015-2017)

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ABSTRACT

The aim: To obtain the prevalence of postpartum endometritis women and antimicrobial resistance of responsible pathogens in Ukraine.

Materials and methods: We performed a retrospective multicenter cohort study. The study population consisted of all women who had a vaginal delivery or cesarean section in 14 Regional Women's Hospitals of Ukraine.

Results: Total 2460 of 25,344 patients were found to have postpartum endometritis, for an overall infection rate of 9.7%. The postpartum endometritis rates were 7.6% after vaginal delivery and 16.4% after cesarean section. Incidence of postpartum endometritis after cesarean section is affected mainly by the mode of delivery (scheduled caesarean deliveries (done before labor starts) – 13.8% and unscheduled caesarean deliveries (done after labor starts) – 22.5%). The predominant pathogens were: *Escherichia coli* (32.7%), *Enterococcus faecalis* (13.0%), *Streptococcus* spp. (12.1%), *Klebsiella* spp. (10.4%) and *Enterobacter* spp. (10%). Among the antimicrobial agents tested, the ertapenem, piperacillin/tazobactam, and cefotaxim were the most consistently active in vitro against Enterobacteriaceae in both vaginal deliveries and after cesarean section infections. The overall proportion of extended spectrum beta-lactamase (ESBL) production among Enterobacteriaceae was 22.8% and of methicillin-resistance in *Staphylococcus aureus* (MRSA) 15.4%.

Conclusions: Postpartum endometritis and antimicrobial resistance of responsible pathogens presents a significant burden to the hospital system. Postpartum infections surveillance is required in all women's hospitals. This knowledge is essential to develop targeted strategies to reduce the incidence of postpartum infections.

KEY WORDS: Postpartum endometritis; vaginal delivery; cesarean section; antimicrobial resistance; pathogens

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INTRODUCTION

Bacterial infections during labour and the puerperium are among the leading causes of maternal morbidity and mortality worldwide [1, 2]. Postpartum endometritis is the most common infectious complications following childbirth and occurs in women from 1% to 30% [3-9]. This infection is more common after cesarean section than with vaginal delivery [10]. This is of particular concern as the number of Cesarean deliveries annually continues to rise and accounted for approximately 30% of all deliveries [11, 12]. Postpartum endometritis is also the major cause of prolonged hospital stay and comprise a large burden to health care system [9].

The epidemiology of postpartum endometritis is not well understood and remains underestimated because surveillance systems are often limited to the acute care setting.

Bacterial postpartum endometritis is a polymicrobial infection usually involving two or three different organisms. It is often a mixed aerobic and anaerobic flora [3].

The resistance of bacteria to antibiotics increases and creates a therapeutic problem for doctors in the treatment of patients with postpartum endometritis. Guidelines encourage consideration of local bacterial resistance when prescribing antibiotics for postpartum infection treatment and prophylaxis [2, 3, 13, 14]. However, studies of postpartum infections and antimicrobial resistance of responsible pathogens are scant.

To identify postpartum endometritis prevention targets and reduce thus disparities between countries, ongoing surveillance is necessary. However, the epidemiology of postpartum endometritis in Ukraine and associated treatment outcomes are not well studied. National network

for the surveillance of antimicrobial resistance is not in Ukraine [15, 16].

Resources are severely limited in country, creating difficulties implementing surveillance and establishing effective measures for infection control and postpartum infection prevention. This knowledge is essential to develop targeted strategies to reduce the incidence of postpartum infections. However, efforts to improve infection control training and begin postpartum infection surveillance have been underway. Previous reports of postpartum infection in Ukraine were limited.

THE AIM

The aim of this study was to obtain the first national estimates of the current prevalence rate of postpartum endometritis and antimicrobial resistance of responsible pathogens in Ukraine.

MATERIAL AND METHODS

STUDY DESIGN AND SETTING

A retrospective cohort study was based on surveillance data for Postpartum Endometritis and included all women's admitted to the 14 regional (tertiary) women's hospitals of Ukraine between January 1st, 2015 and December 31st, 2017. These hospitals provide care to individuals living within its catchment area (total 4 147 586 women's) and regularly take referrals from other (primary and secondary) hospitals. We have included women's hospitals that are similar in terms of medical equipment, personnel, and laboratory facilities. The hospitals had 1450 beds. All participating hospitals were required to have at least one full-time infection-control professional, a clinical microbiology laboratory with the capacity to process cultures. The follow-up of each patient was continued until discharge.

DEFINITION AND DATA COLLECTION

In our study the CDC/NHSN (Centers for Disease Control and Prevention/National Healthcare Safety Network, Atlanta, Georgia, USA) definition of endometritis was used. Postpartum endometritis as a healthcare-associated infection unless the amniotic fluid is infected at the time of admission or the patient was admitted more than 2 days after rupture of the membrane. (Day 1 = rupture day). Cesarean deliveries were classified as elective, urgent, or emergent by use of standardized criteria by the operative team. A standard data collection form was created to extract demographic and clinical data, microbiology (isolated pathogens and their antibiograms) and outcome information from routine patient records

MICROBIOLOGICAL SAMPLING AND SUSCEPTIBILITY TESTING

Uterine secretion samples were taken from women which clinical endometritis. Microbial isolates were identified using standard microbiological techniques, including

automated microbiology testing (Vitek-2; bioMe'rieux, Marcy l'Etoile, France), and antibiotic susceptibility testing was performed by using the disk diffusion method (Kirby – Bauer antibiotic testing) according to the recommendations of the Clinical and Laboratory Standards Institute (CLSI) [17]. Strains showing inhibition zone diameters in the intermediate range were considered resistant.

ETHICS

The Shupyk National Medical Academy of Postgraduate Education (Kyiv, Ukraine) ethics committee approved the waiver of informed consent to participate in this study due to its retrospective design. All patient data were anonymised prior to the analysis. Ethical considerations including privacy of personal data were considered during all steps of the research.

STATISTICAL ANALYSIS

The incidence of Endometritis was reported as the percentage of the total number of patients. The analysis of statistical data was performed using Excel (Microsoft Corp., Redmond, WA, USA). Results are expressed as median (range), mean standard deviation for continuous variables, and number and corresponding percentage for qualitative variables. The primary endpoint was the epidemiology of Endometritis, pathogens and their resistance to antibiotics. Comparisons were undertaken using Student's t-test and Pearson's chi-squared test or Fisher's exact test for categorical variables as appropriate. Statistical significance was defined as $P < 0.05$.

RESULTS

PATIENT CHARACTERISTICS AND PREVALENCE OF POSTPARTUM ENDOMETRITIS

The study population consisted of 25,344 women's who underwent 19,326 vaginal deliveries and 6,018 cesarean sections. Mean cohort age was 25.2 years (standard deviation (SD) 5.5 years), 9811 (38.7%) were primiparous. During the study period (January 2015 and December 2017), 2460 of 25,344 patients were found to have postpartum endometritis, for an overall infection rate of 9.7% [95% CI 9.5 – 9.9]. The postpartum endometritis rates were 7.6% [95% CI 7.4 – 7.8] after vaginal delivery and 16.4% [95% CI 15.9 – 16.9] after cesarean section. Incidence of postpartum endometritis after cesarean section is affected mainly by the mode of delivery (scheduled caesarean deliveries (done before labor starts) – 13.8% [95% CI 13.3 – 14.3] and unscheduled caesarean deliveries (done after labor starts) – 22.5% [95% CI 21.5 – 23.5]). Characteristics of a cohort of women's admitted to the regional women's hospitals of Ukraine for delivery or postpartum care are presented in Table I.

ANTIBIOTIC PROPHYLAXIS

Of 6018 cesarean delivery participants who underwent chart review, 5471 (90.9%) were prescribed combination ceftriaxone and metronidazole postpartum, though there

Table I. Characteristics of a cohort of women's admitted to the regional women's hospitals of Ukraine for delivery or postpartum care (2015-2017) ($P < 0.05$).

Characteristics	Total cohort (n=25344)	Postpartum endometritis (n=2460)	Prevalence of postpartum endometritis [95% CI ^b]
Age (years, mean, SD ^a)	25.2	22.6	
Age category			
<18	438 (1,7%)	118 (4.8%)	3.8 – 5.8
18-24	10868 (42,9%)	1257 (51.1%)	50.6 – 51.6
25-34	9304 (36,7%)	644 (26.2%)	25.7 – 26.7
35-44	3102 (12,2%)	313 (12.7%)	12.1 – 13.3
> 45	1632 (6,4%)	128 (5.2%)	4.7 – 5.8
Delivery mode			
Vaginal deliveries	19326 (76,3%)	1473 (7.6%)	7.4 – 7.8
Cesarean section	6018 (23,7%)	987 (16.4%)	15.9 – 16.9
Scheduled caesarean deliveries (done before labor starts)	4211 (70,0%)	581 (13.8%)	13.3 – 14.3
Unscheduled caesarean deliveries (done after labor starts)	1807 (30,0%)	406 (22.5%)	21.5 – 23.5
Total	25344 (100%)	2460 (9.7%)	9.5 – 9.9

^aCD – standard deviation^bCI – confidence interval**Table II.** Bacterial pathogens detected in cases of postpartum endometritis in Ukrainian hospitals (2015-2017) ($P < 0.05$)

Types of microorganisms	All pathogens (n=4879)	Postpartum endometritis	
		Cesarean section no. (%) of isolates	Vaginal deliveries no. (%) of isolates
<i>Aerobes</i>	4417 (90.5%)	1189 (97.8%)	3228 (88.1%)
<i>Gram-positive cocci</i>	1458 (29.9%)	458 (37.7%)	1000 (27.3%)
<i>Enterococcus faecalis</i>	634 (13.0%)	222 (18.3%)	412 (11.2%)
<i>Streptococcus spp.</i>	588 (12.1%)	84 (6.9%)	504 (13.8%)
<i>Staphylococcus aureus</i>	236 (4.8%)	152 (12.5%)	84 (2.3%)
<i>Gram-negative bacilli</i>	2959 (60.6%)	731 (60.1%)	2228 (60.8%)
<i>Escherichia coli</i>	1594 (32.7%)	410 (33.7%)	1184 (32.3%)
<i>Klebsiella spp.</i>	506 (10.4%)	65 (5.3%)	441 (12.0%)
<i>Enterobacter spp.</i>	486 (10.0%)	92 (7.6%)	394 (10.8%)
<i>Proteus mirabilis</i>	188 (3.9%)	42 (3.5%)	146 (4.0%)
<i>Pseudomonas aeruginosa</i>	162 (3.3%)	106 (8.7%)	56 (1.5%)
<i>Acinetibacter spp.</i>	23 (0.5%)	16 (1.3%)	7 (0.2%)
<i>Anaerobes</i>	340 (7.0%)	25 (2.1%)	315 (8.6%)
<i>Bacteroides spp.</i>	224 (4.6%)	14 (1.2%)	210 (5.7%)
<i>Clostridium spp.</i>	74 (1.5%)	8 (0.7%)	66 (1.8%)
<i>Other</i>	42 (0.9%)	3 (0.2%)	39 (1.1%)
<i>Fungi</i>	122 (2.5%)	2 (0.2%)	120 (3.3%)
<i>Candida albicans</i>	95 (1.9%)	2 (0.2%)	93 (2.5%)
<i>Other</i>	27 (0.6%)	0	27 (0.7%)
Total	4879	1216	3663

Table III. Antibiotic susceptibilities (% susceptible) of aerobic Gram- negative bacteria isolated from patients with endometritis after cesarean section (CS) and vaginal deliveries (VD) in Ukrainian women's hospitals (2015-2017).

Antibiotic	<i>Escherichia coli</i> (n=1594)		<i>Klebsiella spp.</i> (n=506)		<i>Enterobacter spp.</i> (n=486)		<i>Proteus mirabilis</i> (n=188)		<i>P.aeruginosa</i> (n=162)	
	VD	CS	VD	CS	VD	CS	VD	CS	VD	CS
AMP	87.1	72.4	28.7	2.6	41.2	13.1	NT	NT	NT	NT
SAM	NT	NT	68.7	0	38.1	23.1	NT	NT	NT	NT
AMX	65.2	45.8	NT	NT	NT	NT	71.4	50.1	NT	NT
AMC	78.1	32.3	85.2	14.2	39.8	17.3	84.3	75.5	NT	NT
TIC	69.9	48.2	NT	NT	92.7	64.1	86.5	77.8	81.9	60.1
TZP	97.3	86.1	100	92.3	96.5	64.2	100	100	72.8	46.4
COL	NT	NT	100	97.0	100	95.7	NT	NT	100	98.5
CXM	71.1	61.8	88.7	20.4	77.4	43.5	NT	NT	NT	NT
CRO	74.2	68.7	78.9	22.6	65.9	40.9	NT	NT	NT	NT
CTX	99.1	90.2	100	98.8	96.2	61.2	100	97.3	NT	NT
CAZ	88.7	71.7	94.5	21.8	96	36.4	100	97.5	78.6	25.9
FEP	92.1	78.3	86.7	24.2	100	40.7	100	77.6	51.2	20.3
IPM	100	100	84.7	40.2	100	61.5	100	100	88.4	33.4
MEM	NT	NT	NT	NT	NT	NT	NT	NT	100	100
EPM	100	100	100	100	100	100	100	100	100	100
AMK	97.1	95.6	88.6	65.5	100	80.8	100	100	84.7	48.4
NET	100	100	72.1	50.0	88.1	76.7	NT	NT	77.6	71.4
GEN	98.5	88.7	99.2	84.6	92.1	83.9	100	98.8	70.2	53.1
ATM	NT	NT	NT	NT	NT	NT	NT	NT	56.8	29.1
CIP	87.2	52.4	98.1	42.7	100	53.5	75	100	71.2	38.8
LVX	100	67.3	88.3	76.7	100	67	NT	NT	NT	NT
MFX	54.2	45.8	46.3	25.2	87.4	35.7	NT	NT	NT	NT
NOR	66.7	51.3	77.8	61.8	72.6	62.9	NT	NT	NT	NT
FOS	100	98.7	92.6	88.2	100	94.9	NT	NT	78.1	64.2
SXT	43.2	18.4	45.9	35.8	44.2	30.5	NT	NT	100	97.2
CFP	NT	NT	NT	NT	NT	NT	NT	NT	33.8	26.8

Notes:

AMP, ampicillin; SAM, ampicillin/sulbactam; AMX, amoxicillin; AMC, amoxicillin/clavulanic acid; TIC, ticarcillin; TZP, piperacillin/tazobactam; COL, colistin; CXM, cefuroxime; CTX, cefotaxime; CRO, ceftriaxone; CAZ, ceftazidime; FEP, cefepime; IPM, imipenem; MEM, meropenem; EPM, ertapenem; AMK, amikacin; NET, netilmicin; GEN, gentamicin; ATM, aztreonam; CIP, ciprofloxacin; LVX, levofloxacin; MFX, moxifloxacin; NOR, norfloxacin; FOS, fosfomicin; CFP, cefoperazone, SXT, trimethoprim/sulfamethoxazole.

was little documentation of antibiotic receipt. Ceftriaxone and metronidazole was also prescribed for 1912/2460 (77.7%) participants meeting criteria for postpartum infections. Another 249/2460 (10.1%) had no antibiotic prescription, and 299/2460 (12.2%) were prescribed alternative antibiotic regimens. Overall, 5821/6018 (96.7%) women delivering by cesarean had a chart-documented prescription for β -lactam perisurgical antibiotic prophylaxis, including 2183/2460 (88.7%) of participants with postpartum infection. There were four in-hospital maternal deaths, neither of which were due to infection.

MICROORGANISMS CAUSING OF POSTPARTUM ENDOMETRITIS

A total of 4879 different bacterial strains were isolated from 2460 women's with postpartum endometritis. In the present study, 5.7% samples did not show any microbial growth. Since these samples were taken from women showing clinical signs of endometritis, they cannot be bacteria-free. It is possible that the media/conditions used in the study were not favourable for the growth of micro-organisms present in these samples.

Aerobic gram-negative bacilli make up 60.6% and 29.9% gram-positive cocci from of all genital isolates.

Table IV. Antibiotic susceptibilities (% susceptible) of aerobic Gram-positive bacteria isolated from patients with endometritis after cesarean section (CS) and vaginal deliveries (VD) in Ukrainian women's hospitals (2015-2017).

Antibiotic	<i>Staphylococcus aureus</i> (n=236)		<i>Streptococcus spp.</i> (n=588)		<i>Enterococcus faecalis</i> (n=634)	
	VD	CS	VD	CS	VD	CS
PEN	71.2	23.9	88.9	66.7	92.1	79.1
AMP	100	84.2	61.3	50.0	88.9	71.6
SAM	100	100	100	100	84.7	73.9
AMX	92.4	82.1	100	100	100	86.7
AMC	NT	NT	NT	NT	72.5	66.7
OXA	92.1	77.2	100	100	NT	NT
CRO	63.4	58.6	66.4	58.6	NT	NT
EPM	100	91.7	100	91.7	NT	NT
TEC	100	75.3	NT	NT	100	100
AMK	100	97.1	100	100	44.9	18.5
NET	84.5	77.4	100	100	88.7	55.2
GEN	100	88.7	100	14.4	71.0	37.1
CLI	79.9	88.9	79.9	60.1	62.1	50.1
LIN	77.5	69.8	NT	NT	NT	NT
AZM	88.9	66.4	91.6	83.3	56.7	33.3
VAN	100	100	88.5	77.1	100	100
CIP	NT	NT	100	100	77.8	48.1
PEF	100	88.9	80.6	40.2	NT	NT
MFX	86.3	85.6	96.7	88.9	67.8	33.3
LVX	NT	NT	98.2	95.3	81.1	68.1
CHL	NT	NT	88.9	74.4	NT	NT
FOS	100	100	100	100	100	99.6
SXT	NT	NT	95.1	75.2	NT	NT
LNZ	NT	NT	100	98.7	100	99.7

Notes:

NT, no tested; PEN, penicillin; AMP, ampicillin; SAM, ampicillin/sulbactam; AMC, amoxicillin/clavulanic acid; AMX, amoxicillin; OXA, oxacillin; CRO, ceftriaxone; EPM, ertapenem; TEC, teicoplanin; AMK, amikacin; NET, netilmicin; GEN, gentamicin; CLI, clindamycin; LIN, lincomycin; AZM, azithromycin; VAN, vancomycin; CIP, ciprofloxacin; MFX, moxifloxacin; PEF, pefloxacin; LVX, levofloxacin; CHL, chloramphenicol; FOS, fosfomicin; SXT, trimethoprim/sulfamethoxazole; LNZ, linezolid.

The predominant pathogens were: *Escherichia coli* (32.7%), *Enterococcus faecalis* (13.0%), *Streptococcus spp.* (12.1%), *Klebsiella spp.* (10.4%), *Enterobacter spp.* (10%), *Staphylococcus aureus* (4.8%), *Proteus mirabilis* (3.9%) and *Pseudomonas aeruginosa* (3.3%). The distribution of the microorganisms differed according to the after cesarean section or after vaginal deliveries of the infection (Table II).

In cesarean section patients, increased proportions of aerobic bacteria were observed with increased proportions of *Staphylococcus aureus* (12.5% vs. 2.3% in vaginal deliveries patients; $P<0.01$) and *Pseudomonas aeruginosa* strains (8.7% vs. 1.5% in vaginal deliveries patients; $P<0.01$), and *Enterococcus faecium* (7.1% vs. 1.0% in vaginal deliveries patients; $P<0.02$). Conversely, decreased proportions of *Klebsiella spp.* (5.3% vs. 12.0% in cesarean section patients,

$P<0.05$) and *Streptococcus spp.* were observed in cesarean section patients (6.9% vs. 13.8% in vaginal deliveries infection, $P<0.01$) and *Bacteroides spp.* were observed in cesarean section patients (1.2% vs. 5.7% in vaginal deliveries infection, $P<0.02$). When taking into account prior antibiotic therapy, we did not observe any change in the type or proportion of the cultured organisms, whatever the type of infection.

ANTIMICROBIAL RESISTANCE OF RESPONSIBLE PATHOGENS

Among the antimicrobial agents tested, the carbapenems (ertapenem) and piperacillin/tazobactam, and cefotaxim were the most consistently active in vitro against Enterobacteriaceae in both vaginal deliveries and after cesarean

section infections (Table 3). The overall proportion of extended spectrum beta-lactamase (ESBL) production among Enterobacteriaceae was 22.8% and of methicillin-resistance in *S. aureus* (MRSA) 15.4%.

Against *P. aeruginosa*, the carbapenems (meropenem, ertapenem, imipenem), trimethoprim/sulfamethoxazole, amikacin and ticarcillin were the most active agents in vaginal deliveries infections, while meropenem, ertapenem, and trimethoprim/sulfamethoxazole were the most active agents in cesarean section infection cases (Table III). No vancomycin-resistance *E. faecalis* (VRE) strains were cultured. When taking into account the global activity against the Gram-positive bacteria, vancomycin, teicoplanin, linezolid and fosfomycin, were the most consistently active in vitro in both vaginal deliveries and cesarean section infections, due to the strains of *E. faecalis* (Table IV).

DISCUSSION

To our knowledge, this is the first national postpartum infections surveillance multicenter study in Ukraine, which describes prevalence of postpartum endometritis and antimicrobial resistance of responsible pathogens in Ukrainian hospitals. This study, performed over a short period of time (2015-2017), investigated the epidemiology of endometritis in a mixed group of patients with endometritis after cesarean section and vaginal delivery infections. We assume that this descriptive study reflects 'real-life' conditions. The principal results of this study were a high incidence of postpartum endometritis, diversity of microorganisms isolated in cesarean section infections and decreased susceptibility among these strains. The results of antibiotic sensitivity test in our study indicated that the carbapenems (ertapenem) and piperacillin/tazobactam, and cefotaxim were the most consistently active in vitro against Enterobacteriaceae in both vaginal deliveries and after cesarean section infections. The overall proportion of extended spectrum beta-lactamase (ESBL) production among Enterobacteriaceae was 22.8% and of MRSA strains 15.4%. Against *P. aeruginosa*, the carbapenems (meropenem, ertapenem, imipenem), trimethoprim/sulfamethoxazole, amikacin and ticarcillin were the most active agents in vaginal deliveries infections, while meropenem, ertapenem, and trimethoprim/sulfamethoxazole were the most active agents in cesarean section infection cases. Against the Gram-positive bacteria, vancomycin, teicoplanin, linezolid and fosfomycin, were the most consistently active in vitro in both vaginal deliveries and cesarean section infections, due to the strains of *E. faecalis*.

The estimates, postpartum endometritis occurs following 1-3% of vaginal births [3] and up to 30% of caesarean sections [3-9]. In a Cochrane review [4], the mean incidence of postpartum endometritis following elective cesarean section was 7% and after non-elective or emergency operations was 30%. In our study 9.7% patients were found to have postpartum endometritis. The postpartum endometritis rates were 7.6% after vaginal delivery and 16.4% after

cesarean section. Incidence of postpartum endometritis after cesarean section is affected by the mode of delivery deliveries and amounted to 13.8% after the planned cesarean section and 22.5% of unscheduled cesarean section.

According to the literature, the most common pathogenic organisms associated with postpartum endometritis include *Streptococcus* spp., *Staphylococcus* spp. (*S. aureus*, *S. epidermidis*), Gram-negative bacteria such as *E. coli*, *Klebsiella* spp., and *Proteus* spp., *Enterobacter* spp., and finally, anaerobes such as *Bacteroides* spp. [3, 18]. In our study the bacterial spectrum observed in patients with postpartum endometritis matches the previous reports.

Antibiotics are always indicated for endometritis [3]. Cochrane reviews and recommendations from the World Health Organization (WHO) support a combination of clindamycin and gentamicin as the optimal first-line antibiotic treatment [2, 3]. In our study, resistance of responsible pathogens in Ukrainian hospitals to clindamycin and gentamicin was 24.6% and 29.8%, respectively. Recommendations of Ukrainian Ministry of Health support a combination of ceftriaxone and metronidazole for antibiotic treatment. During the study period, resistance to ceftriaxone was 36.4% (39.6% Gram-negative and 33.2% Gram-positive isolates). Therefore, the results of our study show that it is necessary to revise the recommendations for the use of clindamycin, gentamicin and ceftriaxone due to the high resistance of responsible pathogens of postpartum endometritis. Further research should address when and where antibiotic-resistant bacteria are acquired, infection outcomes, and local challenges in guideline implementation.

STRENGTHS AND LIMITATIONS

Strengths of our study include the cohort design, capturing all women's admitted to hospitals for delivery or postpartum care within the study period, and near-complete microbiologic evaluation of clinical endometritis using a reliable microbiology laboratory. The limitations of this study include its retrospective design and conduct at a 58.3% region (14 from 24) in Ukraine. The results may not be representative of other regions of Ukraine with different distributions of antimicrobial resistance of responsible pathogens of postpartum endometritis. However, there are no national surveillance data in Ukraine, which compelled us to rely entirely on data from the only existing national retrospective study of postpartum endometritis. This investigation provides valuable data as a first study for national surveillance of postpartum infections and potential comparison with data from other countries.

CONCLUSION

Postpartum endometritis and antimicrobial resistance of responsible pathogens presents a significant burden to the Ukraine hospital system. Optimizing the management and empirical antimicrobial therapy may reduce the burden of postpartum endometritis, but prevention is the key element. Knowledge about local data of resistance

may contribute to limiting resistance and may have a significant role in designing effective antimicrobial stewardship policies. Strategic planning and implementation of postpartum infections surveillance is required in all women's hospitals.

REFERENCES

- Say L., Chou D., Gemmill A. et al. Global causes of maternal death: a WHO systematic analysis. *The Lancet Global health*. 2014;2(6):e323-33. doi: 10.1016/S2214-109X(14)70227-X.
- WHO recommendation on a combination of clindamycin and gentamicin for the treatment of postpartum endometritis (September 2015). The WHO Reproductive Health Library; Geneva: World Health Organization. Available from: <https://extranet.who.int/rhl/topics/preconception-pregnancy-childbirth-and-postpartum-care/who-recommendation-combination-clindamycin-and-gentamicin-treatment-postpartum-endometritis> [accessed 12 March 2018].
- Mackeen A.D., Packard R.E., Ota E. et al. Antibiotic regimens for postpartum endometritis. *Cochrane Database Syst Rev*. 2015 Feb 2;(2):CD001067. doi: 10.1002/14651858.CD001067.pub3.
- Smaill F., Hofmeyr G.J. Antibiotic prophylaxis for cesarean section. *Cochrane Database Syst Rev*. 2002;(3):CD000933. Review. Update in: *Cochrane Database Syst Rev*. 2010;(1):CD000933.
- Olsen M.A., Butler A.M., Willers D.M. et al. Risk factors for surgical site infection after low transverse cesarean section. *Infect Control Hosp Epidemiol*. 2008;29(6):477-84; discussion 485-6. doi: 10.1086/587810.
- Tita A.T., Szychowski J.M., Boggess K. et al. Adjunctive Azithromycin Prophylaxis for Cesarean Delivery. *N Engl J Med*. 2016;375(13):1231-41. doi: 10.1056/NEJMoa1602044.
- Haas D.M., Pazouki F., Smith R.R. et al. Vaginal cleansing before cesarean delivery to reduce postoperative infectious morbidity: a randomized, controlled trial. *Am J Obstet Gynecol*. 2010;202(3):310.e1-6. doi: 10.1016/j.ajog.2010.01.005.
- Costantine M.M., Rahman M., Ghulmiyah L., et al. Timing of perioperative antibiotics for cesarean delivery: a metaanalysis. *Am J Obstet Gynecol*. 2008; 199(3):301.e1-6. doi: 10.1016/j.ajog.2008.06.077.
- Blumenfeld Y.J., El-Sayed Y.Y., Lyell D.J. et al. Risk Factors for Prolonged Postpartum Length of Stay Following Cesarean Delivery. *Am J Perinatol*. 2015;32(9):825-32. doi: 10.1055/s-0034-1543953.
- Burrows L.J., Meyn L.A., Weber A.M. Maternal morbidity associated with vaginal versus cesarean delivery. *Obstet Gynecol*. 2004;103(5 Pt 1):907-12. doi:10.1097/01.AOG.0000124568.71597.ce.
- Martin J.A., Hamilton B.E., Sutton P.D. et al. Births: final data for 2008. *Natl Vital Stat Rep*. 2010;59(1):1, 3-71.
- Hamilton B.E., Martin J.A., Osterman M.J.K. et al. Births: final data for 2014. *National vital statistics reports*; vol 64 no 12. Hyattsville: National Center for Health Statistics; 2015. Available from: https://www.cdc.gov/nchs/data/nvsr/nvsr64/nvsr64_12.pdf. [accessed 13 March 2019].
- Alfirevic Z., Gyte G.M., Dou L. Different classes of antibiotics given to women routinely for preventing infection at caesarean section. *Cochrane Database Syst Rev*. 2010 Oct 6;(10):CD008726. doi: 10.1002/14651858.CD008726.
- Gupta K., Hooton T.M., Naber K.G. et al. International clinical practice guidelines for the treatment of acute uncomplicated cystitis and pyelonephritis in women: A 2010 update by the Infectious Diseases Society of America and the European Society for Microbiology and Infectious Diseases. *Clin Infect Dis*. 2011;52(5):e103-20. doi: 10.1093/cid/ciq257.
- Salmanov A.G., Vdovychenko S.Y., Litus O.I. et al. Prevalence of health care-associated infections and antimicrobial resistance of the responsible pathogens in Ukraine: Results of a multicenter study (2014-2016). *Am J Infect Control*. 2019 Jun;47(6):e15-e20. doi: 10.1016/j.ajic.2019.03.007.
- Salmanov A., Vozianov S., Kryzhevsky V. et al. Prevalence of healthcare-associated infections and antimicrobial resistance in Kyiv acute care hospitals, Ukraine. *J Hosp Infect*. 2019 Mar 22. pii: S0195-6701(19)30112-4. doi: 10.1016/j.jhin.2019.03.008.
- Clinical and Laboratory Standards Institute (CLSI). Performance standards for antimicrobial susceptibility testing; twenty-third informational supplement. CLSI document M100-S23. 950 West Valley Road, Suite 2500, Wayne, Pennsylvania 19087 USA: Clinical and Laboratory Standards Institute; 2013.
- Carlsen S., Permer A. East Danish Septic Shock Cohort Investigators. Initial fluid resuscitation of patients with septic shock in the intensive care unit. *Acta Anaesthesiol Scand*. 2011;55(4):394-400. doi: 10.1111/j.1399-6576.2011.02399.x.

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Conflict of interest:

The Authors declare no conflict of interest

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ORIGINAL ARTICLE

CLINICAL-MORPHOLOGICAL CHARACTERISTICS AND PECULIARITIES OF TREATMENT OF PARAAURICULAR FISTULAS IN CHILDREN

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ABSTRACT

The aim: Determining the frequency of occurrence of paraauricular fistula in children and comparing the results of their own experience regarding their clinical manifestations, treatment principles and morphological features with existing scientific data.

Materials and methods: The results of a comprehensive examination and surgical treatment of 25 children with paraauricular fistulas.

Results: Most often, para-auricular fistula was observed in infants 22 – (88%). In 18 persons (72%), they were unilateral, in 10 – (40%) hereditary. In 8 – (32%), fistula was diagnosed immediately after birth. In 17 – (68%) the pathology was not clinically manifested, but was an accidental finding during the next medical examination. Morphological research has shown that congenital paraauricular fistula is a formed canal intimately associated with the epithelium and cartilage, and the presence of epithelial lining on the fistula wall with constant support of the inflammatory process makes it impossible to heal even against the background of multicomponent treatment.

Conclusions: Due to the topographic-anatomical localization, features of the clinic of the born fistula, surgical treatment does not always allow to achieve the desired results, and requires repeated interventions during recurrence. It is possible to prevent recurrence by the extensive use of additional diagnostic manipulations before surgery and careful wound control during surgical procedures.

KEY WORDS: children, paraauricular fistulas, clinical manifestations, treatment

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INTRODUCTION

It is well known that paraauricular fistulas (PAF) can be dysentogenic or acquired pathology. According to the researchers, congenital PAF is the result of impaired formation of the auricle in embryogenesis, resulting from the non-fusion of the dorsal end of the first gill slit. Most often, such pathology, in 25% of the observations having an inherited nature and transmitted by recessive type, is already determined in newborn children and occurs, depending on the region, with a frequency of 15,5 – 43,7 cases per 100,000 people [1,2,3,4,5,6,7].

Instead, acquired PAF is usually a complication of surgery or a prolonged purulent process in the parotid or masticatory area (otitis, mastoiditis, tonsillitis, etc.) [8,9,10,11,12].

THE AIM

The purpose of the study is to determine the incidence of PAF in children and to compare the results of their own experiences with regard to their clinical manifestations, treatment principles and morphological features with existing scientific data.

MATERIALS AND METHODS

We have thoroughly analyzed fundamental scientific works and publications in periodicals on these issues.

The frequency of occurrence of PAF was determined at the outpatient reception staff of the Department of Pediatric Surgical Dentistry, with the subsequent referral of patients to the hospital. The final diagnosis was determined by summarizing the results of general clinical and additional examination methods. Surgical treatment was performed according to the classical principles, but the choice of access and the amount of surgical intervention depended on the individual topographic and anatomical features of the location of the fistula.

The staff of the Department of Pathological Anatomy with a section course on preparations made from postoperative material according to conventional methods [13], determined the microscopic structure of the PAF.

RESULTS AND DISCUSSION

According to scientists, during the 5th and 6th weeks of gestation I and II, the gill arches give rise to six ear buds that form around the first brachial cleft from which the external auditory canal develops. The tubercles, in turn, form the structures of the auricle: they assume that the I hump “gives” the kid, II – the leg of the curl, III – the other part of the curl, IV – the antitumor, V – the lower part of the curl and ear lobe [14,15].

Therefore, PAF may result from incomplete fusion of the I tuberculosis, isolation of the ectodermal fold in the formation of the auricle, or impaired splicing of the first gill slit, which may be both sporadic cases and family inheritance with incomplete clinical manifestations [1,3,4,6,9,10,16].

In view of the above, it is quite clear that most of the PAFs were observed in infants (22 (88%) of the 25 cases). Usually they were one-sided (18 persons – 72%). In cases of bilateral fistulas, we do not determine the natural symmetry of their anatomical location.

It was found out that in 10 cases (40%) of PAF were hereditary. Only 8 children (32%) were diagnosed with congenital PAF in the maternity ward immediately after delivery, and this was in cases with clear clinical signs and the location of fistulas in front of the goat ear. In the other 17 patients (68%), the pathology was clinically in no way manifested, and the presence of a “crater” at the fistula exit point did not disturb either the child or her relatives, but was an accidental finding during a regular examination at a pediatrician or surgeon. At the same time, attentive parents observed periodic isolation in a small amount of transparent or white mass of secretions, which, for the most part, was preceded by acute catarrh of the upper respiratory tract, but they were not interested in the “speck” from which these secretions were.

In the objective examination, the ears of the auricle and upwards of the curl (however, there were cases of other location in the para-auricular area) were often found to have a point hole of the fistula mouth no larger than 1 mm in diameter. In 19 cases (76%) in the period of exacerbation, a thick mucus, serous mucous secretion or white mushy mass was released from the exacerbation period, which in some cases led to maceration of adjacent skin (Fig. 1, 2).

Researchers note that poor development or presence of blockage in the course of fistula in some cases does not allow to determine the external opening of the PAF immediately after birth (Fig. 1b), and after infection and inflammation of the fistulas, the exit hole is formed naturally or artificially [2,3,7,17].

There are two types of PAF. The first is a duplication of the cartilaginous part of the external auditory canal and opens in the pre- or retroauricular areas, and the second type is often combined with defects in the development of the ear, being a duplicate of the entire external auditory canal. It is with the second type on one (inner) side that the opening can open near the tympanic membrane, and on the other is located at the bottom of the external auditory canal or in the area of the cheek, the angle of the lower jaw, the upper (above the hyoid bone) of the neck. Sometimes PAF is combined with sensorineural deafness and is an integral part of the autosomal dominant bronchio-oto-renal syndrome [1,4,6,10,16].

Sensing a thin polyethylene catheter, we have always identified a thin tortuous course of various sizes from 0,5 to 3-4 cm long. However, other researchers have found longer fistulous passages that open into the mouth, neck, or middle ear, and mention fistula with a canal width of 1 cm or more [10].

Infectious agents penetrating directly into the fistula may cause inflammation, which was observed in 19 patients (76%). In such cases, deterioration of patients' general well-being, fever, tenderness, and other common signs of acute inflammatory diseases were determined, and pus was excreted from the fistula. The expressiveness of these manifestations was individual and dependent on many factors. Parents noted that similar phenomena in children from time to time have repeatedly occurred before, but did not bite without medical intervention. The frequency of development of inflammatory processes in different patients probably depended on the virulence of the microflora, the state of immunity of the patient and the anatomical features of the structure and size of the fistula.

We observed 1 patient (4%) with acquired PAF, however, like other researchers, we note that their appearance is preceded by compaction, swelling, and formation of tubercles near the surface of the scar formed after the surgical wound, with redness and soreness in the area of the suture. against the background of fever, and then a small amount of purulent exudate begins to emerge. In addition, with purulent chronic otitis, especially on the background of an unsanitary oral cavity, fistula of the bone capsule of the labyrinth can also be formed [2,7,9,12].

In our case, acquired PAF occurred 1 year after surgery to remove the parotid cyst (judging by the content of the extract from the medical history, which had no pathohistological confirmation). Unfortunately, we could not find out the exact issue because the patient was operated on in another clinic. In our opinion, this was a diagnostic error, and we dealt with relapse after incomplete removal of the fistula.

All children with the PAF who were treated at the clinic of the Department of Pediatric Surgical Dentistry under general anesthesia underwent surgical intervention to remove fistulous passages, which is the main method of treatment of this pathology. To determine the localization and distribution of fistula, a solution of diamond green or methylene blue was introduced into its outer opening immediately before surgery.

The fistula canal was removed with obligatory resection of the adjacent cartilage. The edges of the skin incision were mobilized, the wound was sutured in layers and drained with a rubber graduate, which was removed a day. The skin was sutured with a knotted suture as close as possible to the edge, which provided a further satisfactory cosmetic result.

In 1 case (4%) after completely successful removal of PAF in the child in the postoperative period, a hypertrophic scar was formed, which did not undergo medical and physiotherapy leveling during 3-year dynamic observation (Fig. 3).

Parauricular fistulas extend near the facial nerve, so surgery should be performed with utmost care. However, it should be remembered that short fistulas are fairly easy to cut in full, and long ones, which sometimes are quite curved, having a considerable length, need more careful and painstaking removal at full length.

Residues can cause recurrence of the pathology, which, according to Prasad et al (1990), reaches 42%, and the scars

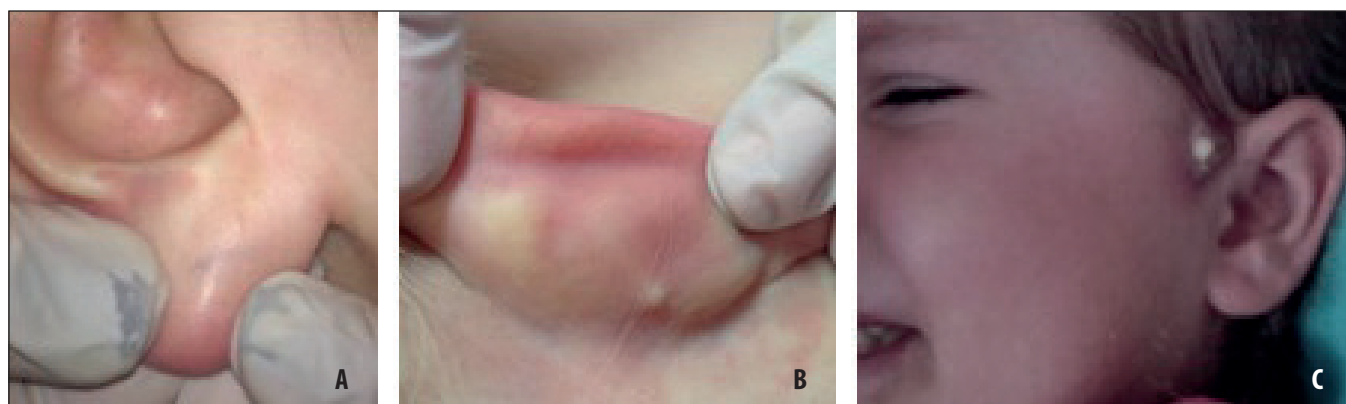


Fig. 1. (a,b,c) The appearance of PAF of different anatomical localization in children.

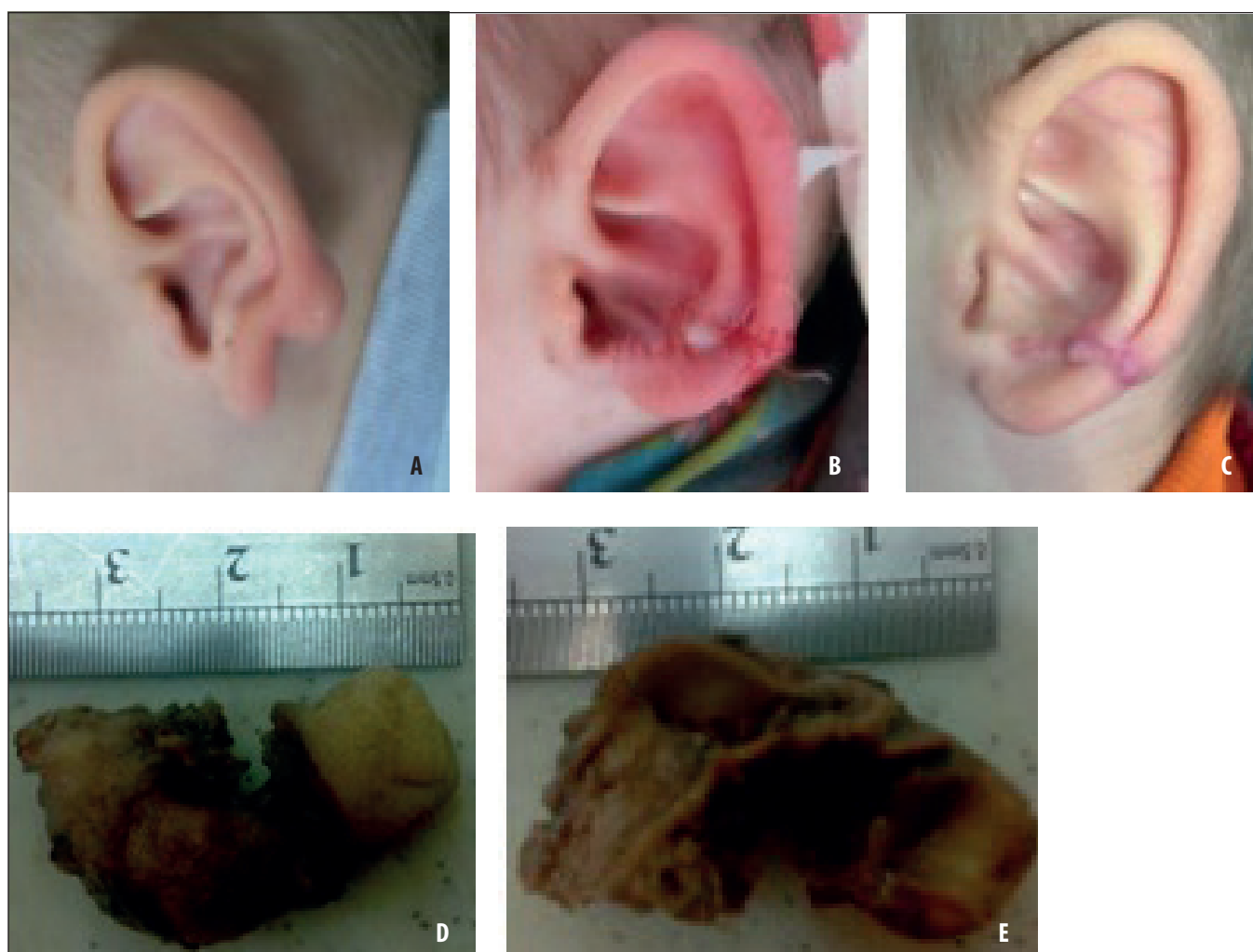


Fig. 2. The appearance (a-c) of PAF and macropreparation obtained after its removal (d, e).

that occur in the case of unsuccessful surgery, mask the tissues of the fistula, complicating its complete removal in the future. To prevent this, prior to surgery, it is advisable to conduct a fistulograph to accurately determine the depth and branching of the stroke to determine the optimal variant of its excision.

In 6 cases (24%), when PAFs were small, shallow, and not prone to inflammation, that is, they did not disturb the

child, we did not perform any active intervention, limited only to dynamic observation.

For the purpose of elimination of inflammatory effects antibacterial, anti-inflammatory, symptomatic and local therapy – instillation into the fistula canal of antiseptic and antibacterial drugs was prescribed.

Against the background of acute inflammation, we did not perform radical surgery, limited, if it is necessary, by



Fig. 3. The appearance of the hypertrophic scar formed in the postoperative period after removal of PAF in the child.

opening the abscess and eliminating its contents, followed by classic management of the purulent wound. After such treatment, usually the fistula was closed and a period of 1 month after the knocking out of the phenomena of inflammation, they underwent surgical removal. It should be noted that in 3 patients (12%) fistulas functioned almost constantly without a significant period of remission, so they had to be operated immediately after elimination of manifestations of acute inflammation. Unfortunately, 2 of them (66.7%) had recurrence again, accounting for 8% of the total number of patients.

After excision, all surgical material was sent for morphological examination, which revealed that the congenital PAF is a formed channel in the ear region (Fig. 2d, e), often intimately associated with the epidermis and cartilage, with the classical structure [17]. (Fig. 4, 5).

The fistula wall was formed by a dense fibrous connective tissue with a moderate number of cellular elements and a well-developed fibrillar component and the

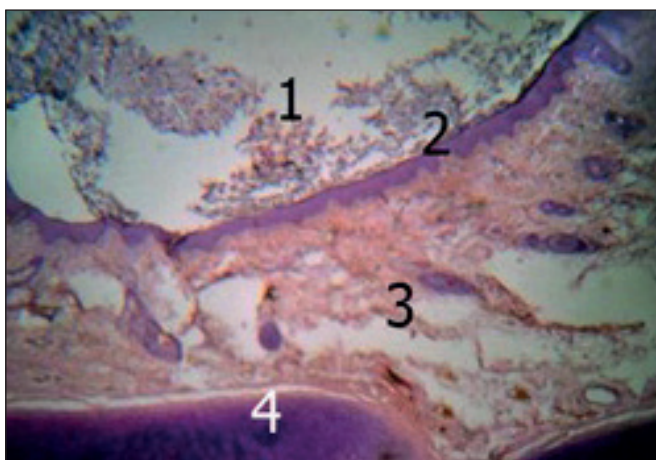


Fig. 4. General plan of the structure of the PAF. Micropreparation. Hematoxylin-eosin staining. About. 4x, approx. 10x.

- 1 – fistula course;
- 2 – epithelial lining;
- 3 – coarse fibrous connective tissue;
- 4 – cartilage.

presence, in most observations, of underdeveloped skin derivatives.

Among the connective tissue cells, mature fibroblasts prevailed in quantitative terms, sometimes grouping of lymphocytes and plasma cells, mainly located directly below the epithelial lining, were found. The presence of the latter indirectly indicates the presence of a long-lasting inflammatory process.

The epithelial lining was mostly formed by a multilayered flat, uncured epithelium with relatively clear stratification into separate layers, the cells of which had characteristic morphological features. Less often the fistula canal was lined by a multilayered cylindrical epithelium.

It is the presence of the described epithelial lining against the backdrop of constant support of the inflammatory process make it impossible to cure fistula even in the case of multicomponent conservative treatment [18].

CONCLUSIONS

Congenital forms of paraauricular fistulas in children are mainly diagnosed immediately after birth and during the first year of life. Due to the topographic-anatomical localization and peculiarities of clinical manifestations, they may be considered for other pathology with the treatment of doctors of different profiles already at the stage of pronounced inflammatory phenomena. In this regard, surgical treatment does not always achieve the desired results, requiring recurrent surgery for recurrence.

Unfortunately, there are no preventive measures of congenital PAF as a consequence of disorders of individual chains of embryogenesis. Instead, recurrence can be prevented by extensive use of additional examination methods and diagnostic procedures before surgery and careful wound control during surgical procedures.

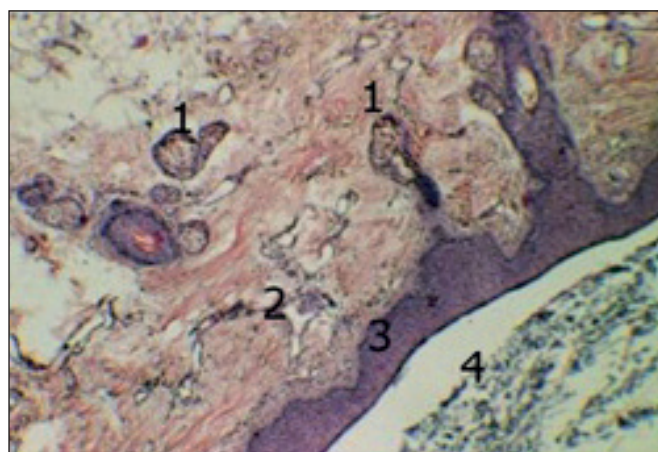


Fig. 5. The structure of the wall of the PAF. Micropreparation. Hematoxylin-eosin staining. About. 10x, Approx. 10x.

- 1 – skin derivatives;
- 2 – blood vessels;
- 3 – multilayered flat non-healing epithelium;
- 4 – cavity of the fistula.

PERESPECTIVES FOR FURTHER RESEARCH

The above mentioned material can be the basis for further in-depth scientific and practical studies on the study of immunohistochemical features of paraauricular fistulas in order to determine their role in the clinical course, to determine individual features and to choose rational options for surgical access.

REFERENCES

- Bernadskiy Yu.I. Osnovy chelyustno-litsevoy khirurgii i khirurgicheskoy stomatologii. [Fundamentals of maxillofacial surgery and surgical dentistry]. Moscow: Medical literature; 2000.404. (Ru)
- Zelenskiy V.A., Mukhoramov F.S. Detskaya khirurgicheskaya stomatologiya i chelyustno-litsevaya khirurgiya [Pediatric surgical dentistry and oral and maxillofacial surgery]. Moscow: Medicine; 2008.206. (Ru)
- Malanchuk V.O., Konchak A.V. Dobroyakisni pukhlyny ta pukhlynopodibni urazhennia shchelepno-lytsevoi dilianky ta shyi [Benign tumors and tumorous lesions of maxillofacial area and neck]. Textbook. K.: Askania Publishing House; 2008.320. (Uk)
- Timofeyev A.A. Chelyustno-litsevaya khirurgiya [Maxillofacial surgery]. K.: 2010.574. (Ru)
- Tkachenko P.I., Starchenko I.I., Bilokon S.O. ta in. Novoutvorennia shchelepno-lytsevoyi dilyanky u ditey [Formations of maxillofacial area in children]. Poltava: 2018.191. (Uk)
- Khar'kov L.V., Yakovenko L.M., Chekhova I.A. Khirurgichna stomatolohiya dytyachoho viku [Surgical dentistry of childhood]. Kyiv: Book Plus, 2003.480. (Uk)
- Cherstvoy Ye.D., Kravtsovoy G.I., Furmanchuk A.V. Opukholi i opukholepodobnyye protsessy u detey [Tumors and tumor-like processes in children]. Minsk: Askar; 2002.400. (Ru)
- Tkachenko P.I., Gurzhiy O.V., Bilokon S.O. ta in. Dytiacha khirurgichna stomatolohiia. Praktychni zaniattia (Chastyny I-III). Metodychni rekomendatsii [Pediatric surgical dentistry. Practical classes (Parts I-III). Methodical recommendations]. Poltava: 2005.140. (Uk)
- Kolesov A.A., Vorob'yov Yu.I., Kasparova N.N. Novoobrazovaniya myagkikh tkaney i kostey litsa u detey i podrostkov [Neoplasms of soft tissues and facial bones in children and adolescents]. Medicine, 1989.302. (Ru)
- Kruchinskiy G.V. Redkiye vrozhdonnyye sindromy litsa i chelyustey [Rare congenital syndromes of the face and jaw]. Minsk: Belarus; 1974.63. (Ru)
- Tkachenko P.I., Starchenko I.I., Bilokon S.O. ta in. Dobroyakisni novoutvorennia m'yakikh tkanyn shchelepno-lytsevoyi dilyanky ta slynnnykh zaloz u ditey [Benign neoplasms of the maxillofacial area and salivary glands in children]. Poltava: 2015.80. (Uk)
- Topolnitskiy O.Z. Stomatologiya detskogo vozrasta. Khirurgiya [Dentistry of childhood. Surgery]. Moscow: GEOTAR-Media; 2016.311. (Ru)
- Merkulov A.B. Kurs patogistologicheskoy tekhniki [The course of pathological technology]. L.: Medicine; 1969.237. (Ru)
- Bykov V.L. Gistologiya i embriologiya organov polosti rta cheloveka [Histology and embryology of the human oral cavity]. [2nd ed., Rev.] St. Petersburg: Special literature; 1998.247. (Ru)
- Gemonov V.V., Lavrova E.N., Falin L.I. Razvitiye i stroeniye organov rotovoy polosti i zubov [The development and structure of the organs of the oral cavity and teeth]. M.: GOU VUNMTS Ministry of Health of the Russian Federation; 2002.256. (Ru)
- Malanchuk V.O. Khirurgichna stomatolohiya ta shchelepno-lytseva khirurgiya [Surgical dentistry and maxillofacial surgery]. K.: Logos; 2011;1:669. (Uk)
- Pal'tsev M.A., Anichkov N.M. Atlas patologii opukholey cheloveka [Atlas of the pathology of human tumors]. M.: Medicine; 2005.424. (Ru)
- Vantsyan E.N. Naruzhnyye i vnutrenniye svishchi [External and internal fistulas]. M.: Medicine, 1990.221. (Ru)

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FEATURES OF MECHANICAL INJURIES OF THE LOWER EXTREMITIES ACCORDING TO A FORENSIC MEDICAL EXAMINATION: A RETROSPECTIVE ANALYSIS

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ABSTRACT

The aim: To study the structure of lower extremities' mechanical injuries and the reasons for an additional (commission) forensic medical examination appointment, according to a retrospective analysis.

Materials and methods: research protocols were 116 reports of additional (commission) forensic medical examinations of victims with mechanical trauma to lower extremities; research methods – retrospective analysis, statistical method. Reports of forensic medical commission examination were selected by random sampling, for the period February – June 2018.

Results: As a result of a retrospective analysis of commission (additional) forensic medical examination, the prevalence of road traffic injuries (109; 94.0% cases) in mechanical injuries of the lower extremities was established. Domestic (5; 4.2%), work (1; 0.9%) and sports (1; 0.9%) injuries were also indicated. It was found that to establish the degree of permanent disability loss according to the outcome of fractures of the femur and shin bones, commission examinations were appointed in 24.1% of cases. The main reason for the commission examinations appointment was to establish the bodily injuries presence (6.9%), as well as to establish the bodily injuries presence and their severity (62.9%) in cases of road traffic injury (lethal and non-lethal).

Conclusions: The use of commission forensic medical examination is mainly related to the criminal law criteria of the preliminary investigation stage. The reason for conducting commission examinations on medical criteria is to establish the outcome of a fracture of the lower limb.

KEY WORDS: mechanical trauma of the lower extremities, forensic medical examination, outcomes of fractures of long bones of the lower extremities, road traffic injury

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INTRODUCTION

An expert assessment of bodily injuries severity to victims with mechanical trauma of lower extremities and an uncomplicated post-traumatic period usually is confined to primary forensic examination. However, in cases when there is a development of post-traumatic arthrosis and/or post-traumatic contractures of the joints, delayed consolidation or non-fusion of bone fragments with the nearthroses formation and a persistent limitation of the bearing and walking functions, an additional forensic medical examination is carried out to determine the disability degree of victims according to the outcome of a mechanical injury. In addition, the tasks of commission examinations are often to establish the fact and mechanism of causing bodily harm, their causal relationship with the circumstances of the injury. Given the fact that the main cause of fractures of the long bones of the lower extremities is a road traffic injury, in some cases, there is a need for a forensic technician commission examination. This situation leads to a prolongation of the investigation period. This situation does not contribute to the principles of inevitability of the criminal process and, in a certain way, it violates the interests of the victims. It should be noted that the nature and

frequency of the reasons for the appointment of commission examinations in cases of the lower extremities' mechanical injury have not been studied, although such data are necessary to improve the forensic medical and expert assessment of the severity of bodily injuries in this category of victims.

THE AIM

Aim of the study – to study the structure of lower extremities' mechanical injuries and the reasons for an additional (commission) forensic medical examination appointment, according to a retrospective analysis.

MATERIALS AND METHODS

Study material – 116 reports of additional (commission) forensic medical examinations of victims with mechanical trauma to lower extremities. In all cases, an expert assessment was carried out at the Kharkov Regional Bureau of Forensic Medical Examination (KRBFME). Reports of forensic medical commission examination were selected by random sampling, for the period February – June 2018.

Table I. Distribution of victims due to mechanical injuries of the lower extremities, gender and age

Parameters	Number of victims (n = 116)	
	abs.	%
Road traffic injuries	109	94,0
Gender		
- male	96	82,8
- female	13	11,2
Average age	39,7 ± 12,8 y/o	
Domestic injuries	5	4,2
Gender		
- male	3	2,6
- female	2	1,6
Average age	46,3 ± 8,5 y/o	
Work injuries	1	0,9
Gender		
- male	1	0,9
- female	-	0,0
Age	38 y/o	
Sports injuries	1	0,9
Gender		
- male	-	0,0
- female	1	0,9
Age	29 y/o	

Criteria for the inclusion were forensic medical examinations' reports with: (I) victims with isolated mechanical trauma of lower extremities; (II) polytrauma (multiple and combined injuries), in which mechanical injury to the lower extremities was the dominant damage; (III) polytrauma in which mechanical trauma to the lower extremities was not a dominant injury. The study included polytrauma with both fatal and non-fatal outcomes.

Exclusion criteria were primary forensic medical examinations' reports with: mechanical trauma to the lower extremities; reports of forensic medical examinations with thermal, chemical trauma, barotrauma, electric trauma, as well as combined lower limb trauma

There was a prevalence of males (100 males; 86.2%), the men to women ratio was 6.25:1. The average age of the victims was 42.3 ± 11.2 years (10 – 78 years).

Research methods – retrospective analysis, statistical method.

When conducting a retrospective analysis, the mechanism, nature and location of the injury, as well as the reasons for the forensic medical commission examinations, were investigated.

Data processing performed using descriptive statistics.

RESULTS

As for circumstances of mechanical injuries of the lower extremities, road traffic injuries prevailed – 109 (94.0%)

cases. Domestic (5; 4.2%), work (1; 0.9%) and sports (1; 0.9%) injuries were also indicated (Table I).

The gender distribution and average age of victims of road traffic injuries and domestic injuries differed from similar indicators for the whole group of 116 victims. For the group of road traffic injuries, the men/women ratio reached 7.38:1; in the group of domestic injuries – 1.5:1; as a whole for the group of all victims – 6.25:1. The average age in the study groups was 39.7 ± 12.8 years; 46.3 ± 8.5 years and 42.3 ± 11.2 years, respectively (Table I).

A study of the structure of mechanical injuries of the lower extremities of victims of road traffic injuries made it possible to establish the following (the total number of victims in this group, 109 people, was taken as 100%). Isolated fractures of the femur (3 cases; 2.8%) and lower leg bones (12 cases; 11.0%), which were not life-threatening, were found mainly among pedestrians when they hit a car at a relatively low speed (in the streets near houses). A collision of a car with a pedestrian, as well as a collision of vehicles on highways, were usually accompanied by polytrauma (multiple skeleton fractures – in 13 cases; 11.9%, combined damage – in 81 cases; 74.3%) with a fatal outcome in 40 cases (36.7%), mainly pedestrians (23 cases; 21.1%) and drivers (14 cases; 12.8%). The dominant injuries that led to the death were injuries to head, chest, abdomen, pelvic organs, which were accompanied by bleeding with the development of terminal stages of traumatic shock. Drivers had almost the same frequency with hip fractures (11 cases; 10.1%) and bone fractures in both segments (thigh and lower leg) – 13 cases; 11.9%. Pedestrian trauma was featuring fractures of the femur in combination with lower leg bones' fractures. Passengers of motor vehicles more often had fractures of the femur (7 cases; 6.4%). For multiple skeletal bone fractures, dominant fractures of the femur and lower leg in pedestrians were characteristic (9 cases; 8.3%) – Table. II.

A study of the reasons for the appointment of forensic medical commission examinations made it possible to establish the following: the assessment of the permanent disability degree was based on the outcome of a mechanical injury of the lower extremities was carried out in 28 cases (24.1%) of road traffic injury, which were not life-threatening, and in a single observation (0.9%) – of a work injury. Unsatisfactory outcomes of lower extremities long bones' fractures in 15 cases (12.9%) were associated with the nature of trauma, as the intra- and periarticular fractures of the acetabulum, femur and tibia, which lead to the development of post-traumatic arthrosis of an injured joint, often with persistent post-traumatic contracture. Unsatisfactory outcomes of femur and lower leg bones' fractures (13 cases; 11.2%), as well as pelvic fractures with rupture of pubic joint during combined road traffic injury (1 case; 0.9%) were associated with iatrogenic errors in choosing the method of osteosynthesis, the development of complications in the short period after surgery and inadequate rehabilitation period (table. III).

Most often, forensic medical commission examinations were associated with the establishment of the bodily injury

Table II. Structure of mechanical injuries of the lower extremities of victims of road traffic injuries

Parameters	Vehicle drivers		Vehicle passengers		Pedestrians		Total
	Male	Female	Male	Female	Male	Female	
Isolated fractures of the femur							
- proximal part	-	-	-	-	1 (0.9%)	1 (0.9%)	2 (1.8%)
- diaphysis (upper third)	-	-	1 (0.9%)	-	-	-	1 (0.9%)
Isolated shin bones' fractures	-	-	-	-	9 (8.3%)	3 (2.8%)	12 (11.0%)
Polytrauma							
- multiple fractures with a prevailing hip fracture	1 (0.9%)	-	-	-	2 (1.8%)	-	3 (2.8%)
- multiple fractures with a prevailing hip fracture and leg fractures	-	-	1 (0.9%)	-	6 (5.5%)	3 (2.8%)	10 (9.2%)
- combined injuries with a prevailing hip fracture	4 (3.7%)	-	6 (5.5%)	1 (0.9%)	2 (1.8%)	-	13 (11.9%)
- combined injuries with non-prevailing hip fracture	7 (6.4%)	-	-	-	2 (1.8%)	-	9 (8.3%)
- combined injuries with non-prevailing hip fracture and leg fractures	11 (10.1%)	2 (1.8%)	3 (2.8%)	-	39 (35.8%)	4 (3.7%)	59 (54.1%)
Total	23 (21.1%)	2 (1.8%)	11 (10.1%)	1 (0.9%)	61 (56.0%)	11 (10.1%)	109 (100%)
Outcomes							
- fatal outcome	12 (11.0%)	2 (1.8%)	3 (2.8%)	-	19 (17.4%)	4 (3.7%)	40 (36.7%)
- non-lethal outcome	11 (10.1%)	-	8 (7.3%)	1 (0.9%)	42 (38.5%)	7 (6.4%)	69 (63.3%)
Total	23 (21.1%)	2 (1.8%)	11 (10.1%)	1 (0.9%)	61 (56.0%)	11 (10.1%)	109 (100%)

presence (8; 6.9%), as well as with the bodily injury presence and severity establishment (73; 62.9%) – table. 3. In 20 (17.2%) cases, additional forensic technical examinations were required.

Commission examinations were appointed on average in 3.5 ± 0.3 months in cases with fatal outcomes of road traffic accidents and on average in 2.7 ± 0.8 months in cases with non-fatal outcomes; the duration of examinations reached 2.4 ± 0.5 months, and 4.0 ± 1.0 months respectively. When appointing forensic medical commission examination, questions that were clarified at the preliminary investigation stage arose while examining the scene of an accident, examining the corpses of people who died as a result of car accidents, examining victims, as well as examining material evidence (in particular, clothing and vehicles in traffic accidents). When conducting these commission examinations, forensic medical experts were not provided with all the necessary information and material evidence. That did not allow to clarify a number of issues regarding the features and location of traces and injuries on the body and clothing; prescription of injuries and their intravital or post-mortem origin; damage formation mechanism (shock, concussion, compression, friction); time of occur-

rence of damage; places of traumatic force application and direction of the force.

DISCUSSION

To date, traffic accidents injuries continue to be one of the most important medical, social and economic problems in the world. According to WHO, although mortality rates relative to the world's population have been stabilized in recent years, deaths from road traffic injuries continue to rise, amounting to 1.35 million deaths per year, and accidents are the leading cause of death for children and young people (5-29 years old) [1]. In Ukraine, in 2019, 160,675 accidents occurred, which amounted to an average of 440 accidents per day. During these accidents, 3,454 people died (10 people per day) and 32,736 people (90 people per day) were injured. Compared to 2018, there is a slight increase in all indicators: the total number of accidents increased by 7.0% (150 120 accidents), the number of accidents per day – by 7.3% (411 accidents); the number of deaths – by 3.1% (3350 people) and the number of injured – by 6.0% (30884 people) [2].

A WHO report (2018) also noted a different mortality rate among different groups of road users. Globally, pe-

Table III. Reasons for the appointment of forensic medical examinations for victims with mechanical trauma to the lower extremities

Parameters	Road traffic injuries (n = 109)	Domestic injury (n = 5)	Work injury (n = 1)	Sports injury (n = 1)	Total (n = 116)
Adverse outcome of mechanical injury					
- incorrectly fused fractures of the ileum, pubic and ischial bones, non-fused gap with divergence of the pubic joint	1 0.9%	-	-	-	1 0.9%
- post-traumatic arthrosis and hip contracture	6 5.2%	-	1 0.9%	-	7 6.0%
- nonfused femoral fracture	2 1.6%	-	-	-	2 1.6%
- abnormally fused fracture with deformation and shortening of the femur	5 4.2%	-	-	-	5 4.2%
- post-traumatic arthrosis with knee contracture	6 5.2%	-	-	-	6 5.2%
- nonfused fracture of the tibia	4 3.4%	-	-	-	4 3.4%
- incorrectly fused fracture with deformation and shortening of the tibia	5 4.2%	-	-	-	5 4.2%
Establishment of the fact of bodily injury	8 6.9%	-	-	-	8 6.9%
Establishment of the fact of causing and the severity of bodily harm	73 62.9%	1 0.9%	-	-	74 63.8%
Disagreement with the results of the primary forensic medical examination	-	4 3.4%	-	1 0.9%	5 4.2%
Total	109 94.0%	5 4.2%	1 0.9%	1 0.9%	116 100,0%

pedestrians and cyclists account for 26% of all road accident deaths, with 44% in Africa and 36% in the Eastern Mediterranean. Motorcyclists and their passengers account for 28% of all deaths due to road accidents, but in some regions this figure is higher – for example, in Southeast Asia it is 43%, and in the Western Pacific – 36% [WHO]. In the study of Lastovetsky A.G. et al. it is noted that against the general background of an increase in the absolute values of the number of accidents involving pedestrians, a steady decrease in the proportion of this accident type, from the total, from 48.6% in 2001 to 30% in 2011 is observed, however, the severity of the consequences of accidents for pedestrians remains the same. The proportion of accidents caused by pedestrians in the total number of accidents decreased from 30.2% to 12.8% and is characterized by a decrease in the number of dead pedestrians [3].

One of the characteristic injuries of pedestrians in a collision with a car is bumper fractures of the femur or lower leg bones resulting from the contact of the lower extremities with the bumper of the car. At the same time, the nature of morphological disorders in the tissues of the lower extremities depends on the speed (and, accordingly, kinetic energy) of the moving car. Given the low speed of the vehicle and the lack of support of the lower limb that is in contact with it, a bumper fracture does not occur (up to 10% of cases) [4]. With an increase in vehicle speed over 60-70 km/h, a transverse fracture is formed by the shifting

mechanism [4]. The direction of the bending of the bone indicates the direction of the traumatic force.

The degree of injury to drivers and passengers of a vehicle depends on the collision mechanism (frontal, side, rear collisions, rollovers, collisions with turning the vehicle in a horizontal axis), size and type of vehicle. Smaller cars are able to absorb less kinetic energy, so if they are involved in an accident, more severe damage occurs and a higher mortality rate is noted. If trucks and sports cars participate in accidents, more accidents occur with only one participant [5].

Due to the design features of modern cars aimed at absorbing and dissipating kinetic energy in a collision of vehicles (energy-absorbing steering columns, seat belts, airbags), a decrease in the frequency of deaths among drivers and passengers to 38% [6,7]. Fastening seatbelts in people sitting in the front seats reduces the risk of fatal injuries by 45% and non-lethal polytrauma by 50%. At the same time, with high kinetic energy of collision between the driver and the passenger in the front seat, complicated injuries of the cervical spine due to whiplash injury, damage to internal organs, clavicle fractures (in the place of fastening the seat belt) are possible [8,9].

CONCLUSIONS

A retrospective analysis of the forensic medical examinations of victims with lower extremities' mechanical injuries

showed that the need for an additional expert assessment of injuries' severity arises in cases of adverse outcomes of fractures of the femur and lower leg bones due to road traffic injury (24.1%). The main reason for the commission examinations appointment was to establish the bodily injuries presence (6.9%), as well as to establish the bodily injuries presence and their severity (62.9%) in cases of road traffic injury (lethal and non-lethal). The lack of an appropriate investigator ordinance at the preliminary investigation stage did not allow experts to conduct the initial forensic medical examination in the needed volume and to give a full expert opinion on the results of the commission examination.

REFERENCES

1. Global status report on road safety 2018. Geneva: World Health Organization;2018; 424 p.
2. Statistika DTP v Ukraini za period z 01.01.2019 po 31.12.2019 [Road accident statistics in Ukraine for the period from 01/01/2019 to 31/12/2019]. <http://patrol.police.gov.ua/statystyka/> (Ua)
3. Lastovetsky A.G., Deineko D.A., Lebedev M.V. Viyavlenie nekotorych mekhanizmov povrezhdayushcheho faktora pri naезде avtomobilya na peshechoda pri osushchestvlenii sudebno-meditsinskoy ekspertizi [Identifying some mechanisms of damaging factor at auto-pedestrian accident during forensic examination]. Social aspects of public health. 2013;22c. <http://vestnik.mednet.ru/content/view/489/30/> (Ru)
4. Isakov V.D. Avtomobilnaya travma: lektsiya dlya slushateley VI fakulteta tsikla «Sudebnaya meditsina» [Car injury: a lecture for students of the VI Faculty of the cycle «Forensic Medicine»]. SPb: VMA; 1996. (Ru)
5. Thais R., Vassallo J.M., Herraiz I. The influence of economic incentives linked to road safety indicators on accidents: The case of toll concessions in Spain." Accident Analysis & Prevention. 2013;59:529-36.
6. Ordonez Mayana L., Martinez Silvab I., Represas Vazquez C. et al. Predictive models for the assessment of bodily harm. Forensic sciences research. 2017;Sept;2(4):185-191 <https://doi.org/10.1080/20961790.2017.1379122>
7. Goniewicz K., Goniewicz M., Pawłowski W. et al. Epidemiology of road traffic accidents in adults. A systematic review. Journal of Education, Health and Sport. 2017;7(7):92-100.
8. Kim J.W., Oh J.K., Byun Y.S. et al. Incidence of avascular necrosis of the femoral head after intramedullary nailing of femoral shaft fractures. A multicenter retrospective analysis of 542 cases. Medicine (Baltimore). 2016 Feb; 95(5): e2728. doi: 10.1097/MD.0000000000002728
9. Larsen P., Elsoe R., Graven-Nielsen T. et al. Decreased muscle strength is associated with impaired long-term functional outcome after intramedullary nailing of femoral shaft fracture. Eur J Trauma Emerg Surg [Internet]. 2015 Dec;41: 673. <https://doi.org/10.1007/s00068-014-0488-2>

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ORIGINAL ARTICLE

ONTGENETIC FEATURES OF SONOGRAPHIC INDICATORS OF THE UTERUS IN ACROBATS OF THE UKRAINIAN ETHNIC GROUP

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ABSTRACT

Introduction: The absence of diagnostic of the female sex organs in time can lead to serious disorders of the female athletes' reproductive system. There is few information in the literature about morphological evolution of the female sex organs, in particular, the uterus under the influence of sports.

The aim: To determine the peculiarities of linear sonographic dimensions of the uterus, its position and shape in the acrobats of the Ukrainian ethnic group of high level of sportsmanship in different periods of puberty.

Materials and methods: 122 acrobats of high level of sportsmanship and 126 girls who have not played sports were examined. The girls' passport age was between 8 and 21 years old. In order to determine belonging to the Ukrainian ethnic group, all surveyed girls were given questionnaires where they were required to indicate the nationality and place of birth of their parents and grandparents. All girls were divided into three groups according to their biological age: athletes of prepubertal period of ontogenesis, during puberty and athletes of postpubertal period of ontogenesis.

Internal sex organs of all girls were examined by ultrasound diagnostic system of expert class Voluson 730 Pro (ATL, Austria) using a convex sensor RAB2-5L. The uterus was examined by the following program: determined its position and shape and 3 linear dimensions (length, width and thickness). The analysis of the obtained results was carried out in the licensed package Statistica 5.5 using nonparametric methods of estimation of indicators.

Results: The monitoring of the growth and development of the uterus in different ontogenetic periods in acrobats and women who are not involved in sports was analysed. We found, that the length of the uterus at all stages of puberty in acrobats was significantly less than in the girls of the control group. The width of the uterus was statistically significantly smaller in female athletes in the pre- and post-pubertal periods, and in puberty. The thickness of the uterus under the influence of acrobatic sports activity does not undergo significant changes in all periods of ontogeny.

Conclusions: Features of competitive activity in sports acrobatics as well as the result of sports selection lead to the delay of sexual development and, as a consequence, to the retardation of development of the uterus in all periods of puberty.

KEY WORDS: sonographic parameters of the uterus, sports acrobatics, periods of the puberty

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INTRODUCTION

In order for the assessing of the health status of female athletes and the prediction of their reproductive capacity, it is important to analyse the morpho-functional parameters of female sex organs. Modern women's sport is characterized by a considerable intensity of physical activity, which have various effects on different organs and systems [1]. Sports acrobatics is marked by a whole set of exogenous factors that have a complex effect on the female body. First of all, to general sports groups children come in 5-6 years, in 7-8 year girls start their trainings in the groups of sports specialization. Secondly, trainings are as intensive physical activity, aimed at developing of flexibility, speed, and strength. Thirdly, girls have a special peculiarities in diet with severe restrictions on food and water. Therefore, acrobats form a specific social-demographic group of the

population, which requires constant medical control at pre-, pubertal and post-pubertal age [2]. The ontogenetic approach in studying of the features of the organism is based on the fact that within one calendar age there are individuals with different morpho-functional level of development [3]. This, first of all, is relevant for female athletes. Indicators of their biological age are the main criteria for assessing the condition of the whole organism [4, 5]. Among the large number of methods for assessing biological age, the most commonly used are the stages of development of secondary sexual characteristics [6].

It should be noted that there are few notes regarding the morphological evolution of female sex organs. We have found publications concerning changes in the uterus and ovaries under the influence of intense loads during different puberty periods [7, 8, 9, 10].

THE AIM

To determine the peculiarities of linear sonographic dimensions of the uterus, its position and shape in the aerobats of the Ukrainian ethnic group of high level of sportsmanship in different periods of puberty.

MATERIALS AND METHODS

Based on the Research Center of the National Pirogov Memorial Medical University, we conducted an examination of 122 aerobats of high level of sportsmanship, among them the first adult rank had 24 athletes, 38 girls were candidates for masters of sports, 46 – masters of sports, 14 – masters of international class sports. Experience in sports in all cases was more than three years. As a control group, 126 girls were examined, who were not engaged in sports and studied in schools of Vinnytsia. The girls' passport age was between 8 and 21 years old. The average calendar age had significant differences. In the prepubertal period of ontogenesis, aerobats had an average age (10.13 ± 0.24) years, and girls who have not played sports – (9.652 ± 0.351) years; in puberty, aerobats had an average age (13.35 ± 0.32) years, control group – (11.51 ± 0.26) years; in the postpubertal period, aerobats had an average age (16.83 ± 0.22) years, girls of the control group – (16.04 ± 0.38) years. In order to determine belonging to the Ukrainian ethnic group, all surveyed girls were given questionnaires where they were required to indicate the nationality and place of birth of their parents and grandparents.

To determine the biological age of the girls, we used the scheme [11], which is based on the determination of the stages of development of the hair in the axillae (Ax) and the pubic (P), the mammary glands (Ma) and the age of the onset of the first menstruation (Me). The subjects were divided according to the degree of biological maturity into three groups:

1 – the prepubertal period (the appearance of pubic hair), to it belonged 36 aerobats and 39 girls of the control group; 2 – pubertal period (puberty to the appearance of menarche), to it belonged to 31 aerobats and 35 girls of the control group; 3 – postpubertal period (fixed and ending puberty, the body reaches a definitive size), to it belonged 55 aerobats and 59 girls of the control group.

Internal sex organs of all girls were examined by ultrasound diagnostic system of expert class Voluson 730 Pro (ATL, Austria) using a convex sensor RAB2-5L. The uterus was examined by the following program: determined its position and shape and 3 linear dimensions (length, width and thickness). Measurement of the length and thickness of the uterus was performed during its longitudinal scan. The length is measured from the farthest point of the bottom of the body of the uterus to the projection of the inner throat, located in the corner between the body of the uterus and the cervix. Measurement of anterior-posterior size (thickness) was performed in the middle part of the uterus between the most distant points of the posterior and anterior walls. The uterine width was determined on the transverse ultrasound at the level of the tube angles. This

section is perpendicular to that at which the thickness measurement was made [12].

The analysis of the obtained results was carried out in the licensed package Statistica 5.5 using nonparametric methods of estimation of indicators.

RESULTS

Using a method of non-invasive introscopy, such as ultrasound, we monitored the growth and development of the uterus during various ontogenetic periods in aerobats and women who are not involved in sports. We found that the athletes and girls of the control group in the prepubertal period of ontogenesis, the uterus is predominantly larger in size, however, it is already growing in width and thickness at this age. In some female athletes and girls in the control group, the cervix is not yet clearly visualized. However, in some cases it is possible to determine that it is about 2/3 of the entire length of the uterus. The endometrium in girls of both comparison groups is poorly visualized or absent at all. In girls of this period, when analyzing the position and shape of the uterus did not reveal deviations of it norm, but it should be noted that in 18.3% of cases in aerobats the uterus has a cylindrical shape. The length of the uterus was 33.27 ± 1.92 cm in girls in the control group, 29.67 ± 2.14 cm in aerobats, and the difference between the comparison groups was significant ($p < 0.05$). We found that aerobats had a significantly smaller ($p < 0.05$) uterine width (22.62 ± 2.94 cm) compared to girls not involved in sports (25.54 ± 1.74 cm). In the aerobatics group, the average value of uterine thickness (11.99 ± 1.52 cm) is also smaller than the girls in the control group (12.39 ± 2.68 cm), but the differences are not significant.

In puberty, uterine growth in length, thickness and width becomes more noticeable. At this age, girls clearly differentiate the cervix, begins to form an angle between the body of the uterus and the cervix. The ratio of the body of the uterus to the cervix is approximately 2: 1, that is, the cervix is almost half the length of the body of the uterus. In 96.8% of female athletes of this period the shape of the uterus was normal, only 3.2% of aerobats had some deviations (uterus with two horns and uterus with partial intrauterine septum). The position of the uterus in the pelvic cavity in aerobats of puberty at 94.4% was normal (anteversio-anteflexio), when the body of the uterus is tilted forward and the angle between the body of the uterus and the cervix is also open in the front. In 5.6% of female athletes a retroversion was found when the body of the uterus was tilted back and the angle between its cervix and body also opened behind. There were no abnormalities in the uterine shape and position in the control group.

By comparing the macrometric size of the uterus between female athletes and non-athletic girls, we found significant differences in the pubertal period of ontogenesis. Thus, the length of the uterus in female athletes (34.27 ± 3.23 cm) is significantly smaller ($p < 0.01$) than in the control (45.03 ± 4.26 cm). The width of the uterus in female athletes (28.63 ± 1.47 cm) also tends to delay

development ($p = 0.057$) compared to girls in the control group (30.92 ± 1.22 cm). The thickness of the uterus makes no significant difference when comparing groups of acrobats (18.64 ± 0.76 cm) and non-athletes (18.27 ± 1.91 cm) of puberty.

Particularly rapid growth of the internal genitalia is observed with the onset of menarche. With the onset of menstrual function on the ultrasounds of acrobats and non-athletes, the uterus is predominantly pear-shaped. Analyzing the shape of the uterus, we found that 91.5% of female athletes did not have deviations, and in 8.5% of acrobats the shape of the uterus is not correct. In control girls in 94.6% of cases the shape of the uterus was correct and in 5.4% it was not correct. We defined such abnormalities as a uterus with a partial intrauterine septum, saddle-shaped uterus and uterus with two horns. The normal position of the uterus was observed in 89.09% of female athletes and in 98.31% of non-athletes.

We found that in the post-pubertal period, the length of the uterus in acrobats (49.41 ± 2.6 cm) was statistically significantly smaller ($p < 0.001$) than in girls of the control group (56.97 ± 3.19 cm). The same pattern was established for the width of the uterus (the difference between the comparison groups is significant, $p < 0.01$): in acrobats its dimensions were 39.88 ± 3.18 cm, in control - 43.97 ± 2.59 cm. The thickness of the uterus, as in previous periods of biological development, has no significant differences. In acrobats its size was 28.48 ± 3.63 cm, in girls who did not play sports - 28.95 ± 2.52 cm.

DISCUSSION

Analyzing the features of prepubertal uterine development, we found that acrobats have significantly smaller uterine lengths and widths than non-sports girls. And this is despite the fact that the passport age in the group of female athletes is much lower than in the control group. It should be noted that the linear sonographic dimensions of the uterus that we have established meet the age standards. In researches of other scientists it is also determined that in the prepubertal period the uterus has cylindrical shape, the anterior-posterior size of the neck is equal to the anterior-posterior size of the body of the uterus. The length of the uterus is 2.5-4 cm, the thickness is 1 cm. The endometrium is not always visible and only using large magnification [13, 14, 15].

In our previous work, it was found that female athletes in the pubertal ontogenetic period had significantly lower ($p < 0.05$) calendar age compared to non-female athletes, indicating a significant re-certification of puberty in acrobatics, which, in our opinion, may be due to features sports selection and competitive sports activities [16]. Significant retardation in rates of puberty and biological maturity of female athletes has been found in other scientific studies [17, 18]. It was found [19] in female athletes 7-18 years old who practice group acrobatics that the majority (68%) of the surveyed belonged to the retardant type of development. The lag of biological age from passport to acrobatics

averaged 2 years. We found that in the pubertal period of biological development, sonographic dimensions of the uterus under the influence of acrobatic sports activity are inhibited in development. Although a significant difference when comparing groups of female athletes and girls not involved in sports was found only for uterine length, they were 31.4% smaller than controls. In addition, it should be noted that the length of the uterus in acrobats is significantly smaller than the population norms characteristic of girls puberty. The authors note [13, 15] that in the pubertal period the uterus takes on the shapes and sizes of the adult women. The cervix is smaller than its body (1: 2-1: 3). The length of the uterus - 5-8 cm, width - 3 cm, thickness - 1.5 cm.

We found that the width of the uterus in acrobats is the same as in the age of standards, but at the same time 7.99% less than the girls of the control group. In addition, in the acrobats of puberty period, we found deviations in the shape and position of the uterus, unlike the girls in the control group. In particular, in the group of female athletes was present cervix with two horns and uterus with a partial intrauterine septum and also uterus in position of the retroversio. The incidence of deviations in the shape and position of uterus in acrobats is in the norm of the intra-population variability, but the changes detected in female athletes require constant medical control.

In acrobats of the post-pubertal period of ontogenesis, we also found deviations in the shape of the uterus, the uterus with a partial intrauterine septum, saddle-shaped uterus and uterus with two horns. At 10.91% of acrobats and in 1.69% of non-sports women deviations in the position of a uterus were revealed. In acrobat group of post-pubertal period, except for retroversion, lateral version was detected in 2.3% of cases when the uterine body was tilted to the lateral pelvic wall. Such a high frequency of deviation of the position of the uterus, which is found in the acrobats, from our point of view, can be explained by the great physical exertion suffered by pre-school girls. Scientists also associate a high percent of reproductive disorders in female athletes with physical activity, which causes the to increasing of the production of androgens by adrenal glands in female body [17].

In the scientific literature there are data on disorders of the internal sex organs in 68.7% of the gymnasts, among which the most frequently revealed ultrasonic signs of chronic anovulatory cycle, inconsistency of the age norm of ultrasound parameters of the uterus and ovaries, sexual infantilism the ovaries. In non-sports girls, the number of violations was 27%. Disorders of the reproductive system of female athletes are determined by a pathological condition called hyperandrogenia, which is caused by a change in androgen secretion and impaired metabolism [2, 20].

We found that in the post-pubertal period of ontogenesis, the length (by 15.3%) and width (by 10.3%) of the uterus in acrobats was statistically significantly smaller than in girls of the control group. L.V. Litisevich [2], studying the groups of elite sports gymnasts of different calendar age, also found that the length and width of the uterus in female athletes is much

lower than the normal control values, in some cases up to 70%, and an average of 50%. In the group of girls 12, 15 and 17 years she noted a slight decrease in uterine length relative to normal, and at the age of 14 and 16 years – an increase in uterine size relative to physiological parameters.

Summarizing the results of our study, it should be noted that, under the influence of acrobatic sports activities, the linear dimensions of the uterus (length and width) are not in the age standards, which can be a consequence of infantilism and retardation of puberty. Scientists consider such retardation of puberty as a consequence of the effects of hereditary factors, which are exacerbated by intense training, deficiency of the total body weight, in particular, its fat component [19]. In previous studies, we also found in acrobats a statistically significant decrease in body fat, which is indicated by the size of the endomorphic component of the somatotype, in all periods of ontogenesis [16].

Specialists of Vinnytsia National Medical University have established the constitutional conditionality of the development of organs of the female sex system [21] and proved the possibility of pubertal uterine bleeding appearance in girls due to the peculiarities of the sonographic parameters of uterus and ovary [22].

Thus, the absence of diagnostic investigation of female sex organs in time, the absence of treatment of abnormalities in the future can lead to serious problems of the female athletes' reproductive system. A high diagnostic value and safety of ultrasound make this method as a main method in the research of female athletes' sex organs.

CONCLUSIONS

1. At the pre-pubertal age, acrobats had shorter ($p < 0.05$) uterine lengths and widths than non-sport girls. In girls of both groups the position and shape of the uterus were in norm.
2. Acrobats at puberty had a smaller uterine length ($p < 0.01$) and width ($p = 0.057$). In 3.2% of acrobats was indicated abnormalities in the shape of the uterus (with two horns and with a partial intrauterine septum) and in 5.6% of female athletes the uterus retroversio was detected. There were no abnormalities in the control group.
3. At the post-pubertal age, acrobats had significantly smaller uterine length ($p < 0.001$) and width ($p < 0.01$) than in girls of the control group. In 8.5% of acrobats and 5.4% of girls in the control group was identified the uterus with a partial intrauterine septum, saddle-shaped uterus and uterus with two horns. In 10,91% of acrobats and in 1,69% of non-sports women were revealed differences in the position of the uterus. In the group of acrobats, except for retroversion, in 2.3% of cases, lateral position was detected.
4. The uterine thickness in all periods of ontogenesis did not differ significantly between the acrobats and girls of the control group.

REFERENCES

1. Yakusheva Yu.I., Sarafyniuk L.A., Kyrychenko Y.V. Interratations of reocardiographic parameters of central hemodynamics with constitutional indicators by volleyball players of different positions. *World of Medicine and Biology*. 2015; 4 (53):96–102.
2. Liticevich L.V. Dannye UZ-issledovaniya organov malogo taza u devochek-sportsmenok [Ultrasound data of the pelvis organs in teenagers girls athletes]. *Reprodukivnoe zdorovye detey i podrostkov*. 2016; 3: 39-40 (In Russian).
3. Cumming S.P., Standage M.V., Loney T.C. et al. The mediating role of physical self-concept on relations between biological maturity status and physical activity in adolescent females. *Journal of Adolescence*. 2011; 3(34):465-473.
4. Cairney J., Veldhuizen S., Kwan M., Hay J., Faught B. Biological age and sex-related declines in physical activity during adolescence. *Med. Sci. Sports Exerc.* 2014; 4(46): 730-735.
5. Freitas A.S., Figueiredo, A.J., de Freitas A.L., Rodrigues V.D., da Cunha A.A., Deusdará F.F. Silva M. J. Biological Maturation, Body Morphology and Physical Performance in 8-16 year-old obese girls from Montes Claros. *MG. J. Hum. Kinet.* 2014; 43:169-176.
6. Linpei J., Weiguang Z., Xiangmei C. Common methods of biological age estimation. *Clin. Interv. Aging*. 2017; 12:759-772.
7. Khmara T.V., Zamorskii I.I., Ryznychuk M.O., Kryvchanska M.I., Boichuk O.M., Dmytrenko R.R. Peculiarities of prenatal vagina morphogenesis. *Wiad. Lek.* 2019; 1(72):72-78.
8. Kuzniak N., Protsak T., Marchuk O., Fedoniuk L., Kamyshnyi A., Penteleichuk N., Stoliar D., Dmytrenko R. Histotopography of the Oviducts in Fetus. *Wiad. Lek.* 2019; 8(72):1481–1485.
9. Khmara T.V., Ryznychuk M.O., Sarafyniuk L.A., Kryvchanska M.I., Biriuk I.F. The peculiarities of the prenatal morphogenesis of the epididymis. *World of Medicine and Biology*. 2018; 3(65):199-204.
10. Koval H, Chopiak V, Kamyshnyi A. mRNA TLR2 and TLR4 expression in the endometrium tissue in women with endometriosis associated with infertility. *Georgian Med News*. 2015; 244:7-11.
11. Avtandilov G.G. *Medicinskaya morfometriya [Medical morphometry]*. Moscow: Medicine, 382p. (In Russian).
12. Kylakov V.I., Kyznetsova M.N., Martush N.S. *Ultrazvukovaya diagnostika v ginekologii detskogo i podrostkovogo vozrasta [Ultrasound investigation in the gynecology of the child and at the juvenile age]*. – Moscow: Medicine. 1994, 112 p. (In Russian).
13. Delyagin V.M., Myasnikov S.V., Toniyan K.A., Senyakovich N.B., Dyaduk T.G. *Ultrazvukovye issledovaniya malogo taza u devochek i devushek-podrostkov SonoAce Ultrasound [Ultrasound investigation of the pelvis at girls and teenagers SonoAce Ultrasound]*. Moscow. 2011; 22:78-87. (In Russian).
14. Herter L., Golendzimer E., Flores J. Et al. Ovarian and uterine sonography in healthy girls between 1 and 13 years old: correlation of findings with age and pubertal status. *American Journal of Roentgenology*. 2002; 178:1531-1536.
15. Razzaghy-Azar M., Ghasemi F., Hallaji F. et al. Sonographic measurements of uterus and ovaries in premenarcheal healthy girls between 6 and 13 years old: correlation with age and pubertal status. *Journal of Clinical ultrasound*. – 2010 (<http://www.ncbi.nlm.nih.gov/pubmed/20572067>).
16. Sarafyniuk L.A., Khapitska O.P., Yakusheva Yu.I., Ivanytsia A.O., Sarafyniuk P.V. Somatotypological features of acrobat girls in different periods of ontogenesis. *Biomedical and biosocial anthropology*. 2018; 32:43-47.
17. Bacciotti S., Baxter-Jones A., Gaya A., Maia J. The physique of elite female artistic gymnasts: a systematic review. *J. Hum. Kinet.* 2017; 58:247-259.
18. Erlandson M.C., Mirwald R.L., Sherar L., Maffulli N. Growth and maturation of adolescent female gymnasts, swimmers, and tennis players. *Medicine & Science in Sports & Exercise*. 2008; 1(40):34-42.
19. Davydov V. Yu., Antonova E. A., Vrublevsky E. P. Estimates of the main aspects of the prospects of young athletes in acrobatics. *Physical culture, sports and health of the nation*. 2013; 15:311-317.

20. Fedonyuk L. Ya., Oleshchuk A.M., Sas L.M., Boyarchuk O.R., Mukolenko A. Z., Orel Yu. N., Glushko K.T. Polipragmaziya: ot pediatrii k geriatrii [Polypragmasy: From paediatrics to geriatrics]. *Voprosy Prakticheskoi Pediatrii*. 2018; 13(1):77-82. (In Russian).
21. Chaika G.V., Prokopenko S.V., Kucherenko O.M. Modeling possibility of uterine bleeding puberty in girls depending on the characteristics of sonographic parameters uterus and ovaries. *World of Medicine and Biology*. 2015; 4(53):84-87.
22. Tkachenko M. M., Prokopenko S. V., Cherkasova L. A. Modeling possibility of uterine bleeding puberty in girls depending on the characteristics of sonographic parameters uterus and ovaries. *World of Medicine and Biology*. 2016; 4(58):66-71.

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MOTOR ACTIVITY AS THE BASIS OF A HEALTHY LIFESTYLE OF STUDENT YOUTH

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ABSTRACT

The aim is to find out the role of motor activity in developing a healthy lifestyle of student youth in the process of physical education.

Materials and methods: The study involved 647 students, aged 18-22. The research methods are the analysis and synthesis of the literature, analysis of curricula, programs, methodological support and quality of training, questionnaires, and the methods of mathematical statistics.

Results: It is determined that the majority of the students had no need for a healthy lifestyle, the lack of knowledge in this area, low activity while performing the requirements of a healthy lifestyle, irrational organization of educational activities, bad habits and other factors that negatively affect their health.

Conclusions: The current system of physical education in the higher education institutions of Ukraine cannot change the attitude of students to a healthy lifestyle. The purpose of physical education, in addition to the formation of physical skills and development of students' physical qualities, should be educational work aimed at forming a positive attitude towards a healthy lifestyle.

KEY WORDS: motor activity, healthy lifestyle, health, physical education, student

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INTRODUCTION

One of the necessary conditions of life and the main form of human behavior in the external environment is motor activity. It improves working capacity, health, provides diverse harmonious development, the functioning of the cardiovascular, respiratory, hormonal and other systems of the body, activates the neuromuscular system and the mechanisms of the reflexes transmission from muscles to internal organs [1, 2, 3, 4]. At the same time, a low level of outlook and motivation in the field of health, wellness physical culture, and healthy lifestyle negatively affects the process of motor activity of students that consequently worsens their health, the level of physical development, physical fitness and increases the number of diseases [5, 6,

7, 8, 9]. Therefore, the original methodology of introducing health-saving technologies into the activities of higher education institutions should be responsible for the health of students, their level of biological and social adaptability, ensure the individuality and conformity of the activities of teachers and medical staff of an institution. The Departments of Physical Education have the task of preserving and improving the health of students, transforming the way of life typical for a large part of students into a healthy one that would not destroy but improve their health.

The analysis of recent studies and publications [10, 11, 12, 13] showed that motor activity is an integral part of the lifestyle and behavior of a person, which is determined by socioeconomic and cultural factors, and which depends on

the organization of physical education, morphofunctional characteristics of the body, the type of nervous system, the amount of free time, the motivation for classes, the availability of sports facilities and rest areas. By the motor activity of a person, it is meant any movement of the body made by skeletal muscles that result in an increase in energy consumption that is higher than the main metabolism [14].

Motor activity is conditioned by three factors, including biological, social and personal [6, 15]. The amount of motor activity of students and the needs of their organisms also depend on the age, gender, the type of constitution, morphofunctional capabilities, the type of nervous system, heredity, the level of physical fitness, motivation for classes, lifestyle, geographical and climatic conditions, the amount of free time and the character of its use, etc. [16, 17].

The sports traditions, education system, the place and role of physical education and sports in this system, the availability of modern programs of physical education and their implementation by qualified teachers play an important role in the formation of physical activity [18, 19]. The limitation of motor activity of students reduces the efficiency of the body's defense mechanisms to adverse environmental influences, develops a tendency for various diseases [20]. Systematic exercises and sports help an organism to reach a new, higher level of development [21, 22]. Intensive sports activities also form adaptive transformations in the body that cannot be achieved by the usual dosed physical training and physical work. Dosing motor activity (combined into a specific system of physical activity) has a medical, preventive, health-improving effect and training effect on students who have health disorders [23, 24].

THE AIM

The aim of the study is to find out the role of motor activity in forming a healthy lifestyle of student youth in the process of physical education.

The objectives:

- 1) according to the results of the researches of various scientists, to characterize the concept of a healthy lifestyle;
- 2) to investigate the attitude of students to physical activity in the process of physical education as a basis for forming a healthy lifestyle.

MATERIALS AND METHODS

The organization and performance of theoretical and experimental studies, the analysis and interpretation of results, the formulation of conclusions were carried out in 2011-2018 and included four stages. The study involved 647 students, aged 18-22.

In the first stage, it was examined the state of the problem of the study, determined the experimental base and research program, conducted the analysis of literary sources on healthy lifestyles and the questionnaire. On the basis of systematization and generalization of literary sources and other data, a program of engaging students in a healthy lifestyle in the process of physical education was formed,

and the main factors that characterize students' health, their attitude to physical activity were determined. In the second and third stages, new sections of the questionnaire and comparative analysis were conducted. The questionnaire revealed the motivational desires and physical and sports interests of the students in various types of physical activity. In the fourth generalizing stage of the study (2018), the final analysis and interpretation of the data were conducted.

The state of students' motor activity was evaluated according to the weekly time budget questionnaire developed by the authors. The self-assessment of physical activity and attitude of students to physical education were also estimated by the original questionnaire. The evaluation of diseases and their consequences was conducted with the help of medical records and certificates.

The research methods included theoretical (the analysis and synthesis of literary sources; analysis of curricula, programs, methodological support and quality of training), and empirical (questioning, pedagogical observations, methods of mathematical statistics).

This study complies with the ethical standards of the Act of Ukraine "On Higher Education" No.1556-VII dated 01.07.2014 and the Letter from the Ministry of Education and Science of Ukraine "On the Academic Plagiarism Prevention" No. 1/11-8681 dated 15.08.2018. Also, this study followed the regulations of the World Medical Association Declaration of Helsinki – ethical principles for medical research involving human subjects. Informed consent was received from all individuals who took part in this research.

RESULTS

The dramatic negative tendencies in the health status of student youth in Ukraine are related, first of all, to the restriction of physical activity, significant disorders of the nutrition system (inadequate, poor nutrition, low-quality food, malnutrition, over nutrition, the lack of regime, etc.), bad habits (smoking, alcohol and drug abuse, etc.), mental overwork and stress, environmental pollution and poor sanitary and living conditions, etc. [10, 17, 22]. The fastest, most affordable and easiest way to solve this problem in Ukraine is to change students' attitudes toward a healthy lifestyle.

The problem of healthy lifestyle formation is largely related to the level of the students' and teachers' culture. It is determined that more successfully the students' need for physical self-improvement is formed, the higher the educational level and the degree of development of other needs are, and that is, the more their personality is formed. A direct correlation between the formation of the need for physical self-improvement and the professional orientation of the students' personality was found that confirms the dialectical unity of physical and intellectual activity [25].

A healthy lifestyle should be considered the forms and methods of daily human activity that contribute to improving the reserve capacity of the organism, the successful fulfillment of social and professional functions, the

Table I. The students' weekly time expenditure on exercise and sports (n=647, hours and min).

Types of activities	Studying departments					
	Special		Main		Sports	
	time	%	time	%	time	%
Educational classes	4:00	2.4	4:00	2.4	–	–
Morning exercises	1:57	1.2	1:33	0.9	2:03	1.2
Extracurricular activities	1:23	0.8	2:27	1.5	9:34	5.7
Competitions and sports events	–	–	0:13	0.1	1:04	0.6
Totally	7:20	4.4	8:13	4.9	12:41	7.5

Table II. The students' level of satisfaction with their motor activity (n=647, %).

The year of study	Gender	Subjective evaluation			
		Satisfied completely	Almost satisfied	Satisfied partially	Not satisfied
1st	male	41.9	37.1	19.1	1.9
	female	20.7	30.5	42.7	6.1
2nd	male	35.9	45.4	15.6	3.1
	female	27.7	41.4	23.6	7.3
3rd	male	25.7	28.6	40.0	5.7
	female	17.6	35.3	39.3	7.8
4th	male	32.4	32.4	26.5	8.7
	female	22.4	42.3	31.8	3.5
Totally	male	36.6	37.3	22.3	3.8
	female	23.9	38.6	31.1	6.4
	totally	28.6	38.2	27.8	5.4

prevention of the most common diseases [2]. There are different interpretations of the concept of a healthy lifestyle, but their essence is to preserve and improve health. E. N. Vayner [26] considers a healthy lifestyle to be the one which corresponds to the genetically determined typological characteristics of a given person, the specific conditions of one's life, aimed at the formation, preservation, and improvement of health and the complete fulfillment of the socio-biological functions. According to the author, a healthy lifestyle is the most efficient way and method of promoting health. M. M. Bulatova and Yu. O. Usachov [27] interpret a healthy lifestyle as activities aimed at the formation, preservation, improvement, and recovery of health, as conditions and prerequisites for the realization and development of other parties and aspects of a lifestyle. G. Apanasenko and L. Dolzhenko [28] define a healthy lifestyle as a set of wellness activities that contribute to the preservation and improvement of human health. This definition reveals a healthy lifestyle through the concept of the complex of wellness activities. The activities are selected depending on the components that are the parts of a healthy lifestyle. Among the most important elements that give a modern interpretation of a healthy lifestyle T. Yu. Krutsevych [29] distinguished: 1) rational individual lifestyle that promotes health (mental activity, healthy nutrition, proper spiritual regime, personal hygiene, refusal of smoking and alcohol abuse); 2) active participation in the formation of social relations that contribute to the preservation and development of an individual; 3) hygienic

rational behavior, taking into account the requirements of the environment; 4) conscious participation in the organization of working conditions that contribute to the maintenance of health and increase in working capacity; 5) a reasonable attitude to health care measures in disease.

Among the components of a healthy lifestyle, R. S. Paffenbarger and E. Olsen [30] distinguish regular three meals a day, daily breakfast, regular motor activity of medium intensity, good quality sleep (7-8 hours), refusal of smoking, maintenance of optimal body weight, non-consumption or restricted use of alcohol. The additional use of vitamins A, C, E, and beta-carotene, reducing stress and engaging in community service are also added to these components. Other experts E. T. Howley and D. B. Franks [31] believe that the purpose of a healthy lifestyle is to create a basis for positive health with minimal risk of its disorders, characterized by favorable hereditary indicators, the level of serum cholesterol, the level of blood pressure, normal body weight, the condition of the cardiorespiratory system, the mobility of the spine, the strength and endurance of the muscles, the ability to overcome stress. These authors also include the following components to a healthy lifestyle: good heredity; health-promoting habits; habits that promote personal safety; environmentally friendly conditions; preventive measures; good physical condition; regular motor activity; proper nutrition. Among the factors that influence a healthy lifestyle, scientists distinguish adiposity, osteochondrosis, depression [6, 32]. In this regard, psycho-pedagogical and specialized literature is actively

discussing the definition and justification of the lifestyle that would improve the health of students.

Therefore, a healthy lifestyle can be interpreted as the behavior of a person who reflects a certain life position aimed at maintaining and promoting health based on compliance with the rules and requirements of personal and social hygiene. In general, the analysis of literary sources gives grounds to state that the main factor of a healthy lifestyle is, first of all, motor activity, which requires the student to achieve some success in this field, get rid of bad habits, stick to healthy eating, acclimation, controlling one's own weight [33].

The increase in students' physical activity is one of the main factors of a healthy lifestyle and means of health improvement. It is revealed that on average 5.9% of the total time is spent on physical education classes, sports training, participation in sports competitions and various sports activities, independent physical exercises and hygienic morning exercises. It can be certainly noted that this time is not enough to provide physical activity, mental recovery processes. There were no special changes in the structure of students' time budget during years of study. Many higher education institutions have eliminated physical education classes for senior students or substantially reduced the number of hours that negatively affects students' general motor activity.

The analysis of the time budget, according to studying departments, revealed even more significant contrasts in spending time on exercise and sports (Table I). The students of special and main educational departments spend even less time on the physical exercises and sport than generally at the university (respectively, 7 hours 20 min – 4.4% and 8 hours 13 min – 4.9%). At the same time, the indicator of the students of the sports department is significantly higher (12 hours 41 min – 7.5%). The structure of the students' of the sports department free time is more refined and the time is used more rationally. Despite the considerable time spent on sports, they pay more attention to social activities, spend less time on passive rest, and follow regimes of study, daily routine and rest more clearly.

The high level of physical activity of students favorably influences the development of physical qualities, the level of physical fitness and health and ensures the successful fulfillment of program requirements and tests. It is determined that only 36.6% males and 23.9% females among students are satisfied with their physical activity while studying in higher education institutions. The male students of the first year of study – 41.9% are defined to be satisfied with their motor activity the most, that is caused by a better material and technical equipment of the sports base, teaching and coaching staff, performing sports and mass work in higher educational establishments, in comparison to schools. In the second or third year, the level of satisfaction with motor activity is decreased. In contrast, the female students of the first year of study have a low level of satisfaction with their motor activity and it remains practically the same throughout the study period (Table II). In the special education department, only 20.8% male students are satisfied with their motor activity, in the main department – 38.9%,

and in the sports one – 45.8%. The significantly lower rates were obtained from female students: 18.6% in the special department, 23.1% in the main and 35.4% in the sports departments.

Accordingly, the deficit of motor activity leads to a deterioration of health and the development of a number of diseases. Diseases are significantly reflected in the decrease in students' motor activity and its complete loss. During the year, 645 students lost 10478 person-days because of illness that is 4.45% of the total number of days.

The analysis of the causes of students' labor capacity loss showed significant differences not only in the number of diseases but also in their consequences between men and women. Among the students who lost their capacity for work during the year, there were 2.18% males and 6.19% females of the first year of study, 2.69 and 4.48% respectively of the second year. The situation was even more vulnerable in the third and fourth years. The male students' loss of capacity for work had a decreasing tendency, and the female students', on the contrary, had a significantly decreasing tendency. It was also revealed the difference in labor capacity loss between the students of different educational departments. Acute respiratory diseases are dominant in all educational departments, especially for females. The students of the special education department have the highest rate of labor capacity loss – 6.29% (2.71% – males, 7.99% – females), the next place is going to the students of the sports educational department – 4.3% (2.02% – males, 6.57% – females), the students of the main education department have the best indicators.

One of the tasks of physical education is the correct formation of value orientations, the realization by students of the most important needs in this field of activity. Only under such a condition, it is possible to form a value-based attitude towards a healthy lifestyle. However, the system of physical education in higher education institutions could not form the correct attitude to exercise of the half of students formed a negative attitude to the process of physical education and physical activity (Table III).

The criterion of the efficiency and quality of the process of physical education is the students' upbringing, that is, the high spiritual and moral-volitional qualities, which are based on an internal desire to systematically maintain the health, a sufficient level of physical fitness and development, love for physical culture and sports and in general a healthy lifestyle.

There are a number of factors that encourage students to exercise, but they lose their strength when students face some difficulties and obstacles quite often. The main factors contributing to the positive attitude of students to physical education are responsibility and discipline, taking pleasure from the lessons, the example of a teacher, friends, etc. (Table IV).

The efficiency of physical exercises is significantly influenced by the form of classes offered to students. The students give the greatest preference to the classes in the sports training department and sections (35.2%) and give considerable attention (30.7%) to independent classes with a group of friends. The male students are particularly

Table III. The aim of attending physical education classes by the students of different educational departments (n=647, %).

The aim	Gender	Studying departments		
		Special	Main	Sports
The health improvement	male	26.4	36.5	55.9
	female	31.9	38.0	46.1
The increase in physical performance	male	28.3	51.6	42.3
	female	27.8	30.3	35.3
The desire to be attractive	male	7.5	11.9	16.9
	female	22.7	21.4	30.7
The improvement of sports results	male	7.5	11.1	23.7
	female	4.1	9.7	23.0
Taking pleasure	male	3.8	5.5	22.0
	female	4.1	3.2	18.5
To pass an exam	male	41.5	34.1	20.3
	female	49.4	42.9	18.5
The fear of being punished	male	11.3	6.3	1.7
	female	3.0	4.4	4.6

Table IV. The factors contributing to the positive attitude of the students of different educational departments to the process of physical education (n=647, %).

The factors	Gender	Studying departments		
		Special	Main	Sports
Responsibility and discipline	male	32.1	42.8	40.6
	female	28.7	21.8	35.4
Harmony of spiritual and physical development	male	20.7	17.4	20.3
	female	16.4	15.8	13.8
Physical education teacher	male	28.3	10.3	11.9
	female	22.6	29.5	18.5
Friends	male	17.0	10.3	15.3
	female	11.3	8.5	10.8
The availability and accessibility of sports facilities	male	17.0	18.2	11.9
	female	7.2	8.1	9.2
The control of the dean's office and department of physical education	male	24.5	6.3	6.8
	female	21.6	20.2	7.7
Parents	male	7.5	3.1	3.4
	female	2.1	2.0	6.2

Table V. The classes in physical education which the students prefer (n=647, %)

The educational classes	Gender	The year of studying				Total
		1st	2nd	3rd	4th	
With music	male	37.1	32.8	17.1	17.6	30.2
	female	56.1	50.8	58.8	63.5	55.5
With gym machines	male	25.7	23.4	31.4	11.8	28.1
	female	20.7	57.1	52.9	28.2	43.2
Using sports games	male	23.8	34.4	57.1	55.9	36.1
	female	18.3	12.0	11.8	14.1	13.7
At the stadium	male	23.8	20.3	17.1	20.6	21.4
	female	23.2	3.7	5.9	5.9	8.3
In the park, in the open air	male	11.4	12.5	20.0	8.8	12.6
	female	13.4	12.0	11.8	4.7	10.8

interested in mini-football, football, volleyball, basketball, table tennis, oriental martial arts, kettlebell lifting, boxing and training with gym machines, and female students

prefer aerobics, shaping, rhythmic gymnastics, training with gym machines, and a small part of female students prefer sports games.

The quality and efficiency of the physical education process depend to a large extent on the content of the training classes, their location, the emotional climate in classes and the choice of the means of development of physical qualities. The students enjoy the classes with functional music the most (Table V). The students, especially females, are quite fond of training with gym machines, while males prefer sports games. The students are less keen on athletics, and cross-country run held at the stadium and in the open air.

One of the main goals of exercise should be related to students' belief that it has great value for their lives. It is important for students to constantly enjoy such classes and feel muscular pleasure.

It is necessary to build the educational process so that it promotes the development of the ability to see not temporary but long-lasting values of life, to experience a certain achievement, to enjoy the classes, get positive emotions.

DISCUSSION

The studies conducted showed that the majority of students have no need for a healthy lifestyle, the lack of knowledge in this area, low activity while performing the requirements of a healthy lifestyle, irrational organization of educational activities, bad personal hygiene, bad habits and other factors that negatively affect their health. The solution to this problem is largely based on the attitude of each student to one's own health, the desire to be healthy and to be able to preserve and maintain health throughout the active social life through self-organization. Therefore, the attitude to the health problem in a particular group should be fundamentally changed by students and teachers, and also by the family, civic and sports organizations, health services and departments, etc.

The current system of physical education can not fully solve the problems that would change the students' attitudes toward a healthy lifestyle. The purpose of physical education, in addition to the formation of motor skills, abilities, and physical qualities, should be a great educational work. The purpose of such educational work should be directed not only to the period of study in a higher education institution but firstly, to the students' further life and it should promote the formation of fitness and health competences. This role falls on the promotion of a healthy lifestyle, that is a purposeful activity aimed at spreading and promotion of health and fitness knowledge.

The formation of the attitude focused on a healthy lifestyle and following it both in higher education and in later life should start with:

- the assessment of the knowledge and skills in a healthy lifestyle;
- the assessment of health, bad habits, diseases and disorders of the musculoskeletal system and the ways to eliminate them;
- the awareness of the need to maintain a healthy lifestyle, showing interest in the specific types of its expression by each student;

- the assessment of students' activity while performing the requirements of a healthy lifestyle, taking physical and health measures;
- the formation of the students' positive attitude to the means of physical culture and sports and the subject of Physical Education;
- the formation of a psychological attitude for the future regarding maintaining high motor activity, negative attitude to bad habits, etc.;
- the determination of the types of physical activity that suit the student's individual abilities and temperament the most;
- the formation of the confidence that the time spent exercising is offset by good health;
- goal setting and following it, regardless of the exhaustion, the lack of time, bad weather, etc.;
- the availability of different variants of individual fitness programs.

CONCLUSIONS

1. The formation of a healthy lifestyle of students has many different interpretations and recommendations. This indicates that there is no single way to maintain a healthy lifestyle and an active life. Therefore, the intensification of pedagogical health-saving technologies requires the conscious involvement of the potential of each student and the efficient adaptation to educational activities.
2. Ensuring optimal motor activity of student youth is one of the priority factors of a healthy lifestyle and means of wellness. The standard of the motor activity of students of higher education institutions can be considered such a value that fully satisfies the biological needs for movement, meets the functional capabilities of the organism, promotes its development, physical fitness, health preservation, the improvement of working capacity and ensures the successful fulfillment of the duties. In the scientific literature and programs on physical education, the optimal amount of the physical activity of students is 12-14 hours a week with sufficient physiological activity.

The prospects for further research are aimed at the development of innovative health and fitness technologies for the formation of a healthy lifestyle of student youth.

REFERENCES

1. Gruzjeva T., Galienko L., Pelo I. et al. Health and lifestyle of students' youth: status, problems and ways of solution. *Wiad Lek.* 2018;71(9):1753-1758.
2. Futornyj S. M. Dvyghatel'naja aktyvnost' y ee vlyjanye na zdorov'je y prodolzhytel'nostj zhyzny cheloveka [Motor activity and its effect on human health and longevity]. *Fyzycheskoe vospytanye studentov.* 2011;4:79-84. (In Russian).
3. Bulatova M. M. Fitnes i dvigatel'naya aktivnost': problemy i puti resheniya [Fitness and physical activity: problems and solutions]. *Teoriya i metodika fizichnogo vikhovannya i sportu.* 2007;1:3-7. (In Russian).
4. Balsevich V. K. Fizicheskaya aktivnost cheloveka [Human physical activity]. Kyiv, 1987. 224 p. (In Russian).

5. Bolotin A., Bakayev V. Structure and content of the educational technology of managing students' healthy lifestyle. *Journal of Physical Education and Sport*. 2015; 15(3): 362-364. doi:10.7752/jpes.2015.03054.
6. Muntjan V. S. Analiz faktorov, opredeljujushchykh zdorov'je cheloveka y okazyvajushchykh na negho vlyanjaja [Analysis of factors that determine human health and influence it]. *Fyzycheskoe vospytanye studentov*. 2010; 6: 44-47. (In Russian).
7. Mozolev O., Bloschynsky I., Alieksieiev O. et al. Influence of modern fitness technologies on the state of health and development of motor abilities of 17–19-year-old female students. *Journal of Physical Education and Sport*. 2019; 19(Supplement issue 3): 917-924. doi:10.7752/jpes.2019.s3132.
8. Prysiazniuk S., Tolubko V., Oleniev D. et al. The influence of physical activities on biological age parameters of the first-year female students from the special medical department. *Journal of Physical Education and Sport*. 2018;18(2):561-564. doi:10.7752/jpes.2018.02081.
9. Kharchenko O., Kharchenko N., Shaparenko I. et al. Analysis of the physical development of youth and the state of its health. *Wiad Lek*. 2019;72(4): 575-578.
10. Mozolev O., Halus O., Bloschynskyi I. et al. Human resources management of educational development in sphere of physical culture and sports in Ukraine: comparative analysis (1992–2016). *Journal of Physical Education and Sport*. 2019; 19(Supplement issue 1): 185-192. doi:10.7752/jpes.2019.s1028.
11. Prontenko K., Griban G., Prontenko V. et al. Health improvement of cadets from higher military educational institutions during kettlebell lifting activities. *Journal of Physical Education and Sport*. 2018;18(1): 298-303. doi:10.7752/jpes.2018.01040.
12. Rus C. M. Physical education and sports – a field more valuable and actual than ever. Editorial. *Revista Romaneasca pentru Educatie Multidimensionala*. 2017;9(3):7-9. doi:https://doi.org/10.18662/rrem/2017.0903.01.
13. Zavydivska O., Zavydivska N., Khanikiants O. Self-management as a condition for creating a health culture among students. *Journal of Physical Education and Sport*. 2016; 16(1):592-597. doi:10.7752/jpes.2016.s1093.
14. Griban G. P. Zhyttiedialnist ta rukhova aktyvnist studentiv [Life activity and mobility of students]. *Zhytomyr: Ruta*; 2009, 594 p. (In Ukrainian).
15. Prontenko K., Griban G., Dovgan N., et al. Students' health and its interrelation with physical fitness level. *Sport Mont*. 2019;17(3): 41-46. doi 10.26773/smj.191018.
16. Zelenskyi B., Zelenskyi R. Motivation: attitude of students of higher education institutions of the I–II accreditation levels toward physical education classes. *Theory and Methods of Physical Education*. 2018;18(3): 114–125. doi:10.17309/tmfv.2018.3.02.
17. Budagh'janc Gh. M. Zdorovyj sposib zhyttja – osnovna umova profilaktyky deviantnoji povedinky pidlitka (istorychnyj aspekt) [Healthy lifestyle – the main condition for the prevention of adolescent deviant behavior (historical aspect)]. *Pedagoghika, psykholohija ta medyko-biologhichni problemy fizychnogho vykhovannja i sportu*. 2010; 6: 25-28. (In Ukrainian).
18. Cucui A. I. Study on sports activities in the free time of gymnasium cycle students. *Revista Romaneasca pentru Educatie Multidimensionala*. 2018;10(4):82–91. doi:https://doi.org/10.18662/rrem/74.
19. Prontenko K., Bloschynskyi I., Griban, G. et al. Formation of readiness of future physical culture teachers for professional activity. *Universal Journal of Educational Research*. 2019;7(9):1860-1868. doi: 10.13189/ujer.2019.070903.
20. Warburton D., Nicol C. W., Bredin S. S. D. Health benefits of physical activity: the evidence. *Canadian Medical Association Journal*. 2006;174:801–809.
21. Bulych E. Gh., Muravov Y. V. Zdorovje cheloveka: Byologhicheskaja osnova zhyznedejateljnosti y dvyghateljnaja aktyvnost' v ee stymuljacy [Human health: the biological basis of vital activity and motor activity in its stimulation]. *Kyiv: Olympic Literature*; 2002, 424 p. (In Russian).
22. World Health Organization. Global recommendations on physical activity for health. 2015. Available from: http://www.who.int/dietphysicalactivity/factsheet_recommendations.
23. Leuciu F. Perception on physical education among students. *Revista Romaneasca pentru Educatie Multidimensionala*. 2018;10(2):134–143. doi:https://doi.org/10.18662/rrem/51.
24. Griban G., Prontenko K., Zhamardiy V. et al. Professional stages of a physical education teacher as determined using fitness technologies. *Journal of Physical Education and Sport*. 2018;18(2):565–569. doi:10.7752/jpes.2018.02082.
25. Griban G. P. Vpliv fizichnih vprav na rozumovu ta intelektualnu diyalnist studentiv [The influence of exercise on the mental and intellectual activity of students]. *Zhytomyr: Ruta*; 2008, 122 p. (In Ukrainian).
26. Vayner E. N. Valeologiya [Valeology]. *Moskow: "Flinta", "Nauka"*; 2001, 416 p. (In Ukrainian).
27. Bulatova M. M., Usachov Yu. O. Suchasni fitnes-ozdorovchi tekhnologhiji u fizychnomu vykhovanni. Teorija ta metodyka fizychnogho vykhovannja [Modern fitness-health-improving technologies in physical education. Theory and methods of physical education]. *Kyiv: Olympic Literature*; 2008, 320 p. (In Ukrainian).
28. Apanasenko G., Dolzhenko L. Rivenj zdorov'ja i fiziologhichni rezervy orhanizmu. [The level of health and physiological reserves of the organism]. *Teorija i metodyka fizychnogho vykhovannja i sportu*. 2007;1:17-21. (In Ukrainian).
29. Krutsevych T. Yu. Teoriia i metodyka fizychnogho vykhovannja [Theory and methods of physical education]: pidruchnyk dlja stud. vuziv fiz. vykhov. i sportu. T. 1. Zahalni osnovy teoriii i metodyky fizychnogho vykhovannja. *Kyiv: Olympic Literature*; 2008, 391 p. (In Ukrainian).
30. Paffenbarger R. S., Olsen E. Zdorovyj obraz zhizni [Healthy lifestyle]. *Kyiv: Olympic Literature*; 1999, 320 p. (In Russian).
31. Hawley E. T., Franks D. B. Ozdorovchij fitnes [Health Fitness]. *Kyiv: Olympic Literature*; 2000, 367 p. (In Ukrainian).
32. Duboghaj O. D., Aljoshyna A. I., Lavrynjuk V. Je. Osnovni ponjattja i terminy zdorov'jazberezhenija ta fizychnoji rehabilitaciji v systemi osvity [Basic concepts and terms of healthcare and physical rehabilitation in the education system]. *Lucjk: Volyns'kyj nacional'nyj universytet imeni Lesi Ukrajinky*; 2011, 296 p. (In Ukrainian).
33. Magh'lovanyj A. V. Osnovy informacijnogho polja zdorov'ja osobystosti [Basics of information field of personality health]. *Visnyk Chernihiv's'kogho nacional'nogho pedagoghichnogho universytetu imeni T. Gh. Shevchenka. Serija: Pedagoghichni nauky. Fizyчне vykhovannja ta sport*. 2010; 81: 285-289. (In Ukrainian).

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QUALITATIVE ANALYSIS OF ORAL *LACTOBACILLI* PARAMETERS AT DIFFERENT STAGES OF HUMAN LIFE CYCLE AND DIFFERENT CARIES INDICES

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ABSTRACT

The aim of this article is to provide the detailed study of the changes in the lactobacilli indices of the oral biotope in health and in caries progression in individuals.

Materials and methods: Materials included on reports and data of research projects conducted at the Department of Therapeutic Dentistry and Department of Microbiology, Virology and Immunology, Ukrainian Medical Stomatological Academy (Poltava), at the Department of Microbiology of Danylo Halytsky National Medical University (Lviv), completed in 2013; research data documented by the Department of Microbiology, Medical Stomatological Institute (now Ukrainian Medical Stomatological Academy, Poltava) in 1978; literature related to the subject matter. Methodology: the standard methods of dental examination recommended by WHO; methods of system analysis and system approach, bibliosemantic analysis.

Results: The presented results indicate that the number of representatives of different types of oral microflora in the oral microbiocenosis is different at different stages of human life. The content of Lactobacilli in children decreases following the rise even under increased dmft indices.

Conclusions: The data observed are of great clinical interest when considering the role of Lactobacilli in the protection of the host organism and the initiation of the carious process.

KEY WORDS: oral cavity, dental caries, Lactobacilli, microbiocenosis.

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INTRODUCTION

The oral microflora plays an important role in maintaining the integrity of the *oral cavity* and contributing to overall health. Microbiota is known to perform the following key functions as to maintain metabolism, provide the protection and trophic support. Under certain conditions, associate members of oral microbiocenosis trigger pathological processes, the intensity and prevalence of which can reach critical values. First and foremost, this is a carious disease and inflammatory periodontal diseases [1, 2]. Cariology research papers allege that the most aggressive representatives of oral microbiocenosis are *Str. mutans* and *Lactobacillus*.

The ability of these bacteria to produce inorganic acids followed by enamel demineralization has been well described in laboratory, experimental, and clinical studies by O. Fejerskov, E.A.M. Kidd (2004); J.J. Soet et al. (2000). Loesche et al. in their reports (1984) have proven that *Str. Mutans* are agents initiating aggression on the dental enamel leading to demineralization. The clinical studies on the caries development in humans under constant monitoring of the changes in microbiological composition in the dental fissures lasting over 18 months have demonstrated *Str. mutans* is the causative agent of the enamel demineralization onset. It should be stresses that 12 months earlier before the detection of initial caries in the fissures, the number of Lactobacilli increased [3]. At the same time, lactobacilli

and streptococci permanently residing in the oral cavity are antagonistic to numerous representatives of transient microflora (*Sarcinae*, *Escherichia coli*, *Proteus*, etc.) and contribute to their expelling from the oral cavity [4].

An analysis of the isolation rate of bacteria from the biotopes studied indicates that there is no necessity to detect the entire spectrum of the microbial composition of the biocenosis. The most exponential (indicative) microorganisms, and in the oral cavity as well, are all the same lactic acid bacteria, streptococci, staphylococci, and *Candida* fungi. Some researchers consider that a decrease in their culturing rate indicates a microflora imbalance [5]. All this suggests that the thorough study of representatives of the human microbiocenoses, especially their exponential forms, is of great clinical relevance.

THE AIM

The aim of this article is to provide the detailed study of the changes in the lactobacilli indices of the oral biotope in health and in caries progression in individuals.

MATERIALS AND METHODS

Materials included on reports and data of research projects conducted at the Department of Therapeutic Dentistry and Department of Microbiology, Virology and Immunology,

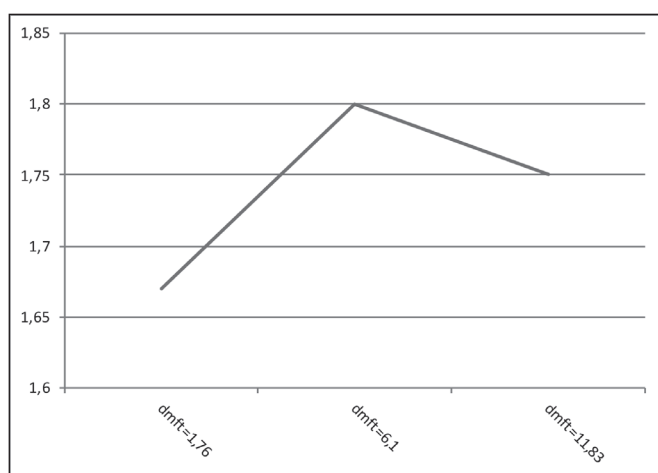


Fig. 1. The number of *Lactobacilli* in the oral cavity ($\times 10^2$ U/ml) in 12 year old children depending on the dmft index.

Table I. The number of *Lactobacilli* in the oral cavity ($\times 10^2$ U/ml) in 12 year old children depending on the dmft index

Microbial flora	dmft = 1,76	dmft = 6,1	dmft = 11,83
<i>Lactobacillus</i> ($\times 10^2$ U/ml)	$1,67 \pm 0,2 \times 10^2$	$1,8 \pm 0,19 \times 10^2$	$1,75 \pm 0,2 \times 10^2$

Ukrainian Medical Stomatological Academy (Poltava), as well as at the Department of Microbiology of Danylo Halytsky National Medical University (Lviv), completed in 2013. We also employed research data documented by the Department of Microbiology, Medical Stomatological Institute (now Ukrainian Medical Stomatological Academy, Poltava) in 1978, as well as an available literature related to the subject matter. Methodology included the standard methods of dental examination recommended by WHO, analysis of the above mentioned research reports as well as bibliosemantic analysis of available relevant literature.

RESULTS

Lactobacillus group is known as a widespread species of gram-positive anaerobic or microaerophilic non-spore-forming lactic acid bacteria. They grow at a temperature of + 15- + 45 ° C, the optimum temperature for their growth is +30° C. The most favourable conditions for *Lactobacilli* are at low pH values, typically 3.2-3.5, and at low oxygen content. In the process of normal metabolism, they are able to produce lactic acid, hydrogen peroxide; they can also produce lysozyme and substances with antibiotic properties as reuterin, plantaricin, lactocidin, lactoline. Moreover, hetero-fermenting species of *Lactobacilli* as end products can produce acetic acid and carbon dioxide. They are found in the intestines, on the skin and on the mucous membranes of humans and animals. Milk for *Lactobacillus* is the most optimal medium [6].

Lactobacilli colonize the human body from the moment of its birth and are identified on the 5th day following this event [7, 8, 9]. There are data reporting that by the age of

4 months exclusively milk-fed infants and bottle-fed ones demonstrate marked differences in the oral microbiota. The milk-fed infants were found to have an increased level of probiotic microorganisms as *Lactobacillus johnsonii* / *L. gasseri*, *L. paracasei* / *L. casei* [8, 9]. This is probably due to the fact that the main regulatory factor in the microbioscenes is nutrients that provide the proper ecological niche for microorganisms colonizing. During the colonization of the niche with symbionts, such a separation of metabolic functions between microorganisms gets settled down, and the mutual exchange between their metabolites becomes inevitable and mandatory [10].

Thereupon, it is appropriate to refer to the study conducted in the last quarter of the twentieth century at the Department of Microbiology at former Poltava Medical Dental Institute (now Ukrainian Medical Stomatological Academy). The conclusion was drawn that the frequency rate of isolation of *Lactobacilli* bacteriocinogenic strains from saliva of individuals with dental caries was 1.75 times higher than from saliva of healthy people ($p < 0.05$), and in 1.9 times higher than from saliva of individuals with periodontal disease ($p < 0.05$) (note: bacteriocins are substances with narrow spectrum antibiotic properties aimed at homologous or related bacterial species; parodontosis was called as parodontitis) [11]. Due to the ability to secrete bacteriocins and other active substances, *Lactobacilli* inhibit the growth of putrefactive and opportunistic pathogens, and thus, manifest their protective function relative to the tissues of the host organism [12].

A part of the research project performed at the Department of Microbiology, Danylo Halytsky Lviv National Medical University in 2013 relates to a comprehensive dental examination of children aged 12 years. And one of the tasks of this research was to determine and assess the quantitative indicators of *Lactobacilli* in the oral cavity of children with different dmft indices (Fig. 1, Table 1).

The authors explain the decrease in the number of *Lactobacilli* following the their rise under an increase in the dmft indices by the development of conditions, which promote the growth of opportunistic and pathogenic microflora, such as *Proteus*, a gram-negative bacillus of the non-fermenting group that leads to the formation of alkaline pH in the oral cavity [13].

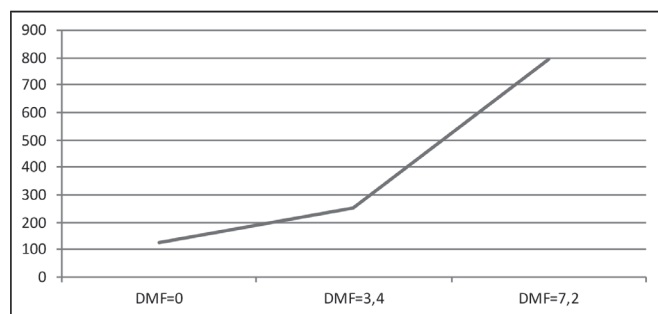
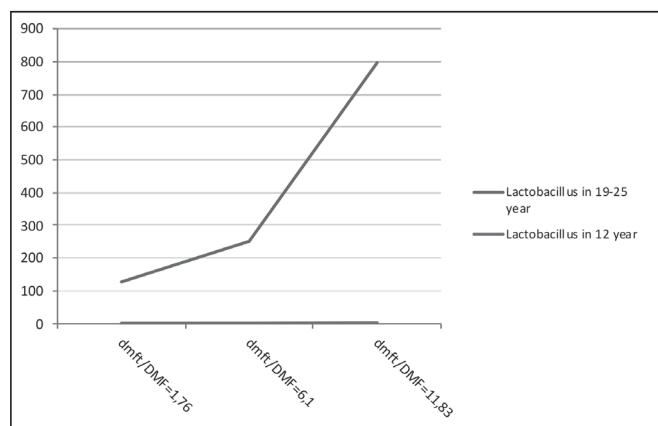
Some results obtained by the Department of Therapeutic Dentistry and the Department of Microbiology, Virology and Immunology, Ukrainian Medical Stomatological Academy (Poltava) in 2013 on studying the quantitative indicator of *Lactobacilli* index in young people aged 19-25 years with different DMF indices and an intact periodontium are presented in Fig. 2 and in Table II.

The researchers suggest that reducing competition for adhesion receptors and nutrients from the stabilizing microflora as well as its lowering production of inhibitors contribute to excessive colonization with cariogenic and opportunistic microflora, including *Lactobacilli*, which are able to metabolize carbohydrates to lactic acid, and tolerant to low pH values of the medium [14].

When summing up the results on indicators of *Lactobacilli*, their changes can be presented as seen in the Figure 3.

Table II. The number of *Lactobacilli* in oral cavity ($\times 10^2$ U/ml) in 19 – 25 year old individuals depending on DMF indices

Microbial flora	DNF=0	DMF=3,4	DMF=7,2
<i>Lactobacillus</i> ($\times 10^2$ U/ml)	125,89 \pm 0,05 $\times 10^2$	251,19 \pm 0,13 $\times 10^2$	794,33 \pm 0,18 $\times 10^2$


Fig. 2. The number of *Lactobacilli* in oral cavity ($\times 10^2$ U/ml) in 19 – 25 year old individuals depending on DMF indices.

Fig. 3. The number of *Lactobacilli* in the oral cavity ($\times 10^2$ U/ml) in 12 year old children and 19-25 young adults depending on dmft / DMF indices.

The graph in Fig. 3 shows that the variability in the number of oral *Lactobacilli* is the most noticeable depending on DMF indices in 19–25-year-old youth, while in 12-year-old children the above changes with this scaling are insignificant. This might be very interesting by its consequences.

DISCUSSION

The presented results indicate that the number of representatives of different types of oral microflora in the oral microbiocenosis is different at different stages of human life. The content of *Lactobacilli* in children decreases following the rise even under increased dmft indices.

We can suggest some explanation for this phenomenon. One of them is associated with a change in the quantitative and qualitative microbial composition, and namely, an increase in opportunistic microbes and appearance of pathogenic microbes that can result in the shift in the indicators of the oral biotope, including its pH.

Another explanation is based on the assumption that representatives of related species can produce substances affecting other species and thus leading to the dominance of one species, possibly the most pathogenic: as a consequence, its closely

related representatives vanish. However, under the changes in the number of oral *Lactobacilli* depending on the DMF indices in 19 – 25 year old individuals, this variability is insignificant.

The data observed are of great clinical interest when considering the role of *Lactobacilli* in the protection of the host organism and the initiation of the carious process.

CONCLUSIONS

The investigation of the representatives of human oral microbiocenosis should be continued not only in a quantitative but in qualitative dimension, which is strongly related to the functioning of microorganisms and outcomes of their functioning. This requires searching for new sophisticated methodology and the updating the existing techniques aimed at identifying and in-depth studying the functional parameters of the oral microbiota.

REFERENCES

1. Boychenko O.N., Kotelevskaya N.V., Nikolishin A.K., i dr. Morfofunktsionalnaya harakteristika nazubnogo naleta. Visnyk problem biolohii i medytyny [Morphological and functional characteristics of plaque]. 2016; 4(134): 9-15.
2. Bublil T.D. Monitorynh stomatolohichnoi zakhvoriuvanosti studentiv-medykiv [Monitoring of dental morbidity of medical students]. Pivdenoukrajinskyi medychnyi naukovyi zhurnal. 2014; 7 (07): 17-9.
3. Leus P.A. Otlozheniya na zubah. Rol zubnogo naleta v fiziologii i patologii polosti rta [Deposits on the teeth. The role of plaque in the physiology and pathology of the oral cavity] [ucheb.-metod. posobie]. Minsk: BGU; 2007, 32 p.
4. Ohta H., Kato K., Fukui K. et al. Microbial interactions and the development of periodontal disease. J. Periodontal Res. 1991; 26(3): 255-7.
5. Penders J., Vink C., Driessen C., et al. Quantification of Bifido-bacterium spp., Escherichia coli and Clostridium difficile in faecal samples of breast-fed and formula-fed infants by real-time PCR. FEMS Microbiol Lett. 2005; 243(1): 141-7.
6. Bochkareva O.P., Krasnozhenov E.P., Goldberg V.E., i dr. Mikroflora polosti rta kak indikator disbioticheskikh rasstroystv u bolnykh rakom molochnoy zhelezy [Microflora of the oral cavity as an indicator of dysbiotic disorders in patients with breast cancer]. Sibirskiy onkologicheskij zhurnal. 2013; 5 (59): 24-6.
7. Lactobacillus (laktobakterii ili laktobatsillyi, rod bakteriy) [Lactobacillus (lactobacilli or lactobacilli, a genus of bacteria)]. URL: <https://www.gastroscan.ru/handbook/118/1906>.
8. Ryimashevskiy A.N., Naboka Yu.L., Svirava E.G., i dr. Vliyanie mikroflory materi na stanovlenie mikrotsenoza kishchnika rebenka v period grudnogo vskarmlyvaniya [The influence of the microflora of the mother on the formation of the microcenosis of the intestines of the baby during breastfeeding]. Vestnik Natsionalnogo mediko-hirurgicheskogo Tsentra im. N.I. Pirogova. 2012; 7, 1: 84-2.
9. Bezirtzoglou E., Tsiotsias A., Welling G.W. Microbiota profile in feces of breast- and formula-fed newborns by using fluorescence in situ hybridization (FISH). Anaerobe. 2011; 17 (6): 478–482.

10. Simonova E.V., Ponomareva O.A. Rol normalnoy mikroflory v podderzhanii zdorovya cheloveka [The role of normal microflora in maintaining human health]. *Sibirskiy meditsinskiy zhurnal*. 2008; 8: 20-5.
11. Fillipov V.A. Harakteristika bakteriotsinogenosti laktobatsill polosti rta. *Stomatologiya* [Characterization of the bacteriocinogenicity of oral lactobacilli]. 1978; 6: 19-21.
12. Novokshonov A.A., Sokolova N.V. Fiziologicheskie funktsii laktobakteriy v organizme i effektivnost ih primeneniya v sostave probiotikov v pediatricheskoy praktike [Physiological functions of lactobacilli in the body and the effectiveness of their use as part of probiotics in pediatric practice]. URL: https://umedp.ru/articles/fiziologicheskie_funktsii_laktobakteriy_v_organizme_i_effektivnost_ikh_primeneniya_v_sostave_probiot.html.
13. Smoliar N.I., Baryliak D.Iu. Mikroflora zubnoho nalotu u ditei zalezno vid intensyvnosti kariiesu zubiv [Plaque microflora in children depending on the intensity of dental caries]. *Profilaktychna ta dytyacha stomatolohiia*. 2013. 2 (9); 26-9.
14. Petrushanko T.O., Chereda V.V., Loban H.A. Yakisnyi sklad mikrobiotsenozu porozhnyny rota osib molodoho viku z riznoi intensyvniestiu kariiesu. Svit medytsyny ta biolohii [Qualitative composition of the oral microbiocenosis of young people with different intensity of caries]. 2013; 1: 57-9.

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ORIGINAL ARTICLE

DIFFERENTIAL DIAGNOSTICS OF INHERITED METABOLIC DISORDERS IN NEWBORNS

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ABSTRACT

The aim: To compose an applicable diagnostic checklist for neonatologists, pediatricians, and general practitioners who refer newborns with certain inherited metabolic diseases (IMDs) suspicion to confirmatory testing laboratories.

Materials and methods: Analyzed international and generally, known national clinical guides and recommendations devoted to IMDs diagnostics, treatment and follow up.

Results: Considering integral character of the diagnostic work-up of inborn errors of metabolism, authors of this article composed an applicable checklist that comprises set of data necessary for interpretation the positive results of expanded newborn screening and making decision of appropriate biochemical and molecular tests are required for confirmatory follow-up testing to establish the diagnosis and prescribe pathogenetic therapy.

Conclusions: Properly filled checklist allow metabolic professionals to select appropriate confirmatory tests and interpret results obtained. Early IMDs diagnosis and prompt treatment initiation are crucial for positive outcomes and proved to be an effective tool to decrease levels of child disability and infant mortality.

KEY WORDS: newborns, differential diagnosis of inherited metabolic diseases (IMDs), expanded newborn screening, confirmatory testing

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INTRODUCTION

Inherited metabolic disorders (IMDs) are orphan diseases which result from the genetic defects of enzymes involved in amino acids, carbohydrates, organic and fatty acids metabolism. Clinical signs of IMDs are nonspecific and don't differ from those for majority of common pediatric pathologies. The latter presents certain difficulties for doctors in diagnosis establishing, causes errors and finally takes too much time to avoid severe consequences like irreversible damage of the brain and internal organs due to late start of pathogenetic therapy. About 70% of IMDs have an acute manifestation, but in neonatal period such clinical states like sepsis, hypoxic ischemic encephalopathy, heart failure, and intestinal obstruction can disguise the presence of metabolic disorder causing delay in diagnostics. In severe cases delay in diagnostics may lead to the development of metabolic decompensation state, rapidly progressive multiple organ failure, mental retardation or death of a neonate [1].

Early detection of IMDs by means of expanded newborn screening and further confirmatory testing for newborns with suspected metabolic disorder having positive screening results or for neonate demonstrating clinical signs allow physicians to start specific pathogenetic therapy as early as possible. Early and diagnostics of IMDs requires proper description of pregnancy and childbirth history, notes of neonatal period flow, and the results of key laboratory and clinical examinations of a child

since his(her) birth. All the data has to be recorded and sent to a specialist in IMDs laboratory diagnostics and to endocrinologists. Interpretation of biochemical findings, correctness of differential diagnostics, and final diagnosis establishing in certain extent depends on the volume of anamnestic data, and the results of clinical and laboratory examinations. Diagnostic errors lead to the delay in pathogenetic treatment initiation, and ultimately – to pessimistic medical prognosis of normal development of newborn [2].

THE AIM

To compose an applicable diagnostic checklist for neonatologists, pediatricians, and general practitioners who refer newborns with certain IMD suspicion to confirmatory testing laboratories.

MATERIALS AND METHODS

Analyzed international and generally, known national clinical guides and recommendations devoted to IMDs diagnostics, treatment and follow up. We focused at the diagnostic algorithms of more dangerous and frequent diseases that were included in the internationally recognized core panel of expanded newborn screening. Special attention was paid to IMDs with prompt progression to metabolic crisis states.

RESULTS AND DISCUSSION

Considering integral character of the diagnostic work-up of inborn errors of metabolism, authors of this article composed an applicable checklist that comprises set of data necessary for interpretation the positive results of expanded newborn screening and making decision of appropriate biochemical and molecular tests are required for confirmatory follow-up testing to establish the diagnosis and prescribe pathogenetic therapy. The checklist form should be filled by a physician and sent to the laboratory along with the samples of biomaterial to perform confirmatory tests.

Objective information in this checklist is used as for planning further confirmatory diagnostics activity, as for assessing results of biochemical, instrumental and genetic investigations to confirm or exclude mutation defect of certain enzyme in specific metabolic pathway, and to improve differential IMDs diagnostics of metabolic disorders suspected according to the results of the expanded newborn screening. Checklist can be seen in Annex.

Inherited metabolic disorders can be grouped into several categories: (I) classic IMD – disorders of intermediary metabolism, (II) disorders of biosynthesis and breakdown of complex molecules, and (III) disorders of neurotransmitter metabolism. Performing differential diagnostics of IMDs it is necessary to consider family history, manifestation and clinical features (such as organomegaly, cardiomyopathy, haematological abnormalities, developmental defects, and signs of dysmorphogenesis). These data are key important for proper understanding and interpretation results of instrumental examinations and clinical laboratory data (such as hypoglycemia, ketosis, hyperammonemia, persistent metabolic lactate acidosis, respiratory alkalosis, cholestatic syndrome, and hyperbilirubinemia which is not caused by hemolytic disease of newborns) [3, 4].

Some IMDs can cause problems during pregnancy and labor (nonketotichyperglycinemia, peroxisomal defects, disorders of cholesterol biosynthesis, lysosomal storage diseases). For instance, low level of maternal serum estriol in case of steroid sulfatase deficiency or multiple sulfatase deficiency, due to defects of certain enzyme from sulfatases family being element of cholesterol biosynthesis pathway; reduced fetal movements in case of multiple affected organs (Smith-Lemli-Opitz syndrome, glycogen storage disease type IV, some lysosomal and peroxisomal disorders); HELLP syndrome, acute fatty liver of pregnancy (long-chain acyl-CoA dehydrogenase deficiency). Steroid sulfatase deficiency can cause prolonged labor as a result of decrease in the placental estrogen production. During IMDs diagnostics it is necessary to consider perinatal loss (miscarriage, ectopic pregnancy, stillbirth, neonatal death, sudden death syndrome cases), as well as consanguineous marriage, and siblings' state of health. Intrauterine growth retardation, dysmorphia, Banti syndrome, and nonimmune fetal hydrops can also be caused by metabolic disorders. Signs of dysmorphogenesis are typical for peroxisomal disorders (large fontanelles, high forehead, hypoplastic supraorbital ridges, epicanthal folds, hypoplasia of the nasal bone in case of Zellweger syndrome), Pyruvate De-

hydrogenase deficiency (epicanthal folds, nose anomalies), mitochondrial disorders (epicanthal folds, hypoplasia of the nasal bone), glutaricaciduria type II (macrocephaly, high forehead, hypoplasia of the nasal bone, ear anomalies, hypospadias), mevalonic aciduria (large fontanelles, high forehead, hypertelorism, epicanthal folds, low-set ears) [5].

It's necessary to remember that the absence of the burden family history does not exclude the risk of birth of a child with inherited metabolic disorder, since the majority of these disorders demonstrate the autosomal recessive type of inheritance [6].

Usually, it's impossible to diagnose IMDs during routine medical examination of newborns due to the absence of specific clinical symptoms. Most diseases of organic acidemias group, as well as urea cycle defects and amino acid metabolism disorders can manifest with acute metabolic emergencies and acute metabolic encephalopathy resulting in significant morbidity. Characteristic symptoms of this state are developed as a consequence of toxic metabolites accumulation in the blood and tissues due to "metabolic block", and its damaging action upon the central nervous system and internal organs. Clinical courses of majority IMDs are characterized by initial asymptomatic period, so called "light interval" can last from a few hours to a few months and even years. Most frequent provocative factors of emergencies in suspected inborn errors of metabolism are states characterized by catabolic processes predominance (such as infection, episodes of prolonged starvation, dehydration, surgical intervention, trauma, vaccination) or excessive consumption of proteins or carbohydrates. Clinical picture is characterized by nonspecific signs or sudden deterioration of a newborn's health state. A neonate can demonstrate symptoms of enteral feeding intolerance, vomiting, respiratory impairments, apnea, lethargy, somnolence, hypotonia (poor muscle tone, commonly known as floppy baby syndrome), and seizures [7]. Vomiting, being a consequence of intoxication, represents one of the most common signs of IMDs in infants, but early vomiting manifestation soon after birth is considered a sign of severe disease course.

Clinical suspicion of IMDs is paramount. To keep up high index of IMDs awareness in newborns, physicians should start analysis of causes of any critical newborn state from exclusion inherited metabolic disorders. Particularly, in cases of severe neonatal encephalopathy, cardiomyopathy of unclear genesis, persistent hypoglycemia, elevated liver enzymes with coagulopathy, ketoacidosis, electrolyte balance disorder, and metabolic acidosis with high anion gap. Anion gap (AG) is the simple blood test indicating occurrence of decompensated shift in acid-base balance in the body. AG is calculated calculated by subtraction sodium cations content from the sum of chlorides and bicarbonates anion content ($AG = (Na^+ - (Cl^- + HCO_3^-))$). A normal value of the anion gap is 3-12 mEq/L. Blood pH less than 7.40 with low bicarbonates upon AG calculation allows to confirm metabolic acidosis. AG serves a key indicator to determine the causes of metabolic acidosis in neonates. High anion gap (>15 mEq/L) is a sign of decompensated

Table I. Early neurosonography brain changes

Metabolic disease	Specific brain changes	Diagnostic methods
Maple syrup urine disease	Brain swelling, echogenicity changes, structural white and grey matter changes	Neurosonography, MRI
Oxidative phosphorylation disorders	Ventricular dilatation, subependymalgerminolysis, anomalous white matter	Neurosonography, MRI
Peroxisomal disorders	Ventricular hypertrophy, lenticulostriatevasculopathy, cortex tissue anomalous structure	Neurosonography, MRI
Organic acidemias	Increased echogenicity of the periventricular white matter	Neurosonography
Amino acid metabolism disorders, urea cycle disorders	Cortex tissue anomalous structure, anomalous white matter, corpus callosum hypoplasia	Neurosonography, MRI
Sulfite oxidase deficiency	Cystic formation of the white matter, possible corpus callosum hypoplasia and ventriculomegaly. Basal ganglia can imitate certain patterns of the course of hypoxic ischemic damages	Neurosonography, MRI
Molybdenum cofactor deficiency	Early signs of a diffuse increase in echogenicity, later - brain tissue hyperechogenicity and basal ganglia calcification, cysts in white matter, later - cerebral atrophy	Neurosonography, MRI
Zellweger Syndrome	Subependymal cysts, ventricular hypertrophy, lenticulostriatevasculopathy, cerebral sulci and gyri defects	Neurosonography, MRI
Nonketotichyperglycinemia	Corpus callosum hypoplasia	MRI

state of acid-base balance due to accumulation of organic acids in blood, which is a characteristic feature of organic acidurias. It is important to note that the AG decreases by 2.5 mEq for every 1 g/dL decrease in serum albumin [8].

It often happens that inherited metabolic disorders are misdiagnosed as neonatal sepsis, hypoxic ischemic encephalopathy, gastrointestinal bleeding, or asphyxia.

Sepsis proved to be the initial consideration in a newborn with lethargy, poor feeding, respiratory impairments, and recurrent vomiting. But inborn errors of metabolism should always be considered and excluded, particularly in a full-term infant demonstrating prompt progression of clinical symptoms after initial well-being period. Signs of systemic inflammatory response (clinical picture of gram-negative sepsis) can occur in case of galactosemia, organic acidemias, urea cycle disorders, and congenital hyperplasia of adrenal glands. Rather often galactosemia in newborns is mistakenly diagnosed as sepsis caused by *e. coli*. Generally, absence of positive dynamics in neonate clinical state on the background of symptomatic therapy performance should be considered as a possible manifestation of IMDs [9].

Seizures presents another clinical signs being characteristic of many inherited metabolic disorders. Seizures can occur during the prenatal period (fetal seizures, clonic convulsions), being refractory to common antiepileptic treatment. Convulsion syndrome is typical for amino acid metabolism and urea cycle disorders, organic acidemias, gangliosidosis, pyruvate metabolism disorders, peroxisomal disorders, mitochondrial disorders, biotinidase deficiency, glycine encephalopathy, molybdenum cofactor deficiency, sulfite oxidase deficiency, disorders of creatine,

purine and pyrimidine metabolism. These pathologies are accompanied by progressive deterioration of neonate clinical status (noted in all organs and systems of the body), including electroencephalographic, and neurosonographic indicators as well [10].

Another integral part of the diagnostic work-up of metabolic disorders are the results of instrumental investigations and brain imaging. The cranial ultrasonography due to the bedside availability allows brain imaging in symptomatic neonates shortly after birth to detect early signs of the brain abnormalities. Early structural brain abnormalities associated with certain metabolic disorders are summarized in Table I.

As far as the signs and symptoms of IMDs are nonspecific and often overlap extensively with more common disorders, clinical laboratory diagnostics plays a key role in the diagnostic work-up of these diseases. Particularly at early (preclinical) stage when the elevated blood concentration of marker (or even pathognomonic) products of impaired metabolic pathway could be reliably detected before an IMD debut. For these purposes complicated analytical methods such as: tandem-mass-spectrometry, gas chromatography-mass-spectrometry etc. are used. These extremely sensitive multiplex methods allow determining concentration of several dozens or hundreds substances in single blood or urine sample. For correct interpretation of this data, specialists in metabolic disorders also need results of routine laboratory analyses (blood gases, electrolytes, anion gap, levels of glucose, lactate, and ammonium in the blood). Considering progredient and rapidly progressive course being characteristic of certain IMDs group, pathogenetic therapy is recommended to start right away

after revealing gross deviation of the results of expanded newborn screening in dried blood spots from referent values, even in the absence of clinical manifestations of the disease and incompleting confirmatory investigations that are stipulated by the diagnostic work-up [11].

In fact, differential diagnostics between inherited metabolic diseases and severe somatic pathologies in newborns being serious challenge to physicians due to: nonspecific symptoms and signs, prodromal prompt progression, and severe outcomes in case of absence or late start of pathogenetic therapy [12]. To help physicians to systematize diagnostically relevant information and arrange in a schematic form the complex of anamnestic data, clinical manifestations, results of routine clinical laboratory tests, and findings of instrumental examinations we propose the form of above-mentioned checklist (Annex). It's believed that routine usage of this form in everyday practice allows to speed up the differential diagnostics of IMDs by shortening the search of potentially suspected diseases. In our experience, this form proved to be very helpful in communication between metabolic specialists and family medicine physician in remote areas upon receipt of the positive results of the expanded newborn screening and impossibility to transfer a neonate to regional or central perinatal facilities.

CONCLUSIONS

Properly filled checklist allow metabolic professionals to select appropriate confirmatory tests and interpret results obtained. Early IMDs diagnosis and prompt treatment initiation are crucial for positive outcomes and proved to be an effective tool to decrease levels of child disability and infant mortality.

REFERENCES

- Engel P.A., et al. Physician and patient perceptions regarding physician training in rare diseases: the need for stronger educational initiatives for physicians. *Journal of Rare Disorders* 2013;1, Issue 2. Online: <http://www.journalofrareorders.com/pub/IssuePDFs/Engel.pdf> Last accessed January 2015.
- Mohamed S. Recognition and diagnostic approach to acute metabolic disorders in the neonatal period. *Sudan J Paediatr.* 2011;11(1):20-8
- Mavropulo T.K. Vrodzheni porushennya metabolizmu u novonarodzhnykh – neobkhidnist' skryninhu [Congenital metabolic disorders in newborns – the need for screening]. *Neonatology, surgery and perinatal medicine.* 2014;4(4):97-102. (In Ukrainian).
- Joe T. R. Clarke, *A Clinical Guide to Inherited Metabolic Diseases*, 2002; 134-136.
- Ozben T. Expanded newborn screening and confirmatory follow-up testing for in born errors of metabolism detected by tandem mass spectrometry. *Clin Chem Lab Med* 2013;51:157-76
- Mak C.M., Lee H.C., Chan A.Y., Lam C.W. In born errors of metabolism and expanded newborn screening: review and update. *Crit Rev Clin Lab Sci.* 2013;50(6):142-62. doi: 10.3109/10408363.2013.847896.
- American College of Medical Genetics Newborn Screening Expert Group. Newborn screening: toward a uniform screening panel and system-executive summary. *Pediatrics* 2006; 117: 5296-307.
- Stevenson D.K, Cohen R.S., Sunshine P. *Neonatology: Clinical Practice and Procedures.* New York: McGraw-Hill, 2015; p. 649–64.
- Saudubray J.M., Garcia-Cazorla A. In born Errors of Metabolism Overview: Pathophysiology, Manifestations, Evaluation, and Management. *Pediatr Clin North Am* 2018; 65: 179-208.
- Gilbert-Barnes E., Farrell P.M. Approach to diagnosis of metabolic diseases. *Transl Sci Rare Dis* 2016; 1: 3-22.
- Nenad Blau, Marinu sDuran, K. Michael Gibson, Carlo Dionisi-Vici (Eds.) *Physician's Guide to the Diagnosis, Treatment, and Follow-Up of Inherited Metabolic Diseases*, 2014; p. 867.
- Blau M. Duran, M. E. Blaskovics, K. M. Gibson (Eds.) *Physician's Guide to the Laboratory Diagnosis of Metabolic Diseases*, 2003 : 309-334.

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Annex. CHECKLIST. REFERRAL TO THE DETAILED LABORATORY DIAGNOSTICS

Patient (Child) Full Name _____		
Patient Age _____	Patient DOB _____	Date _____
Mother Full (Maiden) Name: _____		
Patient Address: _____		
Pre-diagnosis: _____		
Referring Physician _____		
HISTORY: Family (parents' state of health/age, cases of inherited diseases among close relatives, information about previous pregnancies, resulted in, cases of children's deaths): _____		

Antenatal (which pregnancy/development of pregnancy): _____		
Intranatal (course of labor) _____	Gestation period _____	
Causes of preterm labor _____		
Birth weight _____	Apgar score _____	
Newborn baby: no symptoms _____ symptoms appeared on the _____ day of life		

Patient general condition (at the time of filling in the form) _____		
Treatment (mention infusion therapy and hemotransfusion) _____		

Type of feeding: _____		
DIAGNOSTICS: _____		
Primary research results: _____		

MATERIAL ATTACHED TO MEDICAL RECORD:

- dried blood spots on paper;
- urine;
- plasma/serum;
- EDTA test tube with blood (for molecular testing)

Attention! In case of infusion therapy in a child it's recommended to suspend intravenous infusions 3 hours before biomaterial sampling for analysis.

CLINICAL SYMPTOMS

Muscle tone disorders	Yes/No	Note	Diarrhea	Yes/No	Note
Coma	Yes/No		Hepatomegaly	Yes/No	
Tremor	Yes/No		Cardiomegaly	Yes/No	
Convulsion	Yes/No		Cardiomyopathy	Yes/No	
Vomiting/ spitting up	Yes/No		Heart rhythm disorders	Yes/No	
Dynamics of weight	Positive Negative Absent		Swelling/pastosity (of face, body, limbs)	Yes/No	
Other symptoms Comments					

LABORATORY PARAMETERS

COMPLETE BLOOD COUNT

Parameter/Date			
Red blood cells (RBC)			
Hemoglobin (Hb)			
Hematocrit (Hct)			
Thrombocyte/Platelet count (Plt)			
White Blood Cell Count (WBC)			

Eosinophils/basophils			
Metamyelocytes/myelocytes			
Bands			
Segmented neutrophils			
Lymphocytes			
Monocytes			

BIOCHEMISTRY

Parameter/Date			
Ammonium			
Creatine phosphokinase			
Lactate dehydrogenase			
Glucose			
Total bilirubin			
Direct bilirubin			
ALT			
AST			
Protein			
Alkaline phosphatase			
GGT			
Creatinine			
Urea			

ACID-BASE STATUS

Parameter/Date			
pH			
pCO ₂			
pO ₂			
HCO ₃ ⁻			
BE			
Aniongap Na ⁺ -(Cl ⁻ + HCO ₃ ⁻)			

ELECTROLYTES

Indicator/Date			
K ⁺			
Na ⁺			
Ca ⁺⁺			
Cl ⁻			
p ³⁺			

URINALYSIS

Parameter	Results	Parameter	Results
pH		Bilirubin	
Color/odor		RBC	
Relative density		WBC	
Protein		Bacteria	
Glucose		Epithelium (squamous)	
Ketone bodies		Cylinders (hyaline, granular)	

Date:

Doctor's Signature:

STRENGTH COMPARISON OF DIFFERENT METHODS OF CLOSING THE ANTERIOR ABDOMINAL WALL DEFECT (EXPERIMENTAL STUDY)

DOI: 10.36740/WLek202006126

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ABSTRACT

The aim of the study is to compare the mesh implantation and the strength of the mesh fixation to the anterior abdominal wall by modelling the intraperitoneal onlay mesh repair (IPOM) with and without aponeurotic defect closure.

Materials and methods: The experimental animals were randomly divided into 2 groups of 6 rabbits. In experimental group IPOM was modelled without hernia defect closure, in control group – with its suturing. The macroscopic assessment of the severity of adhesions, histological examination of the removed “anterior abdominal wall – mesh” complex and strength of the mesh fixation to the anterior abdominal wall were performed on the 90th day.

Results: In both groups, the displacement or complete separation of the mesh from the parietal peritoneum was not observed. The extent of adhesion formation in the abdominal cavity and strength of the mesh fixation are comparable in both groups ($p > 0.05$). In the experimental group, the mesh was surrounded by scar tissue, mesothelioma lining was not traced. There were also moderate signs of inflammation, which were not seen in the control group.

Conclusions: The strength of the mesh fixation to the parietal peritoneum and its implantation into the anterior abdominal wall is comparable with or without aponeurotic defect closure during the experimental modelling of IPOM.

KEY WORDS: ventral hernia, mesh fixation, defect closure, IPOM

Wiad Lek. 2020;73(6):1217-1222

INTRODUCTION

Ventral hernias are one of the most common pathologies in surgery. The incidence ranges widely from 2 to 69% and depends on the type of ventral hernia. A postoperative hernia is observed in 10-20% of patients undergoing laparotomy. [1-5]

The mesh sutured repair of the hernia defect is a standard procedure for the surgical treatment of ventral hernias during routine surgery. [6] In hernioplasty, the mesh-based repair method has repeatedly demonstrated its effectiveness compared to the suture-based closure techniques in various modifications. The International Endohernia Society notes in its recommendations that the use of meshes in hernioplasty reduces a hernia recurrence rate significantly compared to the defect closure without mesh. [7] The laparoscopic intraperitoneal onlay mesh repair demonstrates a lower percentage of local postoperative complications compared with the open ventral hernia repair. [8] However, laparoscopic surgery does not always involve hernia defect closure. Suwa K et al. emphasises on lack of the research publications that analyse the outcomes of the IPOM procedure with and without hernia defect closure before mesh placement. Hernia defect closure before the IPOM procedure is associated with more favourable surgical outcomes. [9] However, in a study of 134 patients, Gonzalez A et al. observed a higher

recurrence rate of 7.5% in the group without hernia defect closure compared to 1.5% in the group with hernia defect closure before the IPOM procedure. [10] The availability of mostly comparative studies and a limited sample of patients cannot provide reliable evidence for determining the effectiveness of the IPOM procedure without hernia defect closure. Since the hernia recurrence occurs at the site of separation of the mesh from the anterior abdominal wall, in our experimental study, we investigated the strength of the mesh fixation to the parietal peritoneum by evaluating different closure techniques for hernia repair.

THE AIM

The aim of the present research is to compare the mesh implantation and the strength of the mesh fixation to the anterior abdominal wall by modelling the IPOM procedure with and without aponeurotic defect closure (a modelled hernia defect).

MATERIALS AND METHODS

The experimental study evaluates the outcomes of the IPOM technique. The method was modelled and applied to 12 rabbits. The experimental animals (rabbits) were selected based on the possibility of modelling the intra-

peritoneal placement of a 4x4cm composite mesh, which is usually technically difficult in small rodents. All animals were quarantined and kept under standard conditions. The study used rabbits of both sexes, of the Russian Chinchilla breed, with weight from 2.1 to 2.9 kg.

The experimental animals were randomly divided into 2 groups of 6 rabbits. In both groups, surgery was started by performing a laparotomy through a longitudinal incision of the skin along the median line up to 4 cm long. Fig. 1 The hernia defect, measuring 1 x 1 cm along the median line, was modelled in all rabbits in both groups. In the experimental group, the intraabdominal implantation of a 4 x 4 cm composite mesh without hernia defect closure was performed. In both groups, a lightweight polypropylene mesh encapsulated in soluble poly-p-dioxanone (PDS II) was used. On one side, the mesh is covered with oxidized regenerated cellulose, which is placed inside to contact the visceral peritoneum. In this case, there was obtained an overlap of the mesh at least 1 cm beyond the hernia defect in all directions. In the control group, the intraabdominal hernioplasty was modelled in 6 rabbits and a 4 x 4 cm composite mesh was implanted together with hernia defect closure. In both groups, the mesh was fixed with separate interrupted sutures at 8 sites transaponeurotically to the parietal peritoneum. Fig. 2 The restoration of the integrity of the anterior abdominal wall was carried out in layers by applying a continuous suture to the aponeurosis of the rectus abdominis and to the skin. At the end of surgery, the wound was dressed with an aseptic bandage and a protective band was applied.

All surgical interventions were carried out in compliance with the requirements of the European Convention for the Protection of Vertebrate Animals used for Experimental and other Scientific Purposes (1986) and Scientific and Practical Recommendations for the Maintenance of Laboratory Animals and their Operation by the State Pharmacological Centre of the Ministry of Health of Ukraine (2002), which was confirmed by the decision of the Ethics Committee of the Bogomolets National Medical University.

In both groups, the operations were performed under general anaesthesia, with the requirements of aseptic and antiseptic. As premedication, all animals were administered 0.4 ml of a 2% solution of xylazine hydrochloride. For the purpose of sedation and analgesia, 0.8 ml of a 0.1% solution of medetomidine hydrochloride was administered. The animals were placed on the operating table with their backs down, with each leg fixed separately. The anterior abdominal wall hair was removed by the method of dry shaving.

At the end of surgery in both groups, all the rabbits were administered 0.8 ml of 0.5% solution of atipamezole hydrochloride to eliminate sedation. Additionally, all animals were administered ketoprofen 3 mg / kg subcutaneously for analgesia. Antibiotic prophylaxis was performed by intramuscular injection of cefazolin 1.0 g 30 min before surgery and 12 hours after surgery. All the animals were in a vivarium with a standard mode of stay and food.

In both groups, the animals were removed from the experiment on the 90th day by overdose of drugs for anaes-

thesia – intravenous administration of 1.0 g of sodium thiopental, diluted in 5 ml of 0.9% sodium chloride solution.

After opening of the abdominal cavity, macroscopic assessment of the severity of adhesions was performed. For this purpose, we used the classification, proposed by Zühlke et al. in 1990, to evaluate the severity of adhesions in the abdominal cavity in experimental animals. [11] The severity of adhesions is scored according to the macroscopic evaluation and classified as:

Grade I – fibrin deposits, tiny filmy adhesions or sporadic adhesions between the organs that can be separated by blunt dissection;

Grade II – filmy adhesions that can be separated by blunt dissection, but there are also some adhesions with initial vascularization, which can only be separated by sharp dissection;

Grade III – adhesions with clear vascularization, dense and filmy adhesions that can only be separated by sharp dissection;

Grade IV – dense and severe adhesions between the organs that can only be separated by sharp dissection; damage of organs is hardly preventable during surgical separation.

The presence of displacements and partial or complete separation of the mesh from the parietal peritoneum were also evaluated.

After separation of adhesions by partially blunt and partially sharp dissection, the material was collected for the histological examination and evaluation of the strength of the mesh implantation into the anterior abdominal wall layer. The “anterior abdominal wall – mesh” complex was removed completely together with the adjacent tissues of the muscular-aponeurotic layer of the anterior abdominal wall. The fixation of the material was carried out with 10% formalin solution in water.

The microscopic evaluation of mesh implantation into the tissues of the anterior abdominal wall was performed by histological examination of the removed “anterior abdominal wall – mesh” complex.

The strength of the mesh fixation to the anterior abdominal wall of the rabbit was evaluated by the maximum shear stresses at the time of destruction of the sample for the “anterior abdominal wall – mesh” complex. The shear stress was taken as $\tau^* = \frac{P}{A}$, where P is the applied force, A is the contact area of the mesh and the muscle tissue of the anterior abdominal wall, $A = a \cdot b$. Fig. 3

a – the length of the fusion between mesh and the fragment of the anterior abdominal wall, b – the width of the fusion between mesh and the fragment of the anterior abdominal wall, c – the thickness of mesh, d – the length of the free edge of the fragment of the anterior abdominal wall, e – the thickness of the fragment of the anterior abdominal wall (muscular tissue), f – the length of the free edge of mesh, P – the direction of the effort applied.

The mechanical strength tests were performed on an PM-05 machine with an electromechanical drive.

RESULTS

In both groups, no signs of intra- and postoperative complications were observed.



Fig. 1. Intraoperative photo of laparotomy access.

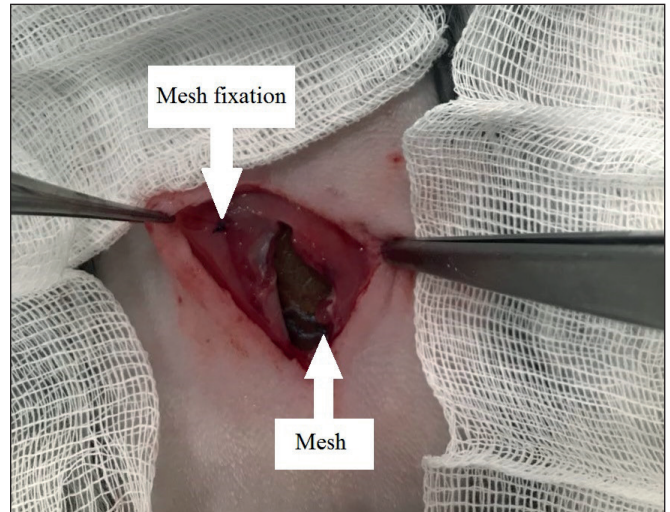


Fig. 2. Intraoperative photo of the mesh fixation to the anterior abdominal wall.

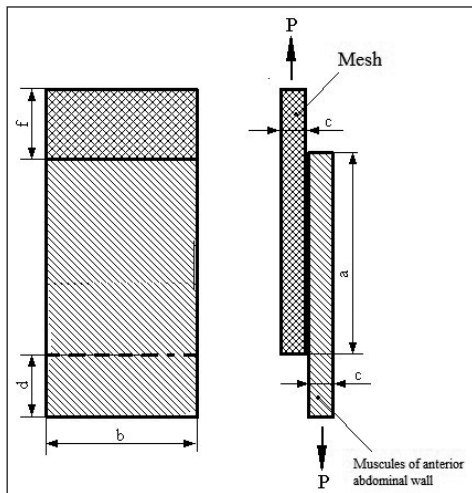


Fig. 3. Scheme of the study of the sample shear.



Fig. 4. Photo of partial separation of the mesh from the anterior abdominal wall.



Fig. 5. Photo of the mesh implantation into the anterior abdominal wall layer.

Table I. Characteristics of the severity of adhesions in animals of the experimental and control groups according to the classification of Zühlke et al.

Group	Nº of rabbit	Grade I	Grade II	Grade III	Grade IV
Experimental (n=6)	1e		+		
	2e		+		
	3e	+			
	4e	+			
	5e	+			
	6e			+	
Control (n=6)	1c	+			
	2c	+			
	3c				+
	4c			+	
	5c			+	
	6c	+			

On the 90th day in both groups, any displacement or complete separation of the mesh from the parietal peritoneum was not seen. In the control group in 1 case, there was an area of partial separation of the mesh from the parietal

peritoneum. Fig. 4 This might be due to the limited number of stitches that were put on and the lack of the possibility of fixation by the double crown method in the experiment. In all animals of the experimental group and in 5 animals

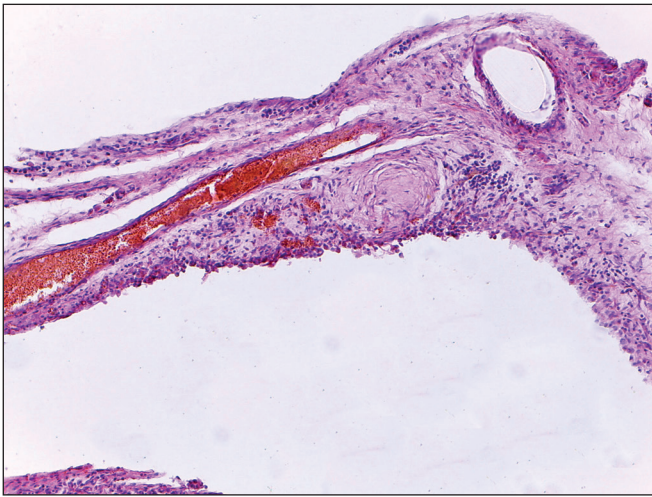


Fig. 6. Microphoto of tissue section around the mesh in the experimental group. Observation period 90 days. Staining with hematoxylin and eosin. Magnification 100.

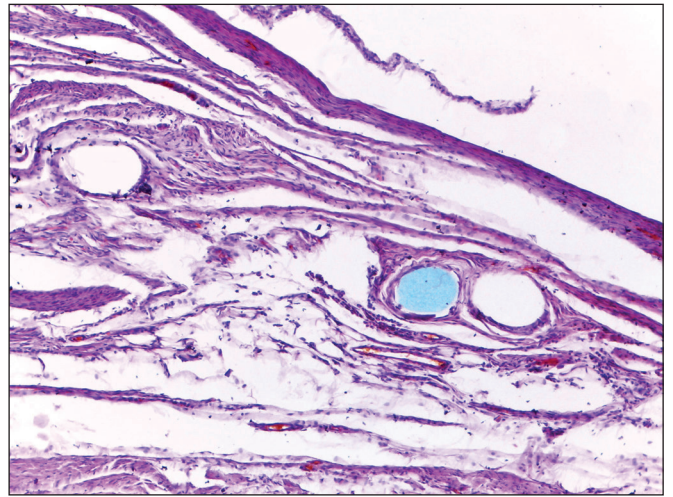


Fig. 7. Microphoto of tissue section around the mesh in the control group. Observation period 90 days. Staining with hematoxylin and eosin. Magnification 100.

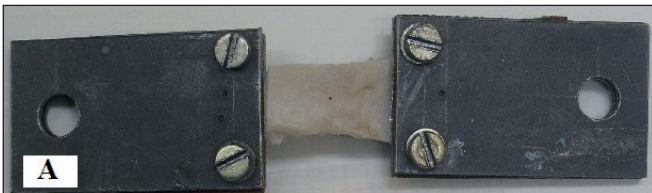


Fig. 8. The “anterior abdominal wall – mesh” complex before (A) and after (B) destruction.

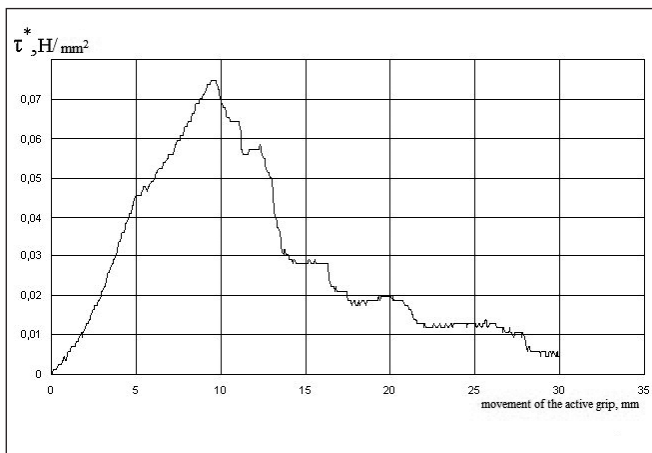


Fig. 9. Schedule of stretching and destruction of the “anterior abdominal wall – mesh” sample complex in the experimental group.

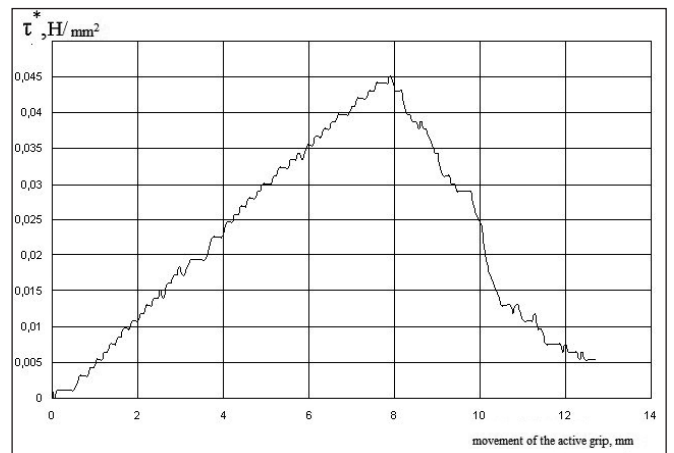


Fig. 10. Schedule of stretching and destruction of the “anterior abdominal wall – mesh” sample complex in the control group.

of the control group, macroscopically complete fusion of the implant with the parietal peritoneum of the anterior abdominal wall was observed. Fig. 5

Table I presents the comparative characteristics of the severity of adhesions in the abdominal cavity according to the macroscopic evaluation in the experimental and control groups, based on the classification of Zühlke et al. (1990).

In the experimental group, 3 rabbits (50%) had fibrin deposits on the visceral surface of the mesh, 3 rabbits (50%) had filmy adhesions with loops of the small intestine and the large cap, which were easily destroyed by the instrument. In the control group, in 1 (16.6%) case, dense

adhesions were observed between the mesh and the strand of the large cap – grade III. Fig. 4 However, in our opinion, this can be explained by partial separation of the mesh from the parietal peritoneum, observed in this particular case, and prolonged traumatization of the free edge of the mesh of the visceral peritoneum, since adhesions were formed at the site of the free edge of the mesh and were not seen in the place of its complete fusion with the parietal peritoneum. Filmy adhesions were detected in 2 (33.4%) cases, and in 3 (50%) cases there were seen the layers of fibrin sporadically distributed on the surface of the mesh implanted into the anterior abdominal wall. The results

of macroscopic evaluation allow us to conclude that the extent of adhesion formation in the abdominal cavity is comparable in both groups ($p > 0.05$).

The histological examination of the samples of the “anterior abdominal wall-mesh” complex showed that the experimental group formed a significant amount of scar tissue at the site of the mesh. The implantation area was infiltrated with lymphocytes, especially around the mesh. Mesothelioma lining was not traceable. At the implantation site, there were observed a few dilated blood vessels accommodating increased blood volume. In some areas there were accumulations of macrophages with increased volume of cytoplasm. Moderate signs of inflammation were noted at the site of the mesh. Fig. 6

In the control group, the following changes were observed: mesothelioma lining on the side of the abdominal cavity was absent in some areas where adhesions were seen. Each filament of the mesh was surrounded by a connective tissue capsule. The capsules were mostly thin, but the formation of thick inhomogeneous capsules was noted around some filaments. The mesh sprouted with a mature dense connective tissue. The connective tissue was predominantly layered at the site of the mesh, and moderately infiltrated by lymphocytes and neutrophilic granulocytes near the filaments. Some capsules contained small, mostly flattened, giant foreign body cells or single activated macrophages. No signs of abnormal changes were found in the surrounding tissues. Fig. 7

In accordance with the obtained findings of histological examinations, it was found out that, in the experimental group, the mesh was surrounded by a connective tissue and it was fixed to the anterior abdominal wall. However, mesothelioma lining was not traced, and the mesh was surrounded by scar tissue. In addition, in the experimental group there were observed moderate signs of inflammation, which were not seen in the control group. The observed changes could result from the contact between the edges of a truncated unclosed aponeurosis and the parietal surface of the mesh during a hernia defect modelling.

The assessment of the strength of the mesh fixation to the anterior abdominal wall showed that the average value of maximum shear stress (t_{max}^*) for the “anterior abdominal wall – mesh” complex was 0.059 ± 0.02 MPa in the experimental group and 0.066 ± 0.03 MPa in the control group. According to the results of the study, the strength of mesh fixation was significantly comparable in both groups ($p > 0.05$). Fig. 8, 9, 10

DISCUSSION

The experiment demonstrated the comparability of the strength of the mesh fixation to the anterior abdominal wall with and without aponeurotic defect closure during modelling of the IPOM procedure. It is not possible to extrapolate the results of the mesh fixation experiment to patients with hernia with 100% confidence. The standard IPOM technique involves fixing the mesh by the double crown method and the presence of a hernia sack, that could not be reproduced in the exper-

iment. These differences can affect the implantation of the mesh. Zeichen MS et al. indicated that the recurrence rate in patients without hernia defect closure was 19.18%, while with hernia defect closure it was 6.25%. [12] However, he noted that the difference did not reach statistical significance. This may be due to the different number of patients sampled to compare the two methods. In an overview study of the effectiveness of IPOM with hernia defect closure, Suwa K et al. indicated the inability to objectively evaluate the difference in effective defect closure and the benefits of its suture-based repair. [9] The results of the existing studies differ in the techniques for the IPOM procedure with hernia defect closure, the type of the mesh selected, the conditions for the study. Therefore, it is currently not possible to reliably determine the benefits of the IPOM procedure that is performed with or without hernia defect closure. Lambrecht JR et al. compared the outcomes of the hernia repair with and without hernia defect closure. The study included 194 patients with primary and postoperative ventral hernias, 107 of whom were enrolled in a randomized controlled multicentre trial, 87 were retrospectively studied. [13] The study did not establish the benefits of long-term outcomes after hernia defect closure using absorbable suture but revealed a higher overall complication rate. The use of 4 different methods for aponeurotic defect closure and mesh fixation (suture-raphe, suture-nonraphe, double crown-raphe, double crown-non-raphe) in 107 patients and the creation of 8 clusters in 4 unbalanced randomization groups did not reveal the benefits of one of the presented surgical methods. There is a need for randomized, controlled, multicentre trials, in which a standardized IPOM technique with and without hernia defect closure is applied to evaluate the effectiveness of each method in a larger sample of patients.

CONCLUSIONS

The strength of the mesh fixation to the parietal peritoneum and its implantation into the anterior abdominal wall is comparable with or without aponeurotic defect closure during the experimental modelling of intraperitoneal only mesh repair.

REFERENCES

1. Dabbas N., Adams K., Pearson K. et al. Frequency of abdominal wall hernias: is classical teaching out of date? *JRSM Short Rep.* 2011;2(1):1-6. doi:10.1258/shorts.2010.010071.
2. Seiler C., Bruckner T., Diener M. et al. Interrupted or Continuous Slowly Absorbable Sutures For Closure of Primary Elective Midline Abdominal Incisions. *Ann Surg.* 2009;249(4):576-582. doi:10.1097/sla.0b013e31819ec6c8.
3. Mudge M., Hughes L. Incisional hernia: A 10 year prospective study of incidence and attitudes. *British Journal of Surgery.* 1985;72(1):70-71. doi:10.1002/bjs.1800720127.
4. Walming S., Angenete E., Block M. et al. Retrospective review of risk factors for surgical wound dehiscence and incisional hernia. *BMC Surg.* 2017;17(1). doi:10.1186/s12893-017-0207-0.
5. Alnassar S., Bawahab M., Abdoh A. et al. Incisional hernia postrepair of abdominal aortic occlusive and aneurysmal disease: five-year incidence. *Vascular.* 2012;20(5):273-277. doi:10.1258/vasc.2011.0a0332.

6. Rutkow I. Demographic and socioeconomic aspects of hernia repair in the United States in 2003. *Surgical Clinics of North America*. 2003;83(5):1045-1051. doi:10.1016/s0039-6109(03)00132-4.
7. Bittner R., Bingener-Casey J., Dietz U. et al. Guidelines for laparoscopic treatment of ventral and incisional abdominal wall hernias (International Endohernia Society (IEHS) – Part 1. *Surg Endosc*. 2013;28(1):2-29. doi:10.1007/s00464-013-3170-6.
8. Sauerland S., Walgenbach M., Habermalz B. et al. Laparoscopic versus open surgical techniques for ventral or incisional hernia repair. *Cochrane Database of Systematic Reviews*. 2011. doi:10.1002/14651858.cd007781.pub2.
9. Suwa K., Okamoto T., Yanaga K. Closure versus non-closure of fascial defects in laparoscopic ventral and incisional hernia repairs: a review of the literature. *Surg Today*. 2015;46(7):764-773. doi:10.1007/s00595-015-1219-y.
10. Gonzalez A., Romero R., Seetharamaiah R. et al. Laparoscopic ventral hernia repair with primary closure versus no primary closure of the defect: potential benefits of the robotic technology. *The International Journal of Medical Robotics and Computer Assisted Surgery*. 2014;11(2):120-125. doi:10.1002/rcs.1605.
11. Zühlke H.V., Lorenz E.M., Straub E.M. et al. Pathophysiology and classification of adhesions. *Langenbecks Arch Chir Verh Dtsch Ges Chir*. 1990, Suppl 2: 1009-1016.
12. Zeichen M., Lujan H., Mata W. et al. Closure versus non-closure of hernia defect during laparoscopic ventral hernia repair with mesh. *Hernia*. 2013;17(5):589-596. doi:10.1007/s10029-013-1115-6.
13. Lambrecht J., Vaktskjold A., Tronsen E. et al. Laparoscopic ventral hernia repair: outcomes in primary versus incisional hernias: no effect of defect closure. *Hernia*. 2015;19(3):479-486. doi:10.1007/s10029-015-1345-x.

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Conflict of interest:

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DO *H. PYLORI* STATUS AND SMALL INTESTINAL BACTERIAL OVERGROWTH DETERMINE THE CLINICAL COURSE OF CHRONIC ACTIVE GASTRITIS IN PATIENTS WITH TYPE 2 DIABETES MELLITUS?

DOI: 10.36740/WLek202006127

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ABSTRACT

The aim: To define clinical peculiarities of chronic active gastritis in patients with type 2 diabetes mellitus (T2DM) considering *Helicobacter pylori* (HP) status and small intestinal bacterial overgrowth (SIBO).

Materials and methods: 172 patients with chronic active gastritis were enrolled in the study, 92 out of them had concomitant T2DM. Symptoms were collected with the questionnaire, HP infection was diagnosed with stool antigen test, SIBO was assessed with glucose hydrogen breath test.

Results: 87.5% (n=70) patients with chronic gastritis without DM had epigastric pain, however those with T2DM reported pain only in 41.3% (n=38) cases. Other symptoms included: nausea, bloating, early satiety, postprandial fullness, heartburn, belching and vomiting. HP infection in patients with chronic gastritis and concomitant T2DM is significantly associated with symptoms of epigastric pain (OR=2.78, 95%CI 0.92-8.41), bloating (OR=3.92, 95%CI 1.40-10.99), nausea (OR=2.32, 95%CI 0.85-6.30), postprandial fullness (OR=1.45, 95%CI 0.54-3.87) and belching (OR=1.01, 95%CI 0.32-3.16), whereas SIBO – with bloating (OR=8.82, 95%CI 2.88-27.01), nausea (OR=5.15, 95%CI 1.88-14.10) and belching (OR=2.53, 95%CI 0.67-9.52).

Conclusions: Patients with T2DM and chronic active gastritis report epigastric pain significantly less than non-diabetics. HP infection probably plays a prominent role in development of epigastric pain in patients with T2DM. Additionally, HP is linked to SIBO, which may lead to bloating, belching and nausea onset.

KEY WORDS: type 2 diabetes mellitus, chronic gastritis, *Helicobacter pylori*, small intestinal bacterial overgrowth, gastrointestinal symptoms

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INTRODUCTION

Comorbidity is always a challenge for diagnostics and therapy of the vast majority of diseases. Clinicians have to consider all the possible interactions, common pathways, and issues that may occur as a result of overlap between two or more disorders. Considering Type 2 diabetes mellitus (T2DM) as an epidemic in the XXI century [1,2], it becomes obvious that different comorbidities associated with T2DM need comprehensive study. As estimated by the International Diabetes Federation in 2019, there are 463 million people with DM worldwide, and this number is increasingly growing [3]. Type 1 diabetes mellitus (T1DM) has always been in the focus of researches, but the data on T2DM is quite limited and controversial. Longstanding T2DM results in complications that may affect any organ in human organism through neuropathy and angiopathy.

It goes without saying that disturbances in gastrointestinal (GI) function may affect the pharmacodynamics of oral hypoglycemic agents and postprandial glucose level. In this case «vicious circle» may be formed: impaired motor function of GI tract may slow down the transit and further absorption of nutrients (including glucose). In turn the postprandial blood glucose profile will be shifted, which dissociates time of plasma glucose concentration peak and

time-related mechanisms of action of hypoglycemic agents. In this case it becomes difficult to maintain the target glucose level within normal ranges, and poorly controlled DM predisposes to complications development, including gastrointestinal [4,5].

Thus, impaired blood glucose levels may predetermine gastrointestinal disorders in patients with DM. On the other hand, gastrointestinal diseases may affect as postprandial blood glucose level as pharmacodynamic of oral hypoglycemic agents. Described mechanisms highlight the importance of GI functioning correction in terms of DM management, enhancing in this way adequate glycemic control.

One of the most common GI pathologies is chronic gastritis, which is often left underestimated in clinical practice, however it may result in peptic ulcer and gastric cancer [6]. Some studies suggest that patients with T2DM are more predisposed to stomach cancer [7,8] than those without DM. In addition T2DM is a risk factor for peptic ulcer bleeding [9] and delayed ulcer healing [10]. Hence, the comorbidity between T2DM and chronic gastritis is considered to be a relevant aspect of clinical research.

It is well known that *Helicobacter pylori* (HP) is the leading etiological factor of gastritis, peptic ulcer and stomach

cancer. As well stress factors are thought to play important role in exacerbations of chronic gastritis and peptic ulcer [11]. The prevalence of HP infection among patients with DM is debatable. However, some studies suggest the link between HP infection and T2DM, claiming that prevalence of HP among patients with T2DM is much higher than in non-diabetics [12–14] and patients with T1DM [15]. The group of Chinese researchers found opposite relationship: people with positive HP status are under the risk of DM [16]. The relevance of HP diagnostics in patients with DM is also supported by better glycemic control after HP-eradication [17], which is probably realized through pro-inflammatory factors decrease [18].

The first step of chronic gastritis diagnostics in patients with T2DM is based on clinical symptoms. Recently one descriptive, cross-sectional study showed that 91.4% patients with DM express mainly such GI symptoms as flatulence, retrosternal pain, belching, postprandial fullness, and constipation [19]. It is typical for patients with diabetes not to have pain syndrome in case of GI disorders, which often complicates timely diagnostics. In addition, severe forms of gastritis and ulcer disease are often followed by mild dyspeptic syndrome [20]. That is why it is important to understand clinical manifestation of GI diseases in patients with DM to make an accurate diagnosis and prescribe proper treatment in time. However, there are no studies, focused on clinical features of stomach disorders in patients with DM depending on their HP status.

Nowadays much attention is paid to GI microbiome. Despite the fact that HP is considered to be the major etiological factor of many stomach diseases, a lot of investigations of GI microbiota, including gastric, are being performed. Even though the data is limited, the role of microbiota impairment was established even in carcinogenesis [21] and bacterial overgrowth was found to promote gastric cancer [22]. Summarizing the role of microbiota in gastric disorders and its probable influence on glycemic control in patients with DM [23], GI bacteria in patients with DM and GI disorders need to be assessed more attentively.

THE AIM

To characterize the upper GI symptoms of chronic active gastritis in patients with T2DM in comparison to non-diabetic patients and define the peculiarities of chronic gastritis in patients with T2DM considering HP infection and small intestinal bacterial overgrowth (SIBO).

MATERIALS AND METHODS

The current multi-centered, descriptive, cross-sectional study was conducted in 2017–2019. 172 patients with clinically, endoscopically and histologically confirmed chronic active gastritis were enrolled. 92 participants had T2DM (diabetic group) and 80 didn't have DM or impaired glycemic states (control non-diabetic group). T2DM was previously diagnosed and defined as fasting plasma glucose (FPG) ≥ 7.0 mmol/L or glycated haemoglobin (HbA1c)

$\geq 6.5\%$ [3]. The diagnosis of chronic gastritis was made on the basis of esophagogastroduodenoscopy (EGD) with biopsy (7 mucosal biopsy samples were analysed). Subjects with oncopathology, autoimmune disorders, inflammatory bowel diseases, acute infections, severe renal and hepatic diseases and peptic ulcer at the moment of investigation were excluded prior to the study. To define HP-infection stool antigen test (SATs) was carried out. SIBO was diagnosed with glucose hydrogen breath test (HBT) when there was a rise in hydrogen more than 12 ppm above the basal level after glucose ingestion [24]. The symptoms were collected with the questionnaire aiming to register the presence of the next upper GI symptoms: epigastric pain, bloating, early satiety, heartburn, nausea, vomiting, postprandial fullness, belching. Additional information on study population, glycemic profile, hypoglycemic therapy, concomitant pathology and complications of DM was obtained from the latest patients' medical records.

Ethical norms were adhered: all enrolled patients were fully informed about the research and informed consents were obtained before the study. The study project was approved by the bioethics committee of Ukrainian Medical Stomatological Academy, Poltava, Ukraine (order number 156, 20.06.17).

Data reported as mean \pm standard deviation and number (%). Statistical analysis to assess the link between events was conducted with the use of odds ratio (OR) parameter. For statistical analysis software STATA/IC v.16 for Windows (Stata Corp LLC, 2019) was applied.

RESULTS

CHARACTERISTICS OF STUDY POPULATION

The total of 172 patients with endoscopically and histologically confirmed chronic active gastritis participated in the research. Those who did not meet the criteria of inclusion were previously excluded. All patients were subdivided onto 2 groups: group I (n=92) – patients with chronic active gastritis and T2DM; group II (n=80) – control group of patients with chronic active gastritis without DM.

The gender distribution in the group I was: male – 68,5% (n=63), female – 31,5% (n=29); in the group II: male – 57,5% (n=46), female – 42,5% (n=34). Male gender is considered to be linked to the chronic gastritis in patients with T2DM (OR=1.61, 95% CI 0.86–2.99). The mean age of the patients in the Ist group was 61.6 \pm 9.0 years, in the IInd group – 54.0 \pm 13.5 years.

The mean level of FBGL in patients with T2DM was 7.3 \pm 2.4 mmol/L, HbA1c – 8.7 \pm 2.3%. About 39.1% (n=36) of patients with T2DM and chronic gastritis had decompensated T2DM, 83.7% (n=77) were diagnosed with diabetic angiopathy and diabetic neuropathy. The glycemic control was maintained in 59,8% (n=55) patients with peroral hypoglycemic agents (metformin, glyclazide, glibenclamid), in 18,5% (n=17) cases – with insulin therapy, and 21,7% (n=20) of patients controlled their glucose levels with dietary and lifestyle modifications.

Table I. Distribution of symptoms of chronic gastritis in patients with T2DM (n=92) depending on HP-status and SIBO.

Symptoms (total number of cases in group)	HP status		SIBO status	
	HP "+" (n=71)	HP "-" (n=21)	SIBO "+" (n=69)	SIBO "-" (n=23)
Epigastric pain (n=38)	46.5% (n=33)	23.8% (n=5)	40.6% (n=28)	43.5% (n=10)
Bloating (n=54)	66.2% (n=47)	33.3% (n=7)	71.0% (n=49)	21.7% (n=5)
Early satiety (n=44)	38.0% (n=27)	80.9% (n=17)	46.4% (n=32)	52.2% (n=12)
Heartburn (n=37)	40.9% (n=29)	38.1% (n=8)	37.7% (n=26)	47.8% (n=11)
Nausea (n=62)	71.8% (n=51)	52.4% (n=11)	76.8% (n=53)	39.1% (n=9)
Vomiting (n=6)	5.6% (n=4)	9.5% (n=2)	5.8% (n=4)	8,7% (n=2)
Postprandial fullness (n=46)	52.1% (n=37)	42.9% (n=9)	49,3% (n=34)	52.2% (n=12)
Belching (n=22)	23.9% (n=17)	23.8% (n=5)	27.5% (19)	13.0% (n=3)

PREVALENCE OF SYMPTOMS

Upper GI symptoms of chronic gastritis in the patients of the Ist group with T2DM differed from the patients in the IInd group. The main contrast was observed regarding abdominal pain: 87.5% (n=70) patients with chronic gastritis without DM had epigastric pain, however those with T2DM reported pain only in 41.3% (n=38) of cases. Thus, T2DM was found to increase the risk of atypical presentation of gastritis without epigastric pain syndrome (OR=8.91, 95%CI 4.17-19.05). On the contrary, patients with chronic gastritis and T2DM reported dyspeptic symptoms more commonly than patients without T2DM: bloating 58.7% (n=54) vs 40.0% (n=32), early satiety 47.8% (n=44) vs 15.0% (n=12), heartburn 40.2% (n=37) vs 30.0% (n=24), nausea 67.4% (n=62) vs 52.5% (n=42), vomiting 6.5% (n=6) vs 1.5% (n=1), postprandial fullness 50.0% (n=46) vs 11.3% (n=9) respectively. However, belching was presented more among patients without T2DM 42.5% (n=34) vs 23.9% (n=22).

SYMPTOMS AND HP INFECTION

According to the obtained results, HP infection was detected in 77% (n=71) patients with chronic gastritis and concomitant T2DM (group I), while only 60% (n=48) of those without DM had this bacterium (group II).

After T2DM patients of the Ist group (n=92) were additionally subdivided onto HP-positive (n=71) and HP-negative cases (n=21), the next data was received. Epigastric pain, bloating and nausea were mainly reported by patients with chronic HP-positive gastritis and T2DM in comparison to non-diabetic patients, namely 46.5% (n=33) vs 23.8% (n=5), 66.2% (n=47) vs 33.3% (n=7), 71.8% (n=51) vs 52.4% (n=11) respectively (Table I). HP infection in

patients with chronic gastritis and concomitant T2DM is significantly associated with symptoms of epigastric pain (OR=2.78, 95%CI 0.92-8.41), bloating (OR=3.92, 95%CI 1.40-10.99), nausea (OR=2.32, 95%CI 0.85-0.6.30), postprandial fullness (OR=1.45, 95%CI 0.54-3.87) and belching (OR=1.01, 95%CI 0.32-3.16), whereas there is no association with early satiety, heartburn and vomiting.

SYMPTOMS AND SIBO

In our study we found that SIBO was another common state in patients with chronic gastritis and T2DM (group I), as 75% (n=69) of them had positive HBT with glucose. Patients with chronic gastritis without DM (group II) were diagnosed with SIBO only in 41.3% (n=33) cases.

After T2DM patients of the Ist group (n=92) were additionally subdivided onto SIBO-positive (n=69) and SIBO-negative subjects (n=23), we detected that those with SIBO express vomiting in 5.8% (n=4) cases, belching – in 27.5% (n=19), heartburn – in 37.7% (n=26), epigastric pain – in 40.6% (n=28), early satiety – in 46.4% (n=32), postprandial fullness – in 49.3% (n=34), bloating – in 71.0% (n=49), nausea – in 76.8% (n=53) cases (Table I). SIBO in patients with chronic gastritis and T2DM is strongly associated with such symptoms as bloating (OR=8.82, 95%CI 2.88-27.01), nausea (OR=5.15, 95%CI 1.88-14.10) and belching (OR=2.53, 95%CI 0.67-9.52).

ASSOCIATION OF HP AND SIBO

As mentioned before, SIBO has been diagnosed in 75% (n=69) diabetic patients of the Ist group. Out of them 79.7% (n=55) were HP-positive and 20.3% were (n=14) HP-negative. HP infection in patients with T2DM and chronic gastritis was

statistically significantly linked to SIBO (OR=1.72, 95%CI 0.59-4.98). While in the IInd (control) group such association was absent, only 41.3% (n=33) patients had SIBO, 57.6% (n=19) out of them were HP-positive and 42.4% (n=14) – HP-negative (OR=0.84, 95%CI 0.34-2.09). Hence, patients with T2DM and HP-positive gastritis are at the risk of SIBO.

DISCUSSION

It is known, that GI symptoms are prevalent in T2DM [5,19,25,26], but the exact mechanisms of this process are still unknown. Results of some studies suggest that GI symptoms predominate in women with DM more than in men [19,25–27], but these studies were focused on symptoms itself, not on specific GI pathology. Speaking specifically about gastritis, Yang et al. observed more severe forms of inflammation exactly in male patients with T2DM, not in females [28]. In the current study upper GI symptoms among patients with T2DM were also linked to the male sex, which may be explained by distinctive features of men's lifestyle and presence of harmful habits, however these aspects were not studied in the current research.

The most common complications of DM are diabetic angiopathy and diabetic neuropathy, including autonomic neuropathy [3]. In such conditions multiple organs, as well stomach, may suffer from lack of blood supply and proper innervation, resulting in GI disturbances [29]. 83.7% of patients with T2DM in our study were diagnosed with these complications, that in turn could negatively influence on gastric function and GI motility in general. Neuropathy probably affects pain perception, that was shown in our study, as T2DM significantly decreases epigastric pain onset in patients with chronic active gastritis and T2DM in comparison to non-diabetics (87.5% vs 41.3%). Khoshbaten et al. reported even lower incidence of abdominal pain among the patients with DM – 31% [5], nonetheless in our study we included patients with confirmed gastric pathology, which can explain the higher rates of pain. Regarding the fact that chronic gastritis is typically followed by pain syndrome, we can assume that T2DM places patients at risk of atypical chronic gastritis without pain syndrome. At the same time, subjects with T2DM express such symptoms as bloating, early satiety, heartburn, nausea, vomiting and postprandial fullness more often than patients without DM. Our results correlate with Asgharnezhad's et al. research [19], besides belching, which in our study was reported more frequently among the patients without T2DM than with T2DM (42.5% vs 23.9%). It is important to notice that delayed gastric emptying is often followed by nausea [25]. All these findings should be considered while managing patients with GI pathology and concomitant T2DM, as untimely made diagnosis may lead to more dramatic consequences, such as stomach ulcer, bleeding, cancer etc., especially in terms of comorbidity with DM [7–9]. This idea was also supported by the research of Boehme et al., reporting high prevalence of silent severe gastritis and other stomach diseases in patients with T2DM [20].

A wide range of studies has demonstrated that patients

with DM are at a greater risk of HP infection [12–16], however the results certainly depend on the country where the research has been carried out and epidemiological situation with HP in the region. Some researchers have proved that HP infection is highly associated with T2DM, however its prevalence widely vary from 59% to 75% [13–15]. The analysis in current study showed that HP infection was the main cause of chronic gastritis in patients with T2DM (77%). It is difficult to assert in scope of our study whether DM is associated with HP infection or not, as only patients with chronic active gastritis were included. However, we noticed that HP probably plays significant role in development of epigastric pain in patients with T2DM (which is not generally typical for patients with T2DM, as mentioned above), as 46.5% HP-positive diabetic patients reported this complaint. Diabetes itself may lead to dyspepsia and gastropathy, so probably its combination with HP differs symptomatically and pathogenetically. Thus, it is possible to conclude that patients with T2DM and epigastric pain should be checked for HP infection, as in this case the probability of positive result is much higher, than if the patient has no epigastric pain.

Another peculiarity of chronic gastritis in patients with T2DM is commonly diagnosed SIBO (75% vs 41.3% non-diabetic cases). In contrast, some literature data suggest that patients with T1DM are diagnosed with SIBO in 37.8% cases [30]. Such symptoms as bloating, belching and nausea in patients with chronic gastritis and T2DM are significantly associated as with HP infection, as with SIBO, which has been diagnosed in 77.5% HP-positive cases and 66.7% HP-negative cases. It was also confirmed that HP infection is significantly associated with SIBO in patients with chronic gastritis and T2DM (OR=1.72, 95%CI 0.59-4.98). Such relationship is observed probably due to GI hypomotility that result in bacterial overgrowth in different parts of GI tract [31]. SIBO may be also triggered by such factors as: stomach hypoacidity and decreased bile flow. These factors took place in our study among diabetic cohort: the stomach acidity according to the EGD protocol was >2.1 in 71.7% (n=66); and 63.0% (n=58) had concomitant biliary disorders. Summarizing the risk factors for SIBO in patients with T2DM, it was estimated that hypoacidity predisposes to SIBO onset (OR=2.87, 95%CI 1.08-7.60). The role of T2DM in SIBO development was also highlighted in one of American studies, where DM was found to be a risk factor for SIBO in patients with chronic pancreatitis [32].

As known, the main source of gas production in GI tract are bacteria, which produce it during their metabolism [24]. This may explain the relationship between SIBO and such symptoms as bloating and belching in patients with chronic gastritis and T2DM.

CONCLUSIONS

Patients with T2DM have some clinical peculiarities of chronic gastritis, that may be linked not only to diabetic neuro- and angiopathy, but also GI microbiota. Patients with T2DM report epigastric pain significantly less, than

non-diabetics, which makes T2DM the risk factor for atypical development of chronic gastritis without pain syndrome. In addition, patients with T2DM and chronic gastritis express nausea, bloating, early satiety, postprandial fullness, heartburn and vomiting more often than those without DM.

HP infection probably plays a prominent role in development of epigastric pain in patients with T2DM, as despite of low incidence of abdominal pain among diabetic patients, HP-positive subjects still report this complaint. Additionally, HP is linked to SIBO, which in turn may lead to bloating, belching and nausea onset. Thus, GI bacteria state might predetermine the spectrum of symptoms in patients with chronic gastritis associated with T2DM.

REFERENCES

- Standl E., Khunti K., Hansen T.B. et al. The global epidemics of diabetes in the 21st century: Current situation and perspectives. *Eur J Prev Cardiol.* 2019;26(2):7–14. doi: 10.1177/2047487319881021.
- Jaacks L.M., Siegel K.R., Gujral U.P. et al. Type 2 diabetes: A 21st century epidemic. *Best Pract Res Clin Endocrinol Metab.* 2016 Jun;30(3):331–43. doi: 10.1016/j.beem.2016.05.003.
- International Diabetes Federation. IDF Diabetes Atlas, 9th edn. Brussels, Belgium: 2019. Available at: <https://www.diabetesatlas.org>.
- Rayner C.K., Samsom M., Jones K.L. et al. Relationships of upper gastrointestinal motor and sensory function with glycemic control. *Diabetes Care.* 2001;24(2):371–81.
- Khoshbaten M., Madad L., Baladast M. et al. Gastrointestinal signs and symptoms among persons with diabetes mellitus. *Gastroenterol Hepatol from Bed to Bench.* 2011;4(4):219–23.
- Sipponen P., Maaros H.I. Chronic gastritis. *Scand J Gastroenterol.* 2015;50(6):657–67.
- Oberaigner W., Ebenbichler C., Oberaigner K. et al. Increased cancer incidence risk in type 2 diabetes mellitus: Results from a cohort study in Tyrol/Austria. *BMC Public Health.* 2014 Oct 10;14:1058. doi: 10.1186/1471-2458-14-1058.
- Wang M., Hu R.Y., Wu H. Bin et al. Cancer risk among patients with type 2 diabetes mellitus: A population-based prospective study in China. *Sci Rep.* 2015;5(June):1–7. doi:10.1038/srep11503.
- Peng Y.L., Leu H.B., Luo J.C. et al. Diabetes is an independent risk factor for peptic ulcer bleeding: A nationwide population-based cohort study. *J Gastroenterol Hepatol.* 2013;28(8):1295–9.
- Lim J.H., Kim S.G., Choi J. et al. Risk factors of delayed ulcer healing after gastric endoscopic submucosal dissection. *Surg Endosc.* 2015;29(12):3666–73.
- Tarasenko, L.M., Skrypnik, I.N., Neporada K.S. Parallelnykh metabolicheskikh narusheniy v tkanyah zheludka i parodonta pri stressornykh vozdeystviya [Simultaneous stress-induced metabolic changes in the stomach and periodontium]. *Bull Exp Biol Med.* 2000;130(7):639–41. (In Russian)
- Ebule I., Djune F., Njeambosay B. et al. Association of Helicobacter Pylori Infection and Diabetes Mellitus Type 2 Subjects in Yaounde Cameroon Using a Panel of Serum Biomarkers (PGI1, HplgG): A Case Control Study. *J Clin Gastroenterol Treat.* 2017;3(4):5–9.
- Tawfeeq R., Amin Z., Nuraddin S. et al. Relationship between type II diabetes mellitus and Helicobacter pylori infection in Erbil city. *Zanco J Med Sci.* 2019;23(1):43–50.
- Wali N., Waheed A., Aslam M. Association of helicobacter pylori infection in patients suffering from Type 2 Diabetes mellitus. *Pakistan J Med Heal Sci.* 2018;12(2):535–7.
- Li J.Z., Li J.Y., Wu T.F. et al. Helicobacter pylori infection is associated with type 2 diabetes, not type 1 diabetes: An updated meta-analysis. *Gastroenterol Res Pract.* 2017;2017:5715403. doi: 10.1155/2017/5715403.
- Wan Z., Song L., Hu L. et al. Helicobacter pylori infection is associated with diabetes among Chinese adults. *J Diabetes Investig.* 2020;11(1):199–205.
- Cheng K.P., Yang Y.J., Hung H.C. et al. Helicobacter pylori eradication improves glycemic control in type 2 diabetes patients with asymptomatic active Helicobacter pylori infection. *J Diabetes Investig.* 2019;10(4):1092–101.
- Bonfigli A.R., Boemi M., Festa R. et al. Randomized, double-blind, placebo-controlled trial to evaluate the effect of Helicobacter pylori eradication on glucose homeostasis in type 2 diabetic patients. *Nutr Metab Cardiovasc Dis.* 2016;26(10):893–8.
- Asgharnezhad M., Joukar F., Fathalipour M. et al. Gastrointestinal symptoms in patients with diabetes mellitus and non-diabetic: A cross-sectional study in north of Iran. *Diabetes Metab Syndr Clin Res Rev.* 2019;13(3):2236–40. doi: 10.1016/j.dsx.2019.05.028.
- Boehme M.W.J., Autschbach F., Ell C. et al. Prevalence of silent gastric ulcer, erosions or severe acute gastritis in patients with type 2 diabetes mellitus—a cross-sectional study. *Hepatogastroenterology.* 2007 Mar;54(74):643–8.
- Dias-Jácome E., Libânio D., Borges-Canha M. et al. Gastric microbiota and carcinogenesis: The role of non-Helicobacter pylori bacteria – A systematic review. *Rev Esp Enfermedades Dig.* 2016;108(9):530–40.
- Wang L., Zhou J., Xin Y. et al. Bacterial overgrowth and diversification of microbiota in gastric cancer. *Eur J Gastroenterol Hepatol.* 2016;28(3):261–6.
- Grasset E., Burcelin R. The gut microbiota to the brain axis in the metabolic control. *Rev Endocr Metab Disord.* 2019;20(4):427–38.
- Gasbarrini A., Corazza G.R., Gasbarrini G. et al. Methodology and indications of H2-breath testing in gastrointestinal diseases: The Rome consensus conference. *Aliment Pharmacol Ther.* 2009 Mar 30;29(1):1–49. doi: 10.1111/j.1365-2036.2009.03951.x.
- Chedid V., Brandler J., Vijayvargiya P. et al. Characterization of Upper Gastrointestinal Symptoms, Gastric Motor Functions, and Associations in Patients with Diabetes at a Referral Center. *Am J Gastroenterol.* 2019;114(1):143–54. doi:10.1038/s41395-018-0234-1.
- Du Y.T., Rayner C.K., Jones K.L. et al. Gastrointestinal symptoms in diabetes: Prevalence, assessment, pathogenesis, and management. *Diabetes Care.* 2018;41(3):627–37.
- Brown L.K., Xu J., Freedman B.I. et al. Symptoms Suggestive of Gastroparesis in a Community-Based Cohort of European Americans and African Americans with Type 2 Diabetes Mellitus. *Dig Dis Sci.* 2019;(0123456789). doi: 10.1007/s10620-019-05974-z.
- Yang Y.J., Wu C.T., Ou H.Y. et al. Male non-insulin users with type 2 diabetes mellitus are predisposed to gastric corpus-predominant inflammation after H. pylori infection. *J Biomed Sci.* 2017;24(1):82. doi: 10.1186/s12929-017-0389-x.
- Ghadiri-Anari A., Gholami S., Sheyda E. et al. Does diabetic microvascular complications affect gastrointestinal symptoms? *Acta Med Iran.* 2019;57(3):156–9.
- Adamska A., Nowak M., Piłaciński S. et al. Small intestinal bacterial overgrowth in adult patients with type 1 diabetes: Its prevalence and relationship with metabolic control and the presence of chronic complications of the disease. *Pol Arch Med Wewn.* 2016;126(9):628–34.

31. Lee Y.Y. Systemic disorders that affect gastrointestinal motility. Clinical and Basic Neurogastroenterology and Motility. In: Lee YY, Haque MM, Lawenko RM et al. Clinical and Basic Neurogastroenterology and Motility. Elsevier Inc; 2020. p. 601–618.
32. Lee A.A., Baker J.R., Wamsteker E.J. et al. Small Intestinal Bacterial Overgrowth Is Common in Chronic Pancreatitis and Associates With Diabetes, Chronic Pancreatitis Severity, Low Zinc Levels, and Opiate Use. Am J Gastroenterol. 2019;114(7):1163–71.

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ORIGINAL ARTICLE

CLINICAL AND LABORATORY ASPECTS OF ACUTE OBSTRUCTIVE BRONCHITIS IN CHILDREN INFECTED WITH MYCOPLASMA PNEUMONIAE

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Svitlana G. Usenko¹, Zalina V. Eloeva², Marina S. Diachenko², Serhiy A. Usenko²¹KHARKIV NATIONAL MEDICAL UNIVERSITY, KHARKIV, UKRAINE²KHARKIV MEDICAL ACADEMY OF POSTGRADUATE EDUCATION, KHARKIV, UKRAINE**ABSTRACT**

The aim of the work is to improve the prognosis of acute bronchitis on the basis of the study of etiology, clinical anamnestic and laboratory-instrumental features of acute bronchitis in children infected with *Mycoplasma pneumoniae*.

Materials and methods: Medical records of inpatients, data from laboratory and clinical examinations, orders from the Ministry of Health of Ukraine. Statistical processing of the obtained results was carried out with the calculation of parametric and non-parametric criteria. The study included 72 patients with acute obstructive bronchitis, infected with *Mycoplasma pneumoniae* and patients not infected with intracellular pathogens who were hospitalized under the conditions of pediatric ward of children of younger and older children of the National Children's Clinical Hospital №24.

Results: Found that infected with *mycoplasma* compared with uninfected intracellular infection, more characteristic course of acute obstructive bronchitis on the background of febrile temperature with its duration of more than 4 days, the presence of midbubble and single dry or wet rales, as well as. In general, in patients infected with *mycoplasma*, compared with patients infected with *chlamydia*, there is a higher functional stress of immunity with the phenomena of exhaustion.

Conclusions: Attention is drawn to the fact that clinical, laboratory data and immunological examinations with the use of systematic analysis make it possible to predict the consequences in the history of children with intracellular infections of various somatic pathologies. In doing so, multivariate and correlation analyzes make it possible to develop new diagnostic criteria.

KEY WORDS: acute obstructive bronchitis, intracellular pathogens, somatic pathology

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INTRODUCTION

Respiratory diseases are one of the first places in the structure of childhood morbidity and remain an important problem in pediatrics. In recent years, the interest of pediatric pulmonologists to the problem of recurrent respiratory diseases has increased [1]. Acute obstructive bronchitis (AOB) is one of the most common forms of respiratory tract damage in children. In the structure of respiratory morbidity they are registered in 30 – 50% of cases [2]. Even a single obstructed bronchitis at an early age is dangerous because of the possibility of recurrent course, and in 47-57% of cases – transformation into bronchial asthma. The relevance of the study of acute obstructive bronchitis is due to the increase in frequency, regional features of the clinic, severity and prognosis of the disease.

Viral infections are among the factors that can cause the formation of secondary hyperreactivity bronchial of, which is observed in 53% of cases after suffering bronchopulmonary disease and can persist for 4-6 weeks after recovery, which increases the risk of recurrent bronchopulmonary diseases [3, 4]. In the last 10-15 years, both acute and recurrent forms of bronchitis in school-age children have taken the leading place in *Chlamydia pneumoniae*. In chil-

dren 5-14 years *Mycoplasma pneumoniae* is the etiological agent of obstructive bronchitis in 21-35% of cases [3, 4].

THE AIM

The aim is to improve the prognosis of acute bronchitis on the basis of the study of the etiology, clinical and anamnestic and laboratory and instrumental features of acute bronchitis in children infected with *Mycoplasma pneumoniae*.

MATERIALS AND METHODS

The study included 72 children with acute obstructive bronchitis who were hospitalized in the department for young and elderly children of the National Pediatric Clinic "City Children's Clinical Hospital №24" in Kharkiv. The Commission on Bioethics of the Kharkiv Medical Academy of Postgraduate Education (Protocol No. 05 of April 2017) found out that the conducted studies were in accordance with the ethical principles of medical research conducted on humans. The study was performed with minimal psychological loss for patients. To solve this problem,

Table I. Distribution of patients in groups depending on the anamnesis data

Indicators	Grades of the indicator	The main group n=31		Control n=41		P
		abs.	%	abs.	%	
The course of childbirth	physiological	24	77,4	31	75,6	> 0,05
	caesarean section	7	22,6	10	24,4	> 0,05
Pregnancy order number	1	22	71,0	19	46,3	< 0,05
	2	7	22,6	13	31,7	< 0,05
	≥ 3	2	6,4	9	22,0	< 0,05
Pregnancy	complicated	21	67,7	27	65,9	> 0,05
	uncomplicated	10	32,3	14	34,1	> 0,05
Birth weight, g.	≤ 2500	2	6,4	6	14,6	> 0,05
	2501-3000	9	29,0	2	4,9	> 0,05
	≥ 3001	20	64,6	33	80,5	> 0,05
Breastfeeding, months	≤ 3	7	22,6	16	39,1	> 0,05
	3,1-6	9	29,0	4	9,8	> 0,05
	6,1-12,0	5	16,1	3	7,3	> 0,05
	≥ 12,1	10	32,3	18	43,8	> 0,05
ARVI frequency at 1 year of age	not sick	9	29,0	21	51,2	< 0,05
	rarely	8	25,8	14	34,2	> 0,05
	often	14	45,2	6	14,6	< 0,01
ARVI frequency after 1 year of life	not sick	10	32,3	13	31,7	> 0,05
	rarely	5	16,1	21	51,2	< 0,01
	often	16	51,6	7	17,1	< 0,01

Table II. Diagnostic sensitivity of anamnestic parameters in patients with AOB

Indicators	Sensitivity %	Rank
Pregnancy	71,0	1
ARVI frequency at 1 year of age	51,6	2
ARVI frequency after 1 year of life	45,2	3

comparisons of clinical and anamnestic and immunological parameters in alternative groups were performed: a) patients with AOB infected with mycoplasma (n = 31; main group); b) AOB patients uninfected with intracellular infection (n = 41; control group).

It follows from the study that the proportion of boys was significantly higher in the control group (68.3%) than in the main group (45.2%), and girls more often found in the main group (54.8%) than in the control group (31.7%). In the age aspect, the age of up to three years was characteristic of patients in the control group, as it was determined 3 times more often (p < 0.01), and patients older than 3 years were found in 83.9% of patients in the main group and in 2, 6 times less (p < 0.01) in control.

The examination consisted of determining the characteristics of complaints, medical history, objective status and laboratory methods of investigation. An immunological blood test included the determination of serum A, M, G immunoglobulins (Ig) by radial immunodiffusion according to Mancini et al.; determining the population and subpopulation

of lymphocytes using monoclonal antibodies (CD3, CD4, CD8, CD16, CD19, CD25); the level of circulating immune complexes (CIC) by the method of selective precipitation of polyethylene glycol (PEG) 3.5%; in order to assess the phagocytic capacity of blood neutrophils, and in particular to determine the phagocytic number and index, the method proposed by DV Bilokrinitsky will be used; the bactericidal activity of neutrophils was evaluated according to the test with nitrosine tetrazolium (NST test) – according to G. Stuart (1983) in the modification of VS Nagoev. Statistical processing of the results was performed using standard programs for personal computer (Microsoft Excel, Statistica 6.0).

RESULTS AND DISCUSSION

During the analysis of premorbid background (table I), it was determined that according to a number of indicators significant differences between groups, were revealed and in patients infected with mycoplasma, significantly more often (1.5 times; p < 0.05) than in control, children were

Table III. Distribution of patients in groups according to clinical data

Indicators	Grading Indicators	Core Group		Control		P
		aбс.	%	aбс.	%	
Body temperature	≤ 37,9	14	45,2	27	65,9	< 0,05
	≥ 38,0	17	54,8	14	34,1	< 0,05
Duration of temperature increase, days	0-3	12	38,7	28	68,3	< 0,01
	≥ 4	19	61,3	13	31,7	< 0,01
Toxic syndrome	IS	23	74,2	26	63,4	> 0,05
	Does not	8	25,8	15	36,6	> 0,05
Respiratory rate	≤ 32	24	77,4	26	63,4	> 0,05
	≥ 33	7	22,6	15	36,6	> 0,05
Whistling wheezes	IS	11	35,5	23	56,1	< 0,05
	Does not	20	64,5	18	43,9	< 0,05
Dry wheezing	IS	1	3,2	6	14,6	> 0,05
	Does not	30	96,8	35	85,4	> 0,05
Medium-bubbling wet rales	IS	8	25,8	6	14,6	> 0,05
	Does not	23	74,2	35	85,4	> 0,05
Single dry rales	IS	6	19,4	0	0	< 0,05
	Does not	25	80,6	41	100	< 0,05
Single wet rales	IS	5	16,1	0	0	< 0,05
	Does not	26	83,9	41	100	< 0,05
Duration of treatment, days	≤ 9	7	22,6	19	46,3	< 0,05
	≥ 10	24	77,4	22	53,7	< 0,05

born from the first pregnancy, 3.1 times ($p < 0.01$) more often suffered from acute respiratory infections (ARVI) both in the first and after the first year of life of the child.

There were no significant differences between the groups regarding such indicators as the nature of labor and pregnancy, birth weight and duration of breastfeeding ($p > 0.05$).

Due to the fact that according to a number of anamnesis indicators significant differences between groups, were revealed it allows them to be used for diagnostic purposes.

In the table II presents the diagnostic sensitivity of anamnestic data: moderate diagnostic sensitivity was characteristic for the order of pregnancy (71% – 1st rank), low – for the ARVI frequency after the first year of life (51.6% – 1st rank) and the ARVI frequency at the first year of life (45.2% – 3rd rank).

With regard to other clinical features (table III), patients of the main group were characterized by: duration of fever ≥ 4 days ($p < 0.01$), and the presence of single dry ($p < 0.05$) and moist rales ($p < 0.05$). In addition, patients of the main group had a long (≥ 10 days) duration of inpatient treatment, which occurred in 77.4%, including significantly less ($p < 0.05$) in the control group.

Therefore, the study indicates that mycoplasma infection of the child is significantly reflected in the clinical characteristics of AOB, which allows them to be used to diagnose mycoplasma infection in patients with AOB.

Analysis of the diagnostic sensitivity of clinical indicators showed that its moderate values were found for the duration of treatment (77.4% – 1st rank) and the duration of fever (61.3% – 2nd rank), and low diagnostic sensitivity was characteristic of body temperature (54.8% – 3rd grade), wheezing wheezing (35.5% – 4th grade), single dry wheezing (19.4% – grade 5) and single wet rales (16.1% – 6th rank).

In determining the characteristics of the immune status of the studied groups in patients with GOB infected with mycoplasma (table IV), found that compared with the norm in patients revealed an increase of 33.7% of the absolute number of T-lymphocytes (CD3), T-suppressors (CD8) by 30.1 %, B-lymphocytes (CD22) by 73.8%, and the relative content of T-lymphocytes helpers (CD4) by 20.8% and B-lymphocytes by 30.8%.

Decrease relative to the norm was found in relation to the phagocytic number by 15.7%, spontaneous HCT test

Table IV. The values of immunity in patients with AOB infected with Mycoplasma

Indicators	M±m		P
	Main group, n = 31	Practically healthy, n = 20	
CD3, %	66,7±0,87	65,4±0,48	> 0,05
CD3, abs.	2,62±0,13	1,96±0,10	< 0,001
CD4, %	35,5±0,70	32,0±0,78	< 0,001
CD4, abs.	1,27±0,07	1,15±0,03	> 0,05
CD8, %	26,1±0,52	21,6±1,0	< 0,001
CD8, abs.	0,95±0,05	0,73±0,03	< 0,001
CD16, %	10,8±0,30	12,3±1,20	> 0,05
CD16, abs.	0,40±0,02	0,41±0,03	> 0,05
CD22, %	19,1±0,35	14,6±0,54	< 0,001
CD22, abs.	0,73±0,04	0,42±0,04	< 0,001
CD25, %	14,1±0,69	12,9±0,66	> 0,05
CD25, abs.	0,54±0,04	0,37±0,03	< 0,01
Phagocytosis,%	53,7±1,30	48,9±0,78	< 0,01
Phagocytic index	1,56±0,14	1,26±0,15	> 0,05
Phagocytic number	4,3±0,25	5,1±0,05	< 0,01
Total compliment,%	57,9±1,13	58,8±2,1	> 0,05
Circulating immune complexes with 3.5% PEG	9,8±0,31	8,1±0,42	< 0,001
NST-spontaneous,%	15,9±0,83	24,7±2,16	< 0,001
The neutrophil activity index is spontaneous, un.	0,27±0,02	0,25±0,02	> 0,05
NST-stimulated,%	51,4±1,1	63,1±2,7	< 0,001
The neutrophil activity index is stimulated, units	0,28±0,02	0,86±0,03	<0,001
Lysosomal cationic proteins, units	1,20±0,008	1,21±0,01	>0,05
IgA, g/l	1,32±0,06	0,62±0,02	<0,001
IgM, g/l	1,0±0,06	0,85±0,01	<0,05
IgG, g/l	8,9±0,22	7,7±0,17	<0,001

by 35.7%, stimulated NST test by 18.6%, neutrophil activity index stimulated by 67.7%.

In addition, in the group infected with mycoplasma compared with the standard there was an increase in phagocytosis by 9.8%, the level of CIC from 3.5% PEG by 21%, IgA by 112, 9%, IgM by 17.6% and IgG by 15.6%.

The analysis of the degree of deviation from the norm of values of indicators of the T-system of immunity found that moderate deviations from the norm were found in relation to the increase in the absolute number of CD3 ($t = 4,0$; $p < 0,001$) and CD8 ($t = 3, 8$; $p < 0,001$), and also the relative contents of CD8 ($t = 4,0$; $p < 0,001$). Moderate deviations are set for the increase in the relative number of CD4 ($t = 3,3$; $p < 0,001$), and insignificant for the absolute content of CD25 ($t = 2,8$; $p < 0,01$). No significant differences were found from the standard for such indicators as the absolute number of CD4 ($t = 1,6$; $p > 0,05$) and CD16 ($t = 0,1$; $p > 0,05$), as well as the relative content of CD16, CD25 ($t = 1,2$; $p > 0,05$) and CD3 ($t = 0,4$; $p > 0,05$).

The above data indicate that activation of the T-system of immunity, which is a manifestation of compensation, is observed in patients with mycoplasma-infected GOB, but there is no adequate activation by natural killers, as well as a tendency to decrease the relative number of CD25, which determines hyperactivity and is a negative point and indicates an imbalance in the functioning of the T-system of immunity.

On the part of the B-system of immunity, pronounced deviations were found regarding the increase of IgA level ($t = 11,1$; $p < 0,001$) and the relative content of CD22 ($t = 6,7$; $p < 0,001$). The obtained data indicate hyperactivation of the B-system of immunity in this category of patients, aimed at the production of antibodies upon penetration into the body of an antigenic stimulus.

Therefore, in general, patients infected with mycoplasma, compared with patients infected with chlamydia, there is a higher functional impairment of immunity with the phenomena of overvoltage, ie exhaustion.

CONCLUSIONS

1. For patients infected with mycoplasma compared with uninfected intracellular infection, more characteristic of the course of AOB on the background of febrile temperature with its duration of more than 4 days, the presence of midbubble and single dry or wet rales, as well as longer.
2. In patients with mycoplasma infection compared with patients without intracellular infection by T – system of immunity proved: higher values of the absolute number of CD3, CD8 and the relative content of CD3, CD8, as well as lower values of absolute and relative amount of CD16, as well as the absolute number of CD25.
3. On the part of the B – immune system higher values of the relative number of CD22, IgA, IgG and low absolute amount of CD22; higher values of the phagocytic level of immunity: phagocytic number, spontaneous NST – test, neutrophil activation index of spontaneous and low – phagocytosis; by the non-specific humoral immunity level – a higher CIC level with 3.5% PEG.
4. In general, in patients infected with mycoplasma, compared with patients infected with chlamydia, there is a higher functional tension of immunity with the phenomena of exhaustion.
5. Significant differences between clinical and immunological parameters were proved between groups of patients with AOB, depending on the presence of their infection with mycoplasma, which is the basis for the development of diagnostic criteria.

REFERENCES

1. Moiseienko R.O., Dudina O.O., Hoida N. H. Analiz stanu zakhvoriuvanosti ta poshyrenosti zakhvoriuvan u ditei v Ukraini za period 2011–2015 roky [Analysis of the incidence and prevalence of diseases in children in Ukraine for the period 2011-2015]. *Sovremennaia pedyatryia*. 2017; №2(82):17-27. (Ua)
2. Boronyna L. H., Samatova E. V. Veryfykatsiya etyolohyy obostrenyi khronycheskykh ynfektsyonno-vospalytelnykh zabolevanyi lehkykh u detei [Verification of etiology of exacerbations of chronic infectious-inflammatory lung diseases in children]. *Pedyatryia*. 2014; 5 (3): 9–15. (Ru)
3. Holubovska O. A. Infektsiini khvoroby (pidruchnyk) [Infectious diseases (textbook)]. In: Holubovska O. A., Andreichyn M. A., Shkurba A. V. Kyiv: VSV «Medytsyna», 2 vydannia, dopovnene i pereroblene, 2018, p. 313–318. (Ua)
4. L.I. Chernyshova. Infektsiini khvoroby u ditei: pidruchnyk (VNZ IV r. a.) [Infectious diseases in children: a textbook (Higher education institution IV a.)]. In; L.I. Chernyshova, A.P.Volokha, A.V. Bondarenko ta in.; za red. L.I. Chernyshovoi. — 2-e vyd., vypr. Kyiv: Medytsyna; 2017, p. 10-16. (Ua)
5. Yeloeva Z. V., Matviienko S. O., Diachenko M. S. Diahnostychni i prohnostychni znachennia vnutrishnoklitynykh zbudnykiv u vypadku atypovoi infektsiinoi patolohii u ditei. [Diagnostic and prognostic value of intracellular pathogens in the case of atypical infectious pathology in children]. *Problemy bezperervnoi medychnoi osvity ta nauky*. 2017; 1 (24): 21–26. (Ua)
6. Shyrobokov V. P. Medytsynskaia mykrobiolohyia, vyirusolohyia y ymmunolohyia [Medical microbiology, virology and immunology]. Vynnytsa: Nova knyha; 2015, 898 p. (Ru)

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ORIGINAL ARTICLE

ASSESSMENT OF THE QUALITY OF CARE FOR PATIENTS WITH MYOCARDIAL INFARCTION

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ABSTRACT

The aim of the work was to study and evaluate the quality of medical care provided to patients with myocardial infarction.

Materials and methods: A sociological survey was conducted in 310 people with myocardial infarction and the copying of data from 318 statistical maps of patients who left the hospital.

Results: It was defined that the majority of patients, $57.7 \pm 2.8\%$, were not offered psychological rehabilitation, only $42.3 \pm 2.8\%$ were recommended the consultation of a psychologist; most of patients, $89.3 \pm 1.78\%$, were unaware of the possibility of self-monitoring of their health status after myocardial infarction and $10.7 \pm 1.8\%$ kept self-control diaries; $88.4 \pm 1.9\%$ of patients were under monitoring supervision, while $11.6 \pm 1.9\%$ were not under it.

Conclusions: Identification of the quality of care makes it possible to optimize the system of providing health care for patients with myocardial infarction.

KEY WORDS: myocardial infarction, medical care, quality of care

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INTRODUCTION

The relevance of presented topic is obvious. Among non-epidemic diseases, cardiovascular maladies are the leading cause of morbidity and mortality worldwide. This also applies to pathologies such as myocardial infarction, about 50,000 cases of this disease are reported annually in Ukraine [1]. Mortality rates from acute myocardial infarction in Ukraine are much higher than those in Western countries [2]. The organization of health care for patients with myocardial infarction makes it possible to reduce the morbidity and mortality among patients with this pathology [3, 4, 5]. In order to increase the priorities for the prevention and control of non-epidemic diseases under the WHO leadership in 2013 the Global Action Plan for the Prevention and Control of Non-Epidemic Diseases for 2013-2020 was developed.

Therefore, one of the priorities of the healthcare system is to improve the quality of care delivery for patients with myocardial infarction.

THE AIM

The aim of this research was to study and evaluate the quality of medical care for patients with myocardial infarction.

MATERIALS AND METHODS

The following methods were used: data copying, medical and statistical, analytical. According to specially designed questionnaires 310 patients after myocardial infarction were interviewed and data from 318 statistical maps were copied (form № 066 / o).

RESULTS AND DISCUSSION

Organization of primary care facilities plays a major role in the treatment of patients with myocardial infarction. The early diagnosis of this disease reduces mortality and disability, improves the results of treatment of patients with this pathology, which, in turn, increases the duration and improves the quality of life of patients. Thus, during the last 12 months, in average, 3.6 visits have been made to the district therapist in connection with this disease. Among the patients with this illness $11.9 \pm 1.8\%$ have never sought medical help, $72.5 \pm 2.5\%$ asked for care 1-3 times, and $15.6 \pm 2.1\%$ needed help of a doctor 4 or more times. In frames of routine control, visits were made in average 2.9 times, $12.8 \pm 1.9\%$ of patients had never visited checkups, $81.4 \pm 2.2\%$ participated in them for about 1-3 times, and just $5.8 \pm 1.3\%$ were under control examinations 4 or more times.

During the last 12 months, in average, 2.8 visits of patients have been made to the cardiologist in connection with this disease, $22.5 \pm 2.4\%$ ones have not visited such specialist, $61.7 \pm 2.8\%$ of them asked for help 1-3 times, and $15.8 \pm 2.1\%$ needed doctor's care 4 and more times. For the purpose of routine control, 2.4 visits were made in average, $13.4 \pm 1.9\%$ did not ask for medical aid, $69.8 \pm 2.6\%$ asked for it 1-3 times, and $16.8 \pm 2.1\%$ of patients needed help of cardiologist 4 or more times.

Emergency care team delivered $77.1 \pm 2.6\%$ of patients, $22.9 \pm 2.6\%$ used other routes of getting to a hospital. Emergency team arrival time was subdivided in such a way: up to 30 minutes in $95.5 \pm 1.4\%$ of cases, 30-60 minutes in $3.6 \pm 1.3\%$, more than one hour in $0.9 \pm 0.6\%$ of cases. Thus,

96.1 ± 1.3% of patients noted that the ambulance doctor provided first aid, 3.9 ± 1.9% did not provide assistance. Most patients, 97 ± 1.1%, noted that the emergency physician had all the necessary drugs to improve their condition, 3 ± 1.1% said that doctors did not have the necessary drugs for this case. Improvements after the help of an ambulance physician were felt by 72.9 ± 2.5%, and 27.1 ± 2.5% of patients did not feel any improvements.

The hospitalization period from the onset of the disease plays an important role in the provision of medical care for patients with myocardial infarction. The authors found that 34.3 ± 2.7% of sick people in the case of myocardial infarction were hospitalized up to 2 hours after the onset of symptoms, 58.3 ± 2.8% ones in the period from 2 up to 12 hours, 3.3 ± 1.1% were taken to hospital from 12 up to 24 hours, and later than 24 hours – 4.1 ± 1.1%.

Examination of the time of day when the condition of the patients worsened and led to hospitalization, it was found that the majority of patients, namely 47.4 ± 2.8% felt deterioration in the evening, 33.2 ± 2.7% at night, 12.6 ± 1.9% in the morning, and 6.8 ± 1.5% in the afternoon. Most of the patients (75.8 ± 2.4%) experienced deterioration in their health at home, 13.6 ± 1.0% at the workplace, 3.9 ± 1.1% in the street and 6.8 ± 1.5% in other places.

Patient confidence to the doctor is one of the most important factors that establishes productive collaboration between the patient and the healthcare professional, which in turn enhances the effectiveness of treatment and rehabilitation activities overall. According to the study, 64.8 ± 2.7% of patients reported complete trust in the doctor, 27.1 ± 2.5% partially trusted, and 8.1 ± 1.5% did not trust at all.

One of the major issues in assessing the quality of care is patient satisfaction with the organization of diagnostic and treatment processes in health care settings. Thus, 32.3 ± 2.7% of respondents rated the organization of the diagnostic process as “excellent”, 58.1 ± 2.8% as “good”, and 9.6 ± 1.7% as “satisfactory”. The following data were obtained regarding the organization of the medical process: 42.3 ± 2.8% of patients rated it as an “excellent”, 51.6 ± 2.8% as a “good” one, and 9.1 ± 2.2% as “satisfactory”.

In assessing the quality of care, the state of sanitary and living conditions plays an important role. Thus, 53.2 ± 2.8% of patients rated the condition of sanitary and living conditions as “good”, 17.7 ± 2.2% as “excellent” and 29.1 ± 2.6% as “satisfactory”.

Myocardial infarction is a disease that requires high financial costs for both the patient and the whole family, which leads to severe economic consequences. Just 18.9 ± 2.2% of patients indicated that they were able to purchase all the necessary medicines, while 81.1 ± 2.2% did not have such an opportunity.

The basis of qualitative and effective provision of medical care is compliance with the main properties of medical care. In frames of this investigation, 66.3 ± 2.7% of patients noticed that it is necessary to improve the availability of medical care, 6.8 ± 1.4% considered that the stage of providing medical care was also important, 13.3 ± 1.9% were sure that the competence of medical staff in their case was

a compulsory thing, about 2.4 ± 0.9% of interviewed sick people needed safety, and 11.2 ± 1.8% of them insisted on an efficiency of medical aid.

Medical registration and patient health monitoring play an important role in the effectiveness of the healing process for patients with myocardial infarction. Whereas, the main purpose of the monitoring is the dynamic monitoring of patients who have suffered myocardial infarction to achieve stabilization and improvement of the clinical course of the disease, prevention of complications and exacerbations, to improve the quality and life expectancy of patients with this pathology. According to the study it was found that 88.4 ± 1.9% of patients were under the regular medical observation, while 11.6 ± 1.9% were not under it. In majority of cases, a family doctor monitors about 87.9 ± 2.0% of patients, while the cardiologist just 12.1 ± 2.0% ones.

Providing detailed written recommendations (plans) to the patient for treatment and rehabilitation is an integral part of effective treatment, because doctors have to form in the patients after myocardial infarction the right attitude to their health and to this disease, which significantly reduces the risk of recurrent cardiovascular complications. According to our survey, 80.3 ± 2.3% of the respondents were given written recommendations for the organization of their lifestyle, and 19.7 ± 2.3% of them did not get such recommendations at all. In fact, 92.6 ± 1.6% of the patients who had got recommendations followed this plan, while 7.4 ± 1.6% did not follow it.

Unfortunately, myocardial infarction for the most patients is a very strong psychological factor that can lead to psycho-emotional disorders. Therefore, psychological rehabilitation is an important aspect in the treatment of patients with this pathology. According to our investigation, only 42.3 ± 2.8% of patients were recommended consultation of a psychologist, while 57.7 ± 2.8% did not receive such recommendation. Approximately 19.0 ± 3.4% of patients who had got an advice to seek for psychological help did so, whereas 81.0 ± 3.4% refused the help of this kind of specialist. Due to psychological help 80 ± 8% of patients noticed improvement of their condition, and just 20 ± 8% did not feel any changes.

Sanitary-resort rehabilitation lets patients to maintain familiar social status, continue to lead an active lifestyle and return to work. Sanitary-resort treatment was offered to 92.4 ± 1.5% of patients, while 7.6 ± 1.5% did not receive such recommendation. According to the data received by authors, 91.0 ± 1.7% of patients whom rehabilitation was offered, were treated at sanatoriums, while 9.0 ± 1.7% refused from this stage of cure. The positive effect of the spa treatment was noted by 93.2 ± 1.6% of patients, whereas 6.8 ± 1.6% did not notice any effect.

Diet therapy after myocardial infarction is a prerequisite for complex cure of patients. Dieting improves cardiac function and myocardial recovery processes, which prevents recurrence. According to this aspect of the study, authors received such results: 69.0 ± 2.6% of patients follow definite diet, while 1.0 ± 2.6% do not monitor their diet, at all. 63.9 ± 2.7% of patients are aware of the consequences

of non-treatment and diet, partially aware $29.0 \pm 2.6\%$, do not know of that $7.1 \pm 1.5\%$.

Self-control is one of the main elements of treatment and rehabilitation. The primary purpose of self-control is to provide the patient with knowledge about the illness that will let him/her to act independently in many situations, to change his/her lifestyle, and plan the treatment in advance. Patients keep diary of self-control and regularly use it in $10.7 \pm 1.8\%$ of cases, $89.3 \pm 1.78\%$ do not even know about this type of control.

In the course of the study, 318 statistical maps of patients who left the hospital (form No. 066/o) were studied to define the quality of inpatient care. Emergency hospitalization of myocardial infarction patients was observed in $73.9 \pm 2.5\%$ of cases, planned one was in $26.1 \pm 2.5\%$. The ambulance team delivered $62.6 \pm 2.1\%$ of patients, while by referring of other medical institutions there were $37.4 \pm 2.7\%$ of sick people such kind of health problem. According to the study, hospitalization in the first 6 hours was performed in $21.1 \pm 2.3\%$ cases, from 7 up to 24 hours – in $51.3 \pm 2.8\%$ ones, and finally, later than 24 hours in $27.6 \pm 2.5\%$ of cases. $91.1 \pm 1.6\%$ of patients were hospitalized for the first time about this disease in the current year, while $8.9 \pm 1.6\%$ were re-hospitalized. Number of hospital days spent in the hospital: from 1 up to 5 days in $3.1 \pm 0.9\%$ of cases, from 6 up to 10 days – $27.4 \pm 2.5\%$, from 11 up to 15 days – $66.7 \pm 2.6\%$, and more than 15 days in $2.8 \pm 0.9\%$ of cases. After treatment, $94.9 \pm 1.2\%$ of patients were discharged with improvement, $4.2 \pm 1.1\%$ without changes, and $0.9 \pm 0.5\%$ with deterioration.

CONCLUSIONS

1. It was found that the majority of patients were not offered psychological rehabilitation. Only $42.3 \pm 2.8\%$ of patients were recommended the consultation of a psychologist, while $57.7 \pm 2.8\%$ did not receive this recommendation. Later, absence of psychological help can lead to the development of psycho-emotional disorders in patients with this pathology.
2. It was noted that not all of the patients had been monitored. About $88.4 \pm 1.9\%$ of patients were under such supervision, while $11.6 \pm 1.9\%$ of them were not under it. It does not give the chance to observe former myocardial infarction patients in dynamics.
3. It was established that myocardial infarction is a disease that requires high financial costs. But, unfortunately, the majority of patients, namely $81.1 \pm 2.2\%$ were not able to buy all the necessary medicines. Only $18.9 \pm 2.2\%$ of patients had sufficient financial resources to purchase all drugs. This adversely affects the effectiveness of the treatment.

4. It was established that the vast majority of patients were unaware of the possibility of self-monitoring of their health status after myocardial infarction. Only $10.7 \pm 1.8\%$ of patients kept self-control diaries, $89.3 \pm 1.78\%$ of patients did not even know about this type of control. As a result, it led to the deterioration in the quality of life of patients after myocardial infarction.

REFERENCES

1. Terenda N. Vchennya pro infarkt miokarda v istorichnomu aspekti [The doctrine of myocardial infarction in historical aspect]. *Visnyk sotsial'noyi medytsyny ta organizatsiyi ohorony zdorov'ya Ukrainy*. 2013; 1:56-61.
2. Terenda N., Petrashyk Y., Slobodian N. et al. Morbidity and prevalence of cardiovascular diseases in Ukraine: trends and forecasts until 2025. *Georgian Medical News*. 2018; 9 (282): 79–82.
3. Hussain S., Jamal S.Z., Qadir F. Medication Adherence In Post Myocardial Infarction Patients. *J Ayub Med Coll Abbottabad*. 2018; 30(4):552-557.
4. Anderson L., Brown J.P., Clark A.M. et al. Patient education in the management of coronary heart disease. *Cochrane Database Syst Rev* 2017;6:CD008895. doi: 10.1002/14651858. CD008895.pub3.
5. Moroz D.M. Problemu zdorov'ya i meduchnoi dopomogu ta model pokrashennya v sychasnuh ymovah: posibnuk dlya kardiologiv, revmatologiv, terapevtiv, organizatoriv ohoronu zdorov'ya ta likariv zagalnoi praktuku [Problems of health and medical care and that abusive mind model: a guide for cardiologists, rheumatologists, therapists, organizers of health protection and general practice]. Gordon Print House. 2016. (In Ukrainian).

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ORIGINAL ARTICLE

EFFECT OF ENOS GENE POLYMORPHISM ON THE COURSE OF EARLY ONSET BACTERIAL INFECTIONS IN PREMATURE INFANTS

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ABSTRACT

The aim of the study was to analyze the associations between 4a/4b polymorphism of the eNOS gene and impaired systemic hemodynamics in premature infants with early neonatal sepsis.

Materials and methods: We conducted a prospective cohort study, which included 120 premature babies with early neonatal sepsis, in 57 children the course of the disease was accompanied by arterial hypotension (AH) and in 61 children – not. In children of both groups, genotyping was performed to determine 4a/4b polymorphism of the eNOS gene.

Results: It was shown that the heart rate, blood pressure, hourly diuresis, the level of total nitrates and nitrites in the urine, as well as a number of echocardiographic and dopplerometric indicators in children with different eNOS gene genotypes are not different.

Conclusions: There is no effect of 4a/4b polymorphism of the eNOS gene on the occurrence of hemodynamic disturbances in premature infants with sepsis.

KEY WORDS: premature infants, early sepsis, eNOS gene, 4a / 4b polymorphism, hemodynamics, total nitrates and nitrites

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INTRODUCTION

In Ukraine, infections of the perinatal period, congenital pneumonia, sepsis occupy 3-4 place in the structure of morbidity and mortality of newborns. Among the causes of mortality, the proportion of infections is 23-25%, and in intensive care units – up to 40-60% [1]. A common cause of death and severe complications in newborns is septic shock, which occurs in deeply premature babies due to several causes. Various pathogenic factors lead to the activation of the sympathoadrenal system, the release of catecholamines and the appearance of generalized vasospasm. Prolonged centralization of blood circulation due to the action of stress factors or the rapid depletion of the compensatory capabilities of a morpho-functionally immature organism leads to progressive tissue hypoxia and the formation of "capillary leak syndrome". It is now known that endothelium regulates vascular tone through the release of vasodilating and vasoconstrictor factors and modulates the contractile activity of smooth muscle cells. Endothelial dilatation factors include nitric oxide (NO). Under physiological conditions, NO is constantly involved in adapting the vascular system to increased metabolic needs and physical activity. Nitric oxide prevents platelet adhesion and aggregation, monocyte adhesion, protects the vascular wall and prevents vascular remodeling in various pathological conditions. Also, this molecule regulates the balance between mitosis and apoptosis of cells [2]. Therefore, we hypothesized that eNOS gene polymorphism may

be associated with impaired hemodynamics in premature infants with early neonatal sepsis.

Nitric oxide in the human body can be formed from L-arginine with the participation of the enzyme of the gene for endothelial NO synthase (eNOS) [3] and the nitrite pathway in ischemic and postischemic tissues [4]. Several polymorphic regions were found in the exons and introns of the eNOS gene, among which the most studied is the mini-satellite repeat in intron 4 (eNOS 4a/4b polymorphism). The 4a/4b mini-satellite in the 4th intron of the eNOS gene has 2 alleles, which consist of 4 or 5 tandem repeats of 27 nucleotide pairs in size. The normal variant has 5 repeats (denoted by 4b), and the mutant variant has 4 repeats (4a). The effect of option 4a is associated with impaired eNOS gene expression, which leads to a decrease in nitric oxide production. The relationship between the level of NO production in the body and the severity of oxidative stress during vascular pathology is clearly traced: inhibition of synthesis and a sharp decrease in nitric oxide in the bloodstream are associated with the accumulation of free radical molecules. Homozygous carriers of the 4N allele of the eNOS gene revealed a significantly lower content of extracellular superoxide dismutase [5]. Anions NO₂ and NO₃ are the end products of the metabolism of nitric oxide in the human body, in which each NO molecule is converted at the end of the metabolic pathway to either NO₂ or NO₃ [3, 4]. The synthesized nitric oxide is excreted as NO₂ and NO₃ mainly (95%) in urine [6].

THE AIM

The aim of the study was to analyze the associations between 4a/4b polymorphism of the eNOS gene and impaired systemic hemodynamics in premature infants with early neonatal sepsis.

MATERIALS AND METHODS

We conducted a prospective cohort study, which included 120 premature babies with early neonatal sepsis, in 57 children the course of the disease was accompanied by arterial hypotension (AH) and in 61 children – not. All children were treated in the neonatal intensive care units of children's hospitals in the Poltava city. In children of both groups, genotyping was performed to determine 4a/4b polymorphism of the eNOS gene. The subject of the study is the clinical indicators that characterize systemic hemodynamics, the level of total nitrates and nitrites in the urine, as well as a number of echocardiographic and dopplerometric indicators in premature infants, depending on the presence or absence of 4a allele of eNOS in a child.

Criteria for inclusion in the study: the presence of clinical symptoms (tachycardia, tachypnea, desaturation, apnea, impaired perfusion, seizures, shock) and laboratory criteria (the number of leukocytes is more than 20×10^9 or less than 5×10^9 and an increased level of C-reactive protein) of sepsis. Confirmation of sepsis, but not a mandatory criterion for inclusion in the main group, was the determination of a positive blood culture. Arterial hypotension was determined by the presence of episodes of lowered blood pressure in the child – the mean blood pressure in millimeters of mercury is less than the gestational age of the child in weeks, according to the record in the intensive care card. The material for this study was the peripheral blood of the newborn. Blood sampling was performed in a volume of 0.25 ml. After the procedure of isolating DNA samples from the obtained material, a molecular genetic study was carried out using a polymerase chain reaction and determining the polymorphism of restriction fragments length. Restriction of alleles of the eNOS gene was carried out using the BanII enzyme (Fermentas, USA). Amplified fragments were distributed using horizontal electrophoresis in a 1.5% agarose gel stained with ethidium bromide.

Constant variables are presented as mean values (M) and standard errors (m), categorical variables as absolute numbers and percentages. Student's test was used to compare independent samples and a chi-square test to compare proportions. All statistical analyzes were performed using the STATA version 11, licensed computer program package for Windows (StataCorp, Texas, USA).

RESULTS AND DISCUSSION

The distribution of newborns stratified according to variants 4a/4b of the eNOS gene polymorphism was identical among the studied groups. In premature infants with arterial hypotension, any child was identified with genotype 4a/4a, genotype 4a/4b was revealed in 56.25% of children

and genotype 4b/4b – in 43.75%. In the group of children without arterial hypotension, genotype 4a/4a was detected in 3.88% of children (OR 0, $p = 0.577$), genotype 4a/4b – in 63.73% of children (OR 1.69, $p = 0.235$) and genotype 4b/4b – in 32.35% of children (OR 0.65, $p = 0.422$). Given the small number of children with 4a/4a polymorphism, we combined children with the 4a allele in one group.

The analysis of medical and demographic indicators in premature infants with early sepsis, stratified according to the eNOS gene genotypes, did not reveal significant differences in such indicators as weight, gestational age at birth, and gender. The Apgar score at 1 and 5 minutes of life, as well as the frequency of usage of primary resuscitation measures in children with genotypes 4a/4a & 4a/4b and 4b/4b, was almost identical. Thus, the medical demographic indicators and the condition of children at birth with different genotypes of the eNOS gene did not differ significantly, which enabled us to minimize the influence of side factors and correctly evaluate the effect of gene polymorphism on the development of systemic hemodynamics disorders in premature babies.

The study did not reveal significant differences in heart rate and blood pressure on the 1st and 6th day in children with different genotypes of the eNOS gene (Table I). It is known that urine output is an indicator that, in addition to renal function, also characterizes systemic hemodynamics, in our study, the hourly diuresis in children with genotypes 4a/4a & 4a/4b and 4b/4b was almost the same.

Thus, children with different 4a/4b variants of the eNOS gene did not have significant differences in hemodynamic parameters. A proof of this is the frequency of use of their hemodynamic support. Thus, dopamine (40% and 37.8%, respectively, $p = 0.482$), dopamine in combination with dobutamine (18.7% and 20%, respectively, $p = 0.519$) or adrenaline (4.1% and 0, respectively, $p = 0.176$) were administered for almost the same number of children with genotype variants 4a/4a & 4a/4b and 4b/4b. The mean age at which dopamine was prescribed was virtually the same (28.8 ± 2.16 hours in children with the 4a/4a & 4a/4b genotype and 26.4 ± 2.64 hours in children with the 4bb genotype ($p = 0.495$). The maximum dose of dopamine was slightly higher in children with genotypes 4a/4a & 4a/4b, compared with children who had genotype 4b/4b – $7.4 \pm 1.0 \mu\text{g}/\text{kg}/\text{min}$ and $6.1 \pm 0.75 \mu\text{g}/\text{kg}/\text{min}$, respectively ($p = 0.276$).

The results of a number of studies indicate that the polymorphism of the eNOS gene affects the level of synthesis of NO [4-5], a local vascular relaxation factor, therefore, we studied the levels of total nitrates and nitrites in the urine of premature babies with sepsis, depending on the type of genotype. There were no significant differences in the average values of this indicator in the examined children. So, on the 1-2 day of life, in children with genotype 4a/4a & 4a/4b, the level of $\text{NO}_2 + \text{NO}_3$ was $89.6 \pm 8.4 \text{ mmol}/\text{l}$, in children with genotype 4b/4b it was $68.5 \pm 12.7 \text{ mmol}/\text{l}$, $p = 0.178$; on the 6th day, respectively, $73.1 \pm 7.2 \text{ mmol}/\text{l}$ and $59.9 \pm 11.6 \text{ mmol}/\text{l}$, $p = 0.345$.

To understand the pathogenesis of hemodynamic disturbances in preterm infants with sepsis, we compared echo-

Table I. Indicators of systemic hemodynamics in premature infants with early sepsis, stratified in accordance with the variants of the eNOS gene genotype, M ± m

Indicators	Genotype 4a/4a&4a/4b n=73	Genotype 4b/4b n=47	p
1 st day after birth HR (beats per min)	152,7±1,55	154,3±2,32	0,569
BP systolic (mmHg)	53,8±1,03	54,8±1,34	0,557
BP diastolic (mmHg)	26,0±0,89	27,1±1,11	0,434
BP mean (mmHg)	32,5±0,82	33,7±1,21	0,412
Urine output (ml/kg/min)	2,3±0,20	2,0±0,15	0,142
6 th day after birth HR (beats per min)	154,6±1,43	153,3±2,15	0,612
BP systolic (mmHg)	61,1±0,87	63,2±0,77	0,067
BP diastolic (mmHg)	30,8±0,80	33,1±0,98	0,066
BP mean (mmHg)	37,3±0,75	39,3±0,93	0,088
Urine output (ml/kg/min)	4,0±0,17	4,0±0,21	0,937

Table II. Echocardiographic and dopplerometric indicators that characterize systemic and organ hemodynamics in prematurely born children stratified in accordance with the eNOS gene genotypes, M ± m

Indicators	Genotype 4aa&4ab n=73	Genotype 4bb n=47	p
Minute heart volume (ml/min)	569,8±39,9	627,4±58,0	0,418
Impact Index (l/min*m ²)	3,7±0,27	4,6±0,44	0,101
The shock index of the work of the left ventricle (g*min/m ²)	1,3±0,12	1,7±0,23	0,112
Cardiac Index (l/min*m ²)	3,8±0,24	4,0±0,29	0,556
Impact volume (ml)	3,7±0,26	4,3±0,37	0,193
Ejection fraction (%)	70,8±1,14	68,7±2,16	0,387
Myocardial contractility (%)	37,7±0,95	36,2±1,64	0,444
Total peripheral vascular resistance (dyn*s/cm ⁵)	5329,7±399	4650,1±570	0,334
Middle cerebral artery resistance index	0,68±0,03	0,78±0,05	0,099
Upper mesenteric artery resistance index	0,69±0,03	0,71±0,06	0,766

cardioscopic and dopplerographic parameters in groups of children stratified according to the eNOS genotype, but no expected significant changes were detected (Table II).

Given the above results, it can be concluded that there is no effect of 4a/4b polymorphism of the eNOS gene on the occurrence of hemodynamic disturbances in premature infants with sepsis.

Diagnosis and treatment of hypertension in prematurely born children is one of the significant problems that clinicians face in their daily practice. There are many debatable issues, for example, how to determine the reference parameters of blood pressure in premature babies, which can cause severe pathological changes in this particular group of patients. It is generally accepted that arterial hypotension occurs in premature infants, when the average blood pressure level is lower than the gestational age of the child or below 30 mm Hg, because it is believed that these blood pressure numbers are critical for brain damage [7-8]. There are studies that indicate a lack of relationship between the level of cerebral blood flow and systemic blood pressure in prematurely born children [9] and suggest the presence of intact cerebral blood flow in such patients with critical numbers of systemic blood pressure [10]. To solve the question of the need for aggressive medical intervention, it is necessary to evaluate arterial hypotension in combination with other indicators of the clinical condition of the child [11] and taking into account possible genetic determinants.

CONCLUSIONS

Our study showed that in premature infants, the development of hypotension during sepsis is not associated with the presence of a polymorphic variant of the eNOS gene, however, we believe that it is necessary to continue the study in a larger sample of patients, as well as to study the effect of polymorphism of other genes, for example, the renin-angiotensin system, on the development of disorders of systemic hemodynamics.

REFERENCES

1. Stefanovic I.M. Neonatal sepsis. *Biochemia Medica*. 2011;21 (3):276-281.
2. Plachta N., Traister A., Weil M. Nitric oxide is involved in establishing the balance between cell cycle progression and cell death in the developing neural tube. *Exp Cell Res*. 2003;288 (2):354-362.
3. Mattila J.T., Thomas C. Nitric oxide synthase: non-canonical expression patterns. *Front Immunol*. 2014; 5:478.
4. Miyahara K., Kawamoto T., Sase K. Cloning and structural characterization of the human endothelial nitric-oxide-synthase gene. *Eur J Biochem*. 1994; 223(3):719-726.
5. Demircubuk A.G., Coşkun M.Y., Demiryürek S. et al. Endothelial NOS gene Glu298Asp polymorphism in preterm neonates with respiratory distress syndrome. *Pediatr Pulmonol*. 2013;48(10): 976-980.
6. Tsukada T., Yokoyama K., Arai T. et al. Evidence of association of the eNOS gene polymorphism with plasma NO metabolite levels in humans. *Biochem Biophys Res Commun*. 1998;245:190-193.
7. Evans N. Assessment and support of the preterm circulation. *Early Hum Dev*. 2006; 82:803-10.
8. Kluckow M., Evans N. Low superior vena cava flow and intraventricular hemorrhage in preterm infants. *Arch Dis Child Fetal Neonatal Ed*. 2000;82:188-94.
9. Miall-Allen V.M., de Vries L.S., Whitelaw A.G. Mean arterial blood pressure and neonatal cerebral lesions. *Arch Dis Child*. 1987;62:1068-9.
10. Tyszczuk L., Meek J., Elwell C. et al. Cerebral blood flow is independent of mean arterial blood pressure in preterm infants undergoing intensive care. *Pediatrics*. 1998;102:337-41.

11. Dempsey E.M., Hazzani F., Barrington K.J. Permissive hypotension in the extremely low birthweight infant with signs of good perfusion. Arch Dis Child Fetal Neonatal Ed. 2009; 94:241-4.

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ORIGINAL ARTICLE

THE CHARACTERIZATION OF HEADACHE IN PATIENTS WITH DYSIRCULATORY ENCEPHALOPATHY OF DIFFERENT GENESIS

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ABSTRACT

The aim of the study was to study the headache features in patients with dyscirculatory encephalopathy of different genesis.

Materials and methods: Clinical-neurological and clinical-instrumental examination of 90 persons aged 40 to 68 was performed. The first group consisted of 60 patients with dyscirculatory encephalopathy and arterial hypertension (DE and AH), the second group – 30 patients with dyscirculatory encephalopathy and cerebral atherosclerosis (DE and CA).

Results: In the study of headache in patients with DE + AH and DE + CA, the frequency of detection, the intensity on the VAS scale, and the nature of the headache, no significant difference was found between study groups.

Conclusions: According to the results of the study, it was proved that patients with DE + CA had headache in the root area, with the circumstances of headache being significantly outweighed «for no apparent reason» ($p = 0.007$) and with changing weather conditions ($p = 0.001$). Arterial hypertension was a major factor in headache ($p = 0.008$) and in patients with DE + AH.

KEY WORDS: dyscirculatory encephalopathy, hypertension, cerebral atherosclerosis, headache, visual-analogue scale VAS

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INTRODUCTION

Pain is an unpleasant sensory and emotional experience that is associated with existing or potential tissue damage, or is described by the patient in terms of such damage (International Association for the Study of Pain – IASP, 1979). Responding to the same painful irritation can vary greatly depending on the genetic predisposition, cultural traditions of the patient, age, gender, and some other factors. Pain occurs in various neurological, somatic and surgical diseases (vascular, inflammatory, tumors, traumas, reflex pain syndrome, polyneuropathy, etc.) and, accordingly, significantly impairs the quality of life of the patient. According to W.N. Cordell et al. [1], pain is the cause of referrals for patients in 52% of all emergency care cases, including primary care. Pain leads to a significant decrease in quality of life in a wide range of diseases. According to the WHO, the most common pain syndromes include headache, neck and back pain, and joint pain. Chronic spine pain ranks first in the prevalence of painful working-age syndromes (35-45 years) [2,3]. It is traditionally believed that 80% of patients with acute pain are fully recovered, only 17-20% of the pain persists. Many studies have shown that 40% of patients with an episode of acute pain continue to experience lower back pain for 6 months, in 62% of cases recurrence occurs within a year. In 5-7% of patients there is a persistent disability due to pain [4]. In clinical practice there are two types of pain – acute and chronic.

Acute (rapid) pain is signaled (danger signal) and caused by nociceptive effects: the sensation of pain occurs approximately 0.1 s from the onset of the pain stimulus (alternative names: piercing, prickly, electrical pain). All pain receptors (nociceptors) are free nerve endings. They are more common in the superficial layers of the skin, as well as in some internal tissues, such as the periosteum, arterial walls, articular surfaces, and skull bones.

Chronic pain differs from acute pain not only in duration but also in pathogenesis, clinical manifestations, treatment approaches and prognosis. Chronic pain changes the clinical picture, appears depressive disorders, decreased performance, disrupted sleep, and reduced quality of life. Increased life expectancy in advanced economies, the accumulation of an aging population, hypodynamia are part of the causes of the formation of a group of people with chronic pain syndrome, a component of which is neuropathic pain. If the formation is caused by the lesion of the somato-sensory system due to involvement in the pathological process of peripheral nerve fibers (A and C – fibers) and central neurons. Neuropathic pain is present in 7-10% of the population in the general population [3,5]. Chronic neuropathic pain is more common in women (8% vs. 5.7% in men) and patients > 50 years of age (8.9% vs. 5.6% of people <49 years old) [6]. Among women, the prevalence of pain remains higher in all age groups than in men. Sex

Table I. Frequency of detection of individual comorbid conditions in the studied patient groups.

Concomitant pathology	AH+DE N=60	DE+CA N=30
Diabetes mellitus type 2, n (%)	10 (16)	0
Anemia, n (%)	1 (2)	2 (6)
Chronic coronary syndrome, n (%)	19 (31)	1 (3)
Cardiac arrhythmias, n (%)	1 (2)	0
Aortic valve insufficiency, n (%)	1 (2)	0
Hypothyroidism, n (%)	3 (5)	7(23)

Table II. Characterization of major syndromes of patients with DE + AH and DE + CA

Syndromes	AH + DE, n=60		DE+ CA, n=30		p
	a6c.	%	a6c.	%	
Cephalic	48	80	23	77	0,786
Vestibular	33	55	13	43	0,372
Atactic	5	8	0	0	0,165
Cerebrostenic	19	32	14	47	0,174
Anxiety-depressive	14	23	6	20	0,794
Cognitive	17	28	7	23	0,801
Pyramidal insufficiency	6	10	6	20	0,204

hormones alter the response to a painful stimulus, which may indirectly lead to different perceptions of pain for men and women [7]. Psychologically, women differ in the cognitive and emotional processes that accompany pain, and have differences from men in their pain behaviors.

The mechanism of pain is due to the expression of Na channels on nerve fibers, reflects the process of compensatory neuroplasticity in response to nerve or root damage, leads to excess ectopic impulsion, directed to the posterior horn and causes its hyperactivity. Discharges of altered nociceptive fibers contribute to the release of excitatory amino acids and neuropeptides in the posterior horn, perform depolarization of postsynaptic membranes, which opens potential-dependent Ca-channels in the neurons of the horn, release of Ca into the cell, release the cells. Hyperactivity of nociceptive neurons of the posterior horn while reducing inhibitory GABA – influence exerts prerequisites for the violation of the regulatory influence on the segmental (limbic) structures in which the focus of excitation is formed, and this provides the conditions for maintaining the sensation of pain after removal of the focus [6,7]. Stressful events prevent the onset of pain – one of the most important factors in chronic pain management. The imbalance of the mediator systems resulting from stress reactions and concomitant depression affects the antinociceptive systems, modifying the sensation of pain. Studies have shown that the link between depression and pain is two-way: pain increases the risk of depression, and depression can be the root cause of pain. Also, pain

often leads to anxiety and tension, exacerbates emotional disturbances, which in themselves enhance the perception of pain – a vicious circle arises. Chronic pain can lead to impaired psychological well-being, sexual health, decreased quality of life and social maladaptation [8,9]. Continuous, non-smoking pain, in contrast to acute pain, contributes to the formation of patients with psycho-emotional disorders, which, in turn, support the process of chronic pain [10].

In this regard, the relevance of this problem is not only of medical but also socio-economic importance and needs further investigation.

THE AIM

The aim of the study is to study the features of headache in patients with dyscirculatory encephalopathy of different origins.

MATERIALS AND METHODS

Under our observation, there were 90 people aged 40 to 68 at the State Institution of Science «Research and Practical Centre of Preventive and Clinical Medicine» State Administration Department, Kyiv, Ukraine. Patients with dyscirculatory encephalopathy were divided into two groups statistically comparable by major disease, sex, and age. The first group consisted of patients with dyscirculatory encephalopathy (DE) and arterial hypertension (AH) – 60 people, the second one with DE without AH (on the background of cerebral atherosclerosis) – 30. Among the examined patients in the first group were 28 men and 32 women. In the second group – 12 men and 18 women. The mean age of men in the first group was 51.54 ± 0.76 , in the second 51.83 ± 2.24 , women in the first group 54.63 ± 0.42 , in the second 56.88 ± 0.72 . Clinical-neurological and clinical-instrumental examination was performed for all patients in order to establish the stage and form of vascular-brain pathology.

The study did not include patients with severe somatic pathology, uncompensated somatic diseases, pregnancy, patients with symptomatic hypertension, malignant lesions of the brain or other facet, hypertensive encephalopathy, or acute cerebrovascular disease, history of traumatic brain injury.

Clinical and laboratory study included general blood test, biochemical blood test, lipidogram. Clinical and instrumental examination methods included electrocardiography, blood pressure measurements, and heart rate.

Intensity of pain was assessed using the VAS-analog scale, where «0» means no pain and «10» is unbearable pain.

Statistical processing of the data obtained was carried out on a personal computer. Although the distribution of the obtained data differs from the normal one, nonparametric analysis methods were used. A statistically significant difference was considered at $p < 0.05$.

RESULTS

On the basis of the complaints, the anamnesis data, according to the results of clinical and instrumental examination,

Table III. Nature of headache among patients in the study groups (incidence rate of headache cases)

The nature of the pain	DE+AH N=48	DE+CA N=20	p
Diffuse, n(%)	5 (10)	4 (20)	0,432
Dull, n(%)	24 (50)	11 (55)	0,793
Clustered, n(%)	2 (4)	3 (15)	0,147
One sided, n(%)	7 (16)	5 (25)	0,316
Shingle, n(%)	3 (6)	1 (5)	1,000
Squeezing, n(%)	25 (52)	12 (60)	0,602

Note. The same patient could have noted several variants of the nature of the pain.

Table IV. Localization of headache among patients in the study groups (incidence rate of headache cases).

Pain localization	DE+AH N=48	DE+CA N=20	p
Frontal area, n(%)	23 (48)	14 (70)	0,115
Temporal area (areas), n(%)	22 (46)	17 (85)	0,003
Occipital area, n(%)	17 (35)	11 (55)	0,179
Timian area (areas), n(%)	12 (25)	8 (40)	0,251

Note. The same patient could have noted several variants of the nature of the pain.

Table V. Headache circumstances and associated conditions among patients in the study groups (incidence of headache cases)

Circumstances and associated conditions	DE+AH N=48	DE+CA N=20	p
Mental load, n(%)	10 (21)	8 (40)	0,134
Exercise, n(%)	8 (17)	5 (25)	0,503
Normal BP, n(%)	0	2 (10)	0,083
Increased BP, n(%)	24 (50)	3 (15)	0,008
For no apparent reason, n(%)	9 (19)	11 (55)	0,007
Changes to weather conditions, n(%)	2 (4)	15 (75)	<0,001

Note. The same patient could provide several options for answering questions.

90 patients were diagnosed with symptom complex, which corresponds to the criteria for the diagnosis of cerebral insufficiency, among patients of the first group in 19 (31.7%) were diagnosed with I stage of dyscirculatory encephalopathy (DE) and 41 (68.3%) of DE stage II. In the second group of patients, 12 (40%) were diagnosed with stage I DE and 18 (60%) – stage II DE.

AH was observed in all patients in the first group. According to the above classification, 8 (13.3%) patients had arterial hypertension stage I and 52 (86.7%) – stage II of arterial hypertension.

Among the surveyed patients were reported such concomitant conditions as chronic coronary syndrome, diabetes mellitus type 2, cardiac arrhythmias, aortic valve

insufficiency, hypothyroidism, anemia. The frequency of detection of individual comorbid conditions in the study groups is shown in Table I.

According to the evaluation of subjective and objective neurological symptoms, patients of the first group had 80% cephalic, 55% vestibular, 32% cerebrotogenic, 28% mystic syndromes and 23% had anxiety-depressive disorders. Among the patients in the second group, 77% had cephalic, 43% vestibular, 47% cerebrotogenic, 23% mystic syndromes, 20% had anxiety-depressive disorders and 20% had pyramidal insufficiency. No significant difference was found between the study groups (Table II).

The incidence rate of headache patients in the comparison groups was 48 (80%) in the DE + AH group versus 20 (67%) in the DE + CA group ($p = 0.197$). Intensity of headache, on a VAS scale (among persons with headache) (median, interquartile interval): 5 (3-6) points in group DE + AH versus 5 (3-6) points in group DE + CA ($p = 0.724$).

The nature of the headache in patients in both groups was predominant: blunt (50% in patients in the first group and 55% in patients in the second group), squeezing 52% in patients in the first group and 60% in patients in the second group) headache, but a significant difference between no study groups were identified (Table III).

Headache in patients of (DE + AH) and (DE + CA) patients was localized mainly in the frontal and temporal areas, and less frequently in the occipital area. Significantly significant difference ($p = 0.003$) was observed for localization in the root region in patients with DE + CA (Table IV).

In the circumstances of the occurrence of headache, patients with DE + CA significantly outweighed «for no apparent reason» ($p = 0.007$) and with changes in meteorological conditions ($p < 0.001$), in patients with DE + AH with elevated blood pressure ($p = 0.008$). The circumstances of headache among patients in the study groups are presented in Table V.

Thus, when analyzing the frequency of occurrence of individual syndromes, we came to the conclusion that patients of both groups were dominated by cephalic, vestibular, and cerebrotogenic syndromes, but no significant difference was found between the study groups.

DISCUSSION

The data obtained by us coincide with the results of the researches of O. M. Treshchinska, E. I. Gusev, O. M. Konovalova, V. I. Skvortsova, I. Yu. Head. In their publications, the authors note that patients with DE mostly report complaints and focus on such subjective manifestations as headache, dizziness, tinnitus, rapid fatigue, emotional lability, etc., but pain syndromes should be recognized as prevalent in clinical settings. The picture of DE, which overwhelmingly determines the severity of patients [11,12,13].

The cause of the headache can be both spasm and enlargement of the arteries, as well as insufficient venous outflow, slowing blood flow [6]. Particular attention should be paid to the opinion of some authors that patients with headache with AH seek help in the second phase – the

phase of paralytic expansion of extracerebral vessels, when there is excessive stretching of extracerebral arterial walls with increased pressure, which increases the amplitude of the amplitude of the amplitude. pain nerve receptors in the artery wall [7].

In the study of headache in patients with DE + AH and DE + CA, the frequency of detection, the intensity on the VAS scale, and the nature of the headache, no significant difference was found between study groups. Significantly significant difference ($p = 0.003$) was observed in localization in the rooted area in patients with DE + CA and in the circumstances of headache among patients with DE + CA significantly outweighed «without obvious reasons» ($p = 0.007$) and when changing meteorological conditions ($p = 0.007$), and in patients with DE + AH with increasing blood pressure ($p = 0.008$). The results obtained may be due to the fact that an important concept of pain is that pain is the result of a dynamic interaction of biological, psychological and socio-cultural factors.

At different stages of the disease, the proportion of different factors may vary. If biological (anatomical, genetic, physiological) factors predominate in the acute phase of illness, then psychological (affective, cognitive, behavioral) and social (gender, national traditions) factors may come to the fore. Biological factors can initiate, support and modulate physical disorders, whereas psychological changes affect the assessment and perception of internal physiological signals. In turn, psychological factors affect biological, altering the production of hormones, neurotransmitters, the state of the autonomic nervous system and biochemical processes in the brain [1,14,15].

CONCLUSIONS

According to the results of the study, it was proved that patients with DE + CA had headache in the root area, with the circumstances of headache being significantly outweighed «for no apparent reason» ($p = 0.007$) and with changing weather conditions ($p = 0.001$). Arterial hypertension was a major factor in headache ($p = 0.008$) and in patients with DE + AH.

REFERENCES

1. Cordell W. H., Keene K. K., Giles B. K. et al. The high prevalence of pain in emergency medical care. *Am. J. Emerg. Med.* 2002; 20(3): 165–169.
2. Kukushkin M. L., Hitrov N. K. Obshchaya patologiya boli [General pathology of pain]. *Medicine*. 2004; 141 p. (Ru)
3. Habirov F. A. Klinicheskaya nevrologiya pozvonochnika [Clinical neurology of the spine]. Kazan, 2001; 472 p. (Ru)
4. Colloca L., Ludman T., Bouhassira D. et al. Neuropathic pain. *Nat. Rev. Dis. Primtr.*, 2017; 3: 170–172.
5. Meana M. The meeting of pain and depression comorbidity in women. *Can. J. Psychiatry*. 1998; 43 (9): 893–899.
6. Bouhassira D., Attal N. Diagnosis and assessment of neuropathic pain: the saga of clinical tools. *Pain*, 2001; 152 (3 Suppl.): 74–83.
7. Bouhassira D., Lanteri-Minet M., Attal N. et al. Prevalence of chronic pain with neuropathic characteristics in the general population. *Pain*, 2008; 136 (3): 380–387.

8. Hains B.C., Saab C.Y., Klein J.P. et al. Altered sodium channel expression in second-order spinal sensory neurons contributes to pain after peripheral nerve injury. *J. Neurosci.* 2004; –Vol. 24: 4832–4839.
9. Meana M. The meeting of pain and depression: comorbidity in women. *Can. J. Psychiatry*. 1998; 43 (9): 893–899.
10. ter Kuile M.M., Weijnenborg P.T., Spinhoven P. Sexual functioning in women with chronic pelvic pain: the role of anxiety and depression. *J. Sex. Med.* 2010; 7(5): 1901–1910.
11. Nnoaham K.E., Hummelshoj L., Webster P. et al. World Endometriosis Research Foundation Global Study of Women's Health consortium. Impact of endometriosis on quality of life and work productivity: a multicenter study across ten countries. *Fertil. Steril.* 2011; 96(2): 366–373.
12. Gusev E.I., Konovalov A.N., Skvortsova E. I. Hronicheskaya nedostatochnost mozgovogo krovoobrashcheniya [Chronic insufficiency of cerebral circulation]. *Neurology: national leadership. M.*, 2011. (Ru)
13. Treshchinskaya M. A. Arterialnaya gipertenziya i cerebrovaskulnaya patologiya [Arterial hypertension and cerebrovascular pathology]. *Medicine and pharmacy news*. 2013; 30–35. (Ru)
14. Golovach I. Yu. Discirkulatornaya encefalopatiya: nekotoriye patogeneticheskiye, klinicheskiye i terapevticheskiye aspekti [Discirculatory encephalopathy: some pathogenetic, clinical and therapeutic aspects]. *Medicines of Ukraine*. 2011; 4: 60–67. (Ru)
15. Van Roenn G. X., Peys G. A., Preoder M. I. Diagnostika i lecheniye boli [Pain diagnosis and treatment]. M.: Binom, 2012; 494 p. (Ru)

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ORIGINAL ARTICLE

RISK FACTORS ASSOCIATED WITH THE OCCURRENCE OF EARLY COMPLICATIONS OF ACUTE MYOCARDIAL INFARCTION AFTER CARDIO-INTERVENTION TREATMENT

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ABSTRACT

The aim of our study was to identify the main risk factors for the occurrence of early complications of acute myocardial infarction after cardio-interventional treatment and to evaluate prognostic risk indicators.

Materials and methods: Risk factors of myocardial infarction were determined by copying the case history data and calculating on their basis of the odds ratio and $\pm 95\%$ confidence interval. After it, we made a prediction of the risk of early complications of AMI with cardiovascular intervention by using a Cox regression that took into account the patient's transportation time by ambulance.

Results: Thus, the factors that increase the chances of their occurrence were: summer time of year; recurrent myocardial infarction of another specified localization (I122.8); the relevance of the established STEMI diagnosis; diabetes mellitus; renal pathology; smoking; high rate of BMI.

Factors that reduce the chances of their occurrence: men gender – in 35%; the age over of 70 – by 50%; the timely arrival of an emergency medical team – by 55%. The factors that increase the chances of their occurrence were: age over 70 years; subsequent myocardial infarction of unspecified site; diabetes mellitus.

Using of a Cox regression analysis, it was proved that the cumulative risk of early complications of AMI with cardio-intervention treatment increased from the 10th minute of ambulance arrival at place, when ECG diagnosis (STEMI), presence of diabetes mellitus, smoking and high BMI.

Conclusions: As a result of the conducted research, the risk factors for early complications of AIM with cardio-interventional treatment were identified.

KEY WORDS: acute myocardial infarction, cardio-interventional treatment, odds ratio, Cox regression

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INTRODUCTION

The issue of coronary heart disease is one of the most important medical problems in the world (heart attack aka myocardial infarction, coronary heart disease, angina pectoris) [1, 2, 3, 4]. In acute myocardial infarction (AMI), unlike other cardiovascular diseases, timely pre-hospital and emergency treatment ensures successful recovery of the patient and a better prognosis. Ignoring of these principles can lead to increasing of mortality rates, even among young people [5, 6].

After conducting of reperfusion therapy, it is important to identify patients at high risk for further cardiac events, such as re-infarction or death, and make intervention to prevent such complications [7]. As the risk of adverse events decreases over time, an early assessment of the risks is necessary. The assessment of the size of the infarct area and function of the left ventricle at rest, as a rule, by the method of echocardiography, should be done before discharge of the patient from the hospital [8, 9]. The timing of follow-up will depend on whether the treatment was performed and whether the angiography and percutaneous coronary intervention (PCI) were successful. Assessment of ischemia risk prior to hospital discharge has become less important, due to the increased

use of primary PCI, which makes it possible to assume that infarct-dependent coronary lesions have been treated and stabilized, and the presence or absence of significant lesions in other arteries has been evaluated.

Several parameter-based risk assessment scales have been developed and put into practice that allow one to easily identify the risk in the acute phase before reperfusion [10, 11, 12]. High-risk clinical indicators in the acute phase include older age, tachycardia and tachyarrhythmia, hypotension, more than 1 score in Killip-Kimball scale, anterior infarction, history of heart attack, elevated serum creatinine and heart failure. Malignant arrhythmia, persistent chest pain, and early angina with minimal physical activity are considered to be poor results of treatment [13, 14, 15].

The recommendations of the Association of Cardiologists of Ukraine regarding the management of patients with acute coronary syndrome with ST segment elevation are of great help in the practice of dealing with such patients [16].

THE AIM

The aim of our study was to identify the main risk factors for the occurrence of early complications of acute myocar-

Table 1. Prognostic variables associated with risk factors for early complications of AMI after cardio-intervention treatment

Prognostic variables	Prognostic variables	Prognostic variables
Age	Body mass index	ECG diagnosis
Gender	Smoking	Codes of AMI (ICD-10)
Place of residence	Increase in blood pressure	The onset of symptoms before the emergency call (more than 120 minutes)
Season	Pain in the heart	Emergency arrival time (more than 10 min in Poltava)
Complications	The concomitant renal pathology	The start time of the PCI from the moment of the ECG
Death	Diabetes mellitus	

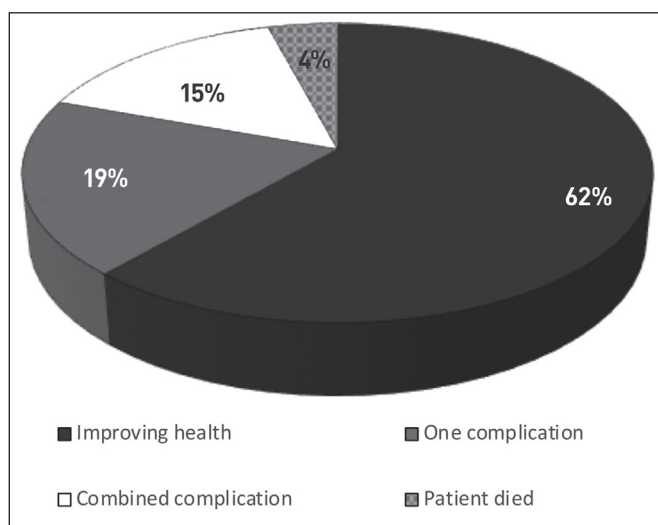


Fig. 1. Distribution of patients according to the results of cardio-interventional treatment.

dial infarction after cardio-interventional treatment and to evaluate prognostic risk indicators.

MATERIALS AND METHODS

Risk factors of myocardial infarction were determined by copying the case history data and calculating on their basis of the odds ratio. To achieve this goal, we calculated the next indexes: odds ratios (OR) and ±95% confidence interval (95% CI).

The coefficient of OR was calculated by the formula:

In this formula: a – the number of patients with complications of AMI in the presence of a risk factor; b – the number of patients without the complication of AMI in the presence of a risk factor; c – number of patients with complications of AMI in the absence of a risk factor; d – number of patients without complication of AMI in the absence of risk factor.

The following complications of AIM that occurred during cardio-intervention treatment were considered:

- aortic aneurysm;
- arrhythmia;
- reduction of blood fraction;
- cardiogenic shock;
- pulmonary edema.

To identify significant risk factors, there is 17 prognostic variables were considered, and all these variables are related to the identification of risk factors for early complications of AMI after cardio-intervention treatment (Table I).

After determining of the odds ratio for prognostic variables, we made a prediction of the risk of early complications of AMI with cardiovascular intervention. This risk was calculated using a Cox regression that took into account the patient’s transportation time by ambulance. The object of observation is a patient with AMI who has been delivered to a tertiary level of healthcare system. The determination of the predicted risk of early complications of AMI with cardiovascular intervention, lasting up to 10 – 20 minutes, was estimated by Cox regression as an influence on this risk of independent variables (predictors). For this study, those predictors that were found to be significant in the odds ratio study were selected. Risk is defined as a function of time. The risk of an event occurring for an object is given as a formula:

$$h_i(t) = h_0(t) \exp(\beta_1 X_{i1} + \beta_2 X_{i2} + \dots + \beta_p X_{ip})$$

In this formula: $h_i(t)$ – basic risk that is the same for all entities; β_1, \dots, β_p – coefficients; X_1, \dots, X_p – independent variables, predictors.

Base risk – $h_0(t)$ – is the risk of an event occurring for an object in the reference group (with all independent variables X_1, \dots, X_p being equal zero). Statistical analysis of the results of the study was performed using statistical analysis methods implemented in the SPSS 6.1 software package.

The result of treatment by the method of cardio-intervention was determined by the presence of complication or improvement of the patient’s condition. The following factors that could affect the completion of treatment were considered:

1. Natural and climatic genesis:
 - Seasonality
2. Medical and demographic genesis:
 - Place of residence
 - Gender
3. Organizational genesis:
 - Carrying out a troponin test
 - The time of arrival of emergency medical care and conducting of ECG
 - The time of arrival of the patient in the reception department from the conducting of ECG
 - Thrombolytic therapy at the pre-hospital stage
 - The start time of the PCI from the conducting of ECG

Table 2. Distribution of patients by risk factors according to the complication after cardiac intervention

Risk factor	Patients with complications abs. (%) n=85 (36,8)	Patients with improvement abs. (%) n=146 (63,2)	Odds ratio (95% CI)	P
Winter	0 (0%)	88 (29,7%)	-	-
Spring	20 (11,8%)	58 (19,1%)	1,780 (0,818 – 3,874)	0,197
Summer	100 (58,8%)	44 (14,9%)	8,052 (4,305 – 0,232)	0,001
Autumn	50 (29,4%)	106 (36,3%)	1,368 (0,769 – 5,0623)	0,315
Man	112 (65,9%)	222 (75,0%)	0,655 (0,426 – 0,972)	0,024
Age 19-49 years	54 (26,7)	63 (23,9)	0,918 (0,452 – 1,865)	0,856
Age 50-69 years	87 (43,1)	139 (52,8)	1,676 (0,964 – 2,913)	0,088
Age over 70 years	61 (30,2)	61 (23,2)	0,508 (0,261 – 0,987)	0,050
Place of residence: Poltava	100 (49,4%)	132 (50,7%)	0,950 (0,557 – 1,622)	0,892
Place of residence: another region	101 (50,6%)	130 (49,3%)		
DS: Subsequent myocardial infarction of unspecified site	37 (8,6)	35 (13,1%)	2,15 (1,224 – 5,183)	0,014
Time from the onset of symptoms to a emergency call (more than 120 minutes)	36 (7,8)	66 (14,3)	1,107 (0,578 – 2,119)	0,870
Emergency arrival time (up to 10 minutes in Poltava, up to 20 minutes in regions)	123 (26,4)	153 (32,9)	0,453 (0,255 – 0,806)	0,008
Start time of PCI after ECG withdrawal (more than 120 minutes)	68 (14,7)	78 (16,7)	1,721 (1,000 – 2,959)	0,056
DS: STEMI	8 (1,7%)	30 (6,4%)	2,284 (1,022 – 5,103)	0,027
DS: NSTEMI	162 (34,8)	266 (57,1)		
Diabetes mellitus	149 (32,0)	23 (4,9)	84,2 (45,1-157,2)	0,001
Renal pathology	74 (15,9)	40 (8,6)	4,93 (3,144-7,741)	0,001
Smoking	84 (18,0)	14 (3,0)	19,674 (10,6-36,4)	0,001
High BMI	116 (24,9)	22 (4,7)	26,754 (15,572-45,96)	0,001
Stenting	78 (91,8%)	130 (89,0%)	1,371 (0,540 – 3,481)	0,650
Conservative treatment	7 (8,2%)	16 (11,0%)	1,371 (0,540 – 3,481)	0,650

- The type of PCI
- 4. Medical genesis:
 - ECG diagnosis (STEMI/NSTEMI)
 - Diabetes mellitus
 - The concomitant renal pathology

- Smoking
- Increasing of BMI

RESULTS

In determining the consequences of cardio-intervention

Table 3. Distribution of patients who died after cardiac intervention (by risk factors, respectively)

Risk factor	Patients with complications abs. (%) n=20 (6,3)	Patients with improvement abs. (%) n=296 (65,8)	Odds ratio (95% CI)	P
Winter	0	88 (29,7)	1,1 (1,053-1,141)	0,002
Spring	6 (30,0)	58 (19,6)	1,759 (0,648-4,773)	0,258
Summer	6 (30,0)	44 (14,9)	2,455 (0,895-6,729)	0,105
Autumn	8 (40,0)	106 (35,8)	1,195 (0,474-3,015)	0,811
Man	14 (70)	222 (75,0)	1,759	0,253
Woman	6 (30,0)	74 (25,0)	(0,6484-4,773)	
Age over 50 years	20 (100)	248 (83,8)	0,925 (0,894-0,957)	0,033
Age over 70 years	12 (21,4)	44 (14,9)	8,591 (3,322-4,218)	0,000
Place of residence: another region	6 (30,0)	134 (45,3)	0,518	0,136
Place of residence: Poltava	14 (30,0)	162 (54,7)	(0,194-1,385)	
DS: Subsequent myocardial infarction of unspecified site	16 (80,0)	64 (21,6)	14,500 (4,684-14,890)	0,001
Time from the onset of symptoms to a emergency call (more than 120 minutes)	8 (40,0)	64 (21,6)	2,417 (0,947-6,165)	0,058
Emergency arrival time (up to 10 minutes in Poltava, up to 20 minutes in regions)	18 (90)	208 (25,7)	35,4 (7,993-156,775)	0,089
Start time of PCI after ECG withdrawal (more than 120 minutes)	4	140	0,279 (0,091-0,853)	0,014
DS: STEMI	20 (100)	266 (89,9)	0,930	0,127
DS: NSTEMI	0	30 (10,1)	(0,901-0,906)	
Diabetes mellitus	17 (85,0)	23 (7,8)	67,261 (18,348-46-567)	0,001

factors such as aneurysm, arrhythmia, reducing the ejection fraction of the heart, cardiogenic shock, and pulmonary edema were considered. Most of the patients noted improving health – 148 (60,7%). After conducting of cardio-intervention treatment there is 85 (34,8%) patients with different complications: one complication was 46 (18,9%), combined complication – 37 (15,2%), the patient died – 10 (4,1%) (Fig.1).

The next step in our study was a two-dimensional analysis, which was performed using tables of conjunction and odds ratio. The chance of getting complications after cardiovascular intervention increases 8.0 times in the summer: OR is 8,052 (95% CI 4,305 – 0,232), $p < 0,001$ (Table II). Significant associations were obtained between the age of the patient and the number of complications. Analyzing the relationship between the risk of complications of cardio-interventional intervention and the gender of the patient, it was found that men had a 35% lower risk of complications of cardio-interventional manipulations (OR is 0,655 (95% CI 0,426 – 0,972), $p = 0,024$.

In people over 70, the chances of getting complications are reduced by 50%: OR is 0,508 (95% CI 0,261 – 0,987), $p = 0,050$. Investigating the relationship between the risk of complications and the place of residence (Poltava, districts), no reliable correlation was found. It is revealed that such diagnosis as recurrent myocardial infarction of another specified localization (code according to IHD – 122.8) increases the risk of complication development by 2.1 times: OR is 2,15 (95% CI 1,224 – 5,183), $p = 0,014$. The timely arrival of an emergency care team reduces the chances of complications from cardio-intervention by 55%: OR is 0,453 (95% CI 0,255 – 0,806), $p = 0,008$. Established diagnosis – STEMI increases the risk of complications after intervention by 2.2 times: OR is 2,284 (95% CI 1,022 – 5,103) $p = 0,027$. According to the calculations, concomitant diabetes mellitus is extremely dangerous in the aspect of complications – it increases the risk after cardio-interventional complications by 84 times: OR is 84,2 (95% CI 45,1 – 157,2) $p = 0,001$. The presence of concomitant

Table 4. Risk factors affecting the early complication of AMI with cardio-intervention and late arrival of ambulance

STEP Nºº	Prognostic factor	Coef. B	Stand. deviation	Wald.	df	Sig.	Exp (β)
Step 1	Season			10,731	3	0,013	
	Winter	0,044	0,158	0,079	1	0,779	1,045
	Spring	-0,235	0,175	1,798	1	0,180	0,791
	Summer	-0,517	0,183	7,972	1	0,005	0,596
	Autumn	-0,347	0,151	5,311	1	0,021	0,707
Step 2	Age over 70 years	-0,106	0,113	0,894	1	0,345	0,899
	ECG diagnosis - STEMI	0,669	0,212	9,935	1	0,002	1,953
	Diabetes mellitus	1,449	0,296	23,983	1	0,000	4,259
	Anamnesis of atrial hypertension	0,148	0,198	0,562	1	0,453	1,160
	Renal pathology	0,215	0,188	1,313	1	0,252	1,240
	Smoking	1,095	0,293	13,986	1	0,000	2,988
	High BMI	0,726	0,239	9,218	1	0,002	2,066

renal pathology increases the risk of complications by 4.9 times: OR is 4,93 (95% CI 3,144 – 7,741) $p=0,001$. Smoking is extremely dangerous for the development of complications – smokers have a 19.6-fold increased risk of complications: OR is 19,674 (95% CI 10,6 – 36,4) $p=0,001$. A similar pattern is also observed for patients with a high BMI, which increases the risk of complications by 26.7 times: OR is 26,754 (95% CI 15,572 – 45,96), $p=0,001$. A significant influence of the type of treatment of AMI (stenting, conservative therapy) on the development of complications has been identified.

In determining of the risk factors that affect the mortality rate of patients with AMI, it was found that the risk of death higher in people older than 70 years in 8.5 times: OR = 8,591 (95% CI 3,322 – 4,218), $p=0,001$; in those who have repeated myocardial infarction of another specified localization in 14 times: OR = 14,500 (95% CI 4,684 – 14,890) $p=0,001$; anamnesis of diabetes mellitus increase risk of death in 67 times: OR = 67,261 (95% CI 18,348 – 46-567), $p=0,001$. The fact that the start time of PCI after ECG withdrawal (more than 120 minutes) reduces the risk may indicate that not all patients admitted to the hospital do PCI (Tab. III).

Based on the data obtained, one can speak of a diagnostic model of risk factors for early complications of AMI after cardio-intervention treatment. Finding that the timely transportation of a patient with GIM by ambulance forces is a significant factor, we investigated what additional factors would affect the untimely delivery of a patient to a tertiary level of health care system. To determine the factors that influence the early complication of AMI after cardio-intervention treatment, the Cox regression equation included predictors that were significant in determining of OR: season, age over 70 years, male gender, ECG diagnosis – STEMI, presence of diabetes mellitus, anamnesis of atrial hypertension, renal pathology, smoking, high BMI. Using of the regression analysis, we determined the factors that affect the early complication of AMI with cardio-intervention treatment (with timely arrival of the emergency).

According to the data analysis, 276 observations were identified as censored. This is the time of arrival of the

ambulance, which was more than 10 minutes in the city of Poltava or more than 20 minutes in the districts.

Table 4 shows the model constructed by the likelihood ratio method. Thus, in the first step of the analysis the model includes the alternating season: winter, spring, summer, autumn; the second stage included: age over 70 years, male gender, ECG diagnosis – STEMI, presence of diabetes mellitus, anamnesis of atrial hypertension, renal pathology, smoking, high BMI.

We found significant relationships for cases of early complication of AMI in cardio-interventional treatment, as evidenced by predicted changes in risk when changing the value of the independent variable by one (Table IV).

In the first step of the study, the most significant variables were “summer” – $\exp(\beta)$ 0,596 ($p=0,005$) and “autumn” – $\exp(\beta)$ 0,707 ($p=0,021$) – where the relative risk of complication decreased by 41.4% with each minute those who received a third of the level of care in the summer and 29,3% in the autumn. Obviously, the risk of complications in the summer and autumn is reduced when arriving by ambulance up to 10 minutes in the city and 20 minutes in the countryside, since the roads are better at this time than other seasons.

In the analysis of the second step of the equation, significant factors were: ECG diagnosis (STEMI), which increased the risk of complications by 1,9 times – $\exp(\beta)$ 1,953 ($p=0,002$); presence of diabetes mellitus by 4,25 times – $\exp(\beta)$ 4,259 ($p=0,001$); smoking by 2,98 ($p=0,001$) and high BMI by 2 times ($p=0,002$).

The estimates of the respective coefficients, as well as the graphs constructed for the mean values of the independent variables, are shown in Fig. 2, 3.

Each point and segment on the survival curve indicated the probability that the patient was in a higher risk zone of getting early complications of AMI with cardio-interventional treatment with each minute of delayed ambulance arrival. After 10 minutes there is a sharp increase in relative risk, which stops for 20 minutes, after which the number of patients who will have complications increases.

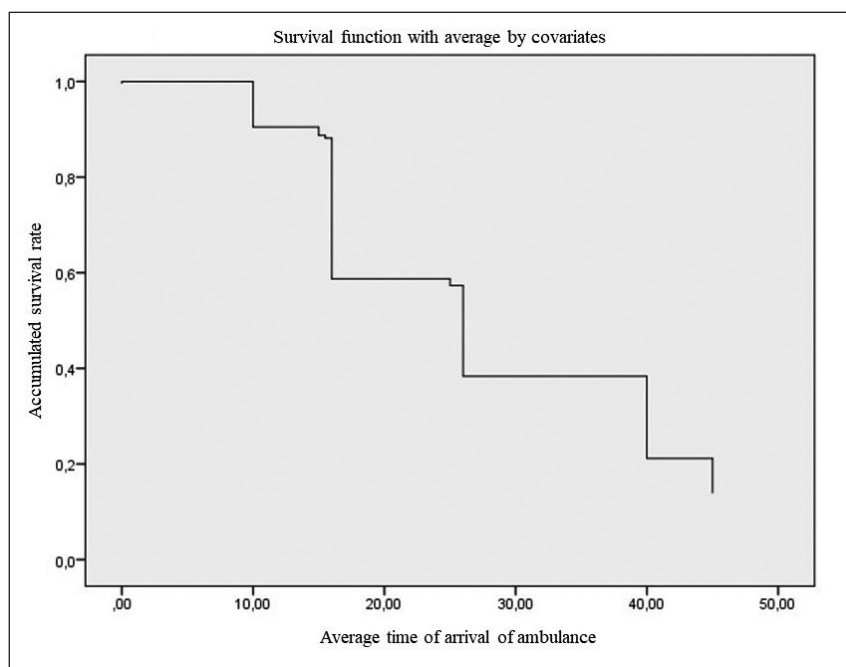


Fig. 2. Dependence of occurrence of early complications of AIM with cardio-interventional treatment for mean values of ambulance arrival covariates

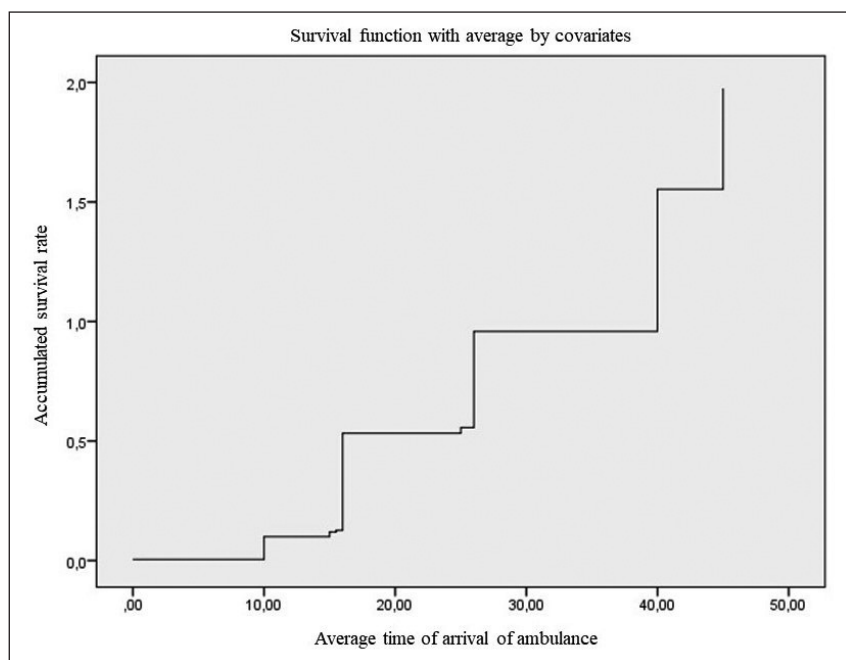


Fig. 3. Risk function of early complications of AIM with cardio-interventional treatment for the mean values of ambulance time of arrival covariates.

CONCLUSIONS

As a result of the conducted research, the risk factors for early complications of AIM with cardio-interventional treatment were identified. Thus, the factors that increase the chances of their occurrence were: summer time of year: OR = 8,052 (95% CI 4,305 – 0,232), ($p < 0,001$); recurrent myocardial infarction of another specified localization (ICD code: 122.8): OR = 2,15 (95% CI 1,224 – 5,183), $p = 0,014$; the relevance of the established STEMI diagnosis: OR = 2,284 (95% CI 1,022-5,103) $p = 0,027$; diabetes mellitus: OR = 84,2 (95% CI 45,1-157,2) $p = 0,001$; renal pathology: OR = 4,93 (95% CI 3,144-7,741) $p = 0,001$; smoking: OR = 19,674 (95% CI 10,6-36,4) $p = 0,001$; high rete of BMI: OR = 26,754 (95% CI 15,572-45,96), $p = 0,001$.

Factors that reduce the chances of their occurrence: in men, the risk of complications of cardio-interventional treatment in 35% lower: OR = 0,655 (95% CI 0,426 – 0,972) $p = 0,024$; over the age of 70, the chances of getting complications are reduced by 50%: OR = 0,508 (95% CI 0,261 – 0,987), $p = 0,050$; the timely arrival of an emergency medical team reduces the chances of complications from cardiovascular intervention by 55%: OR = 0,453 (95% CI 0,255 – 0,806), $p = 0,008$.

Risk factors have been identified that affect the mortality of patients with AMI. The factors that increase the chances of their occurrence were: age over 70 years – OR = 8,591 (95% CI 3,322-4,218) $p = 0,001$; subsequent myocardial infarction of unspecified site: OR=14,500 (95% CI 4,684-

14,890), $p=0,001$; diabetes mellitus – OR = 67, 261 (95% CI 18,348-46-567), $p=0,001$.

Using of a Cox regression analysis, it was proved that the cumulative risk of early complications of AMI with cardio-intervention treatment increased from the 10th minute of ambulance arrival at place, when ECG diagnosis (STEMI), which increased the risk of complications by 1,9 times – exp (β) 1,953 ($p = 0,002$); presence of diabetes mellitus by 4,25 times – exp (β) 4,259 ($p = 0,001$); smoking by 2,98 ($p = 0,001$) and high BMI by 2 times ($p = 0,002$).

REFERENCES

1. Bechthold A., Boeing H., Schwedhelm C. et al. Food groups and risk of coronary heart disease, stroke and heart failure: A systematic review and dose-response meta-analysis of prospective studies. *Critical Reviews in Food Science and Nutrition*. 2019; 59:7, 1071–1090; DOI:10.1080/10408398.2017.1392288
2. Zhdan, V.M., Holovanova I.A., Filatova V.L. et al Medical evaluation of efficiency of optimized models for early detection and primary prevention of cardiovascular diseases. *Wiad. Lek*. 2017; 70 (1): 433–438.
3. De Bacquer D., De Smedt D., Kotseva K. et al. Incidence of cardiovascular events in patients with stabilized coronary heart disease: the EUROASPIRE IV follow-up study. *Eur J Epidemiol*. 2019; 34, 247–258; <https://doi.org/10.1007/s10654-018-0454-0>
4. Case B.C., Waksman R. Coronary Heart Disease: Have We Reached a Plateau in Primary Prevention? *Journal of the American Heart Association*. 2020; 9:e04963; <https://doi.org/10.1161/JAHA.120.016034>
5. Brunetti N.D., DiPietro G., Aquilino A. et al. Pre-hospital electrocardiogram triage with tele-cardiology support is associated with shorter time-to-balloon and higher rates of timely reperfusion even in rural areas: data from the Bari- Barletta/Andria/Trani public emergency medical service 118 registry on primary angioplasty in ST-elevation myocardial infarction. *European Heart Journal: Acute Cardiovascular Care*. 2014; 3(3), 204–213; <https://doi.org/10.1177/2048872614527009>
6. Knoery C.R., Heaton J., Polson R. et al. Systematic review of clinical decision support systems for pre-hospital acute coronary syndrome identification. *Critical Pathways in Cardiology*: 2020 Mar 11. doi: 10.1097/HPC.0000000000000217
7. Pil-Sang Song, Myung Ho Jeong. Incidence, Predictors, and Implications of Re-Hospitalization for Heart Failure after Acute Myocardial Infarction. *Journal of Cardiac Failure*. August 2019; Volume 25, Issue 8, Supplement, Page S151; <https://doi.org/10.1016/j.cardfail.2019.07.435>
8. Saleh A., El-Amin A., El-Baz M. et al. Assessment of Myocardial Viability After Acute ST- Elevated Myocardial Infarction Using Stress Speckle Tracking Echocardiography and Cardiac MRI. *The Egyptian Journal of Hospital Medicine*. 2019; 77(3), 5173-5182: doi: 10.12816/ejhm.2019.53303
9. Zhdan V.M., Dvornyk V.M., Bielikova I.V. et al. Epidemiology of diseases of the circulatory system among the population of Poltava region. *Wiad. Leka*. 2019; 12 (1): 2366–2370.
10. Forte E., Punzo B., Gentile Fet al. Normal patterns of left ventricle rest myocardial perfusion assessed by third-generation cardiac computed tomography. *Clin Physiol Funct Imaging*. 2020: 40: 30-36. doi:10.1111/cpf.12598
11. Xing Y., Rao N., Miao M. et al. Task-State Heart Rate Variability Parameter- Based Depression Detection Model and Effect of Therapy on the Parameters. *IEEE Access*. 2019; vol. 7, pp. 105701-105709; <https://ieeexplore.ieee.org/abstract/document/8784161>
12. Killip T., Kimball J.T. Treatment of myocardial infarction in a coronary care unit. A two year experience with 250 patients. *Am J Cardiol*. 1967 Oct; 20(4):457-64.
13. Mostafa M., Attia W., Taha M. et al. Assessment of Left Atrial Function in Patients with Non-ST-Segment Elevation Myocardial Infarction Using Two-Dimensional Speckle Tracking Echocardiography. *The Egyptian Journal of Hospital Medicine*. 2018; 73(4), 6562-6570; doi: 10.12816/ejhm.2018.15418
14. Chen Kan, Hui Yang. Internet of Hearts – Large-Scale Stochastic Network Modeling and Analysis of Cardiac Electrical Signals. *Stochastic Modeling and Analytics in Healthcare Delivery Systems*. 2017. P. 211–251 https://doi.org/10.1142/9789813220850_0009
15. Khorosh M.V., Harkavenko M.O., Holovanova I.A. Risk factors for development of hypertension in Poltava region. *Wiadomosci Lwarskie*. 2016; 2:190–197.
16. Mannheimer C., Camici P., Chester M.R. et al. The problem of chronic refractory angina. Report from the ESC Joint Study Group on the Treatment of Refractory Angina. *European Heart Journal*. 2002; 23, 355–370 doi:10.1053/euhj.2001.2706
17. Parchomenko O.M. et al. Rekomendacii`yi asoczi`aczi`yi kardi`ologi`v Ukraini shhodo vedennya paczi`yenti`v z gostrim koronarnim sindromom z elevaczi`yeyu segmenta ST. [Recommendations of the Association of Cardiologists of Ukraine on the management of patients with acute coronary syndrome with ST segment elevation]. <http://www.webcardio.org/Data/Sites/1/lecture/rekomendacii-2.pdf>

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ORIGINAL ARTICLE

PREVALENCE OF COMPLAINTS AND RISK FACTORS IN PATIENTS WHO APPLIED TO THE AMBULATORY OF GENERAL PRACTICE – FAMILY MEDICINE

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ABSTRACT

The aim of our work was to conduct a comprehensive assessment of the frequency and features of patient's complaints, the prevalence of major vascular risk factors in patients who applied for medical care to the ambulatory of general practice – family medicine and analysis of the results based on questionnaires using the original questionnaire.

Materials and methods: It was compiled a questionnaire according to which 87 people from 18 to 60 years old, were interviewed who applied to the general practice outpatient clinic – family medicine. The questionnaire included questions related to the well-being of those who went to the outpatient clinic, questions regarding the lifestyle, nutrition, bad habits, the specifics of work and the chronic pathology of the respondents and their relatives. First group included 42 (48.3%) middle-aged patients according to WHO classification, second group – 45 (51.7%) young adults.

Results: With the help of questioning of the patients who went to the outpatient clinic, we identified and statistically confirmed the risks of the occurrence and development of pathology of arterial hypertension and coronary heart disease. The odds ratio is quite high in persons with memory impairment, attention – 4.41; feeling of heaviness in the head – 3.45; dizziness – 5.02; heartache – 5.54; overweight – 6.80; not involved in sports – 3.66 in our survey groups.

Conclusions: In this study we have determined the risk groups of patients and the predictors of development of cardio- and cerebrovascular pathology in patients of the first group are revealed.

KEY WORDS: prevention, family medicine, risk groups, early diagnosis, questionnaire

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INTRODUCTION

In the modern doctrine of health, a key role is played by prevention [1] and early diagnosis of diseases [2, 3]. This is especially pronounced in primary health care. A family doctor has a great responsibility in the early diagnosis, prevention of diseases, as well as determining the patient's route [4, 5, 6].

Cardiovascular diseases occupy a leading position in the structure of mortality not only in our country but in the whole world [7]. Therefore, the identification of early cardiovascular risk factors, their susceptibility (first line relatives) and timely evaluation of complaints that may indicate cardiovascular disease (such as arterial hypertension, diabetes mellitus, etc.) are of extreme importance to prevent conditions such as stroke, myocardial infarction and sudden cardiac death [8, 9]. It is known that vascular risk factors such as arterial hypertension and diabetes mellitus have a long-term subclinical or asymptomatic course and should therefore be detected at the earliest possible stages to prevent damage to the target organs, namely the vessels of the brain, heart, kidneys, etc. [9, 10].

At the prehospital stage, almost 80% of patients begin and end treatment. Therefore, optimization of the early diagnosis of diseases is the starting point in the diagnosis, treatment, prevention of possible complications, the identification of

possible risk groups with various pathologies and recovery, and, accordingly, in improving the patient's quality of life [11].

THE AIM

The aim of our work was to conduct a comprehensive assessment of the frequency and features of patient's complaints, the prevalence of major vascular risk factors in patients who applied for medical care to the ambulatory of general practice – family medicine and analysis of the results based on questionnaires using the original questionnaire.

MATERIALS AND METHODS

To achieve this goal, we compiled a questionnaire according to which 87 people were interviewed who applied to the general practice outpatient clinic – family medicine in the village of Khotov, Kiev-Svyatoshinsky district. The study included individuals from 18 to 60 years old. Patients with traumatic brain injury, infection, as well as persons in contact with radiation were excluded from the analysis.

The questionnaire included questions related to the well-being of those who went to the outpatient clinic, questions regarding

Table I. The increase in quietness of the most important factors in the income groups.

	Patients	Healthy
Tinnitus	30,77±7,39	11,36±4,78
Ear pain	10,26±4,86	2,27±2,25
Ear plugging	12,82±5,35	18,18±5,81
Memory impairment, attention*	41,03±7,88	13,64±5,17
Feeling of heaviness in the head*	56,41±7,94	27,27±6,71
Headache	89,74±4,86	77,27±6,32
Dizziness*	48,72±8,00	15,91±5,51
Pain in the heart*	61,54±7,79	25,00±6,53
Reception of antihypertensive	61,54±7,79	2,27±2,25
Are relatives with hypertension	66,67±7,55	54,55±7,51
Relatives of patients with diabetes	23,08±6,75	31,82±7,02
Overweight*	69,23±7,39	22,73±6,32
Healthy eating	61,54±7,79	59,09±7,41
Smoking	12,82±5,35	15,91±5,51
Consuming alcohol	46,15±7,98	56,82±7,47
Drinking coffee	48,72±8,00	75,00±6,53
Consuming foods with high salt content	64,10±7,68	63,64±7,25
Sports *	17,95±6,15	43,18±7,47
Glucose levels	87,18±5,35	70,45±6,88
Episodes of glucose increase	17,65±6,54	0,00±0,00
Thyroid ultrasound	51,28±8,00	40,91±7,41
Healthy lifestyle	66,67±7,55	77,27±6,32

* - the difference between the groups is statistically significant.

the lifestyle, nutrition, bad habits, the specifics of work and the chronic pathology of the respondents and their relatives. Tinnitus, pain and stuffiness in the ears, memory impairment, attention loss, feeling of heaviness in the head, headache, dizziness, pain in the heart, receiving antihypertensive drugs, whether there are relatives with arterial hypertension, relatives with diabetes mellitus, relatives with obesity, healthy eating, tobacco smoking, alcohol abuse, coffee overuse, consuming high-salt foods, sport activities, high glucose level, high heart rate, healthy lifestyle – a list of questions of this questionnaire. According to the study design, first group (N = 42, 48.3%) included middle-aged patients, while the second group (N = 45, 51.7%) consisted of healthy young people. There are 69 (79.3%) women and 18 (20.7%) men among them. Women in the young group were 35 (77.8%) and middle-aged 34 (81%), men 10 (22.2%) and 8 (19%) respectively. Statistical analysis was performed with Statistica 13.1. All values were expressed as means ± standard deviation (average ± SD). Differences were considered to be significant at $p < 0.05$.

RESULTS AND DISCUSSION

The results of the prevalence of various factors, according to the groups, are presented in Table I.

As a result of the analysis of the factors we are studying, it should be noted: the predominance of symptoms is ill in first

group. Tinnitus (30.77 ± 7.39%), ear pain (10.26 ± 4.86%), memory impairment, attention (41.03 ± 7.88%), feeling of heaviness in the head (56.41 ± 7.94%), headache (89.74 ± 4.86%), dizziness (48.72 ± 8, 00%), pain in the heart area (61.54 ± 7.79%) compared with the second group: tinnitus (11.36 ± 4.78%), ear pain (2.27 ± 2.25 %), memory impairment, attention (13.64 ± 5.17%), feeling heaviness in the head (27.27 ± 6.71%), headache (77.27 ± 6.32%) , dizziness (15.91 ± 5.51%), pain in the heart area (25.00 ± 6.53%). As for bad habits, smoking, alcohol and coffee were more frequently reported by the second group, (15.91 ± 5.51%), (56.82 ± 7.47%), and (75.00 ± 6.53%), and in the first group (12.82 ± 5.35%), (46.15 ± 7.98%), (48.72 ± 8.00%) respectively. Healthy eating is not much more commonly adhered to by representatives of group 1 (61.54 ± 7.79%), against (59.09 ± 7.41%) of the second group, while the consumption of products with high salt content was approximately the same in both groups (64.10 ± 7.68%) and (63.64 ± 7.25%). The intake of antihypertensive drugs was predominant in the subjects of the first group (61.54 ± 7.79%) compared with the second group (2.27 ± 2.25%). Tendency to overweight was noted in the first group (69.23 + 7.39%) relative to the second group (22.73 + 6.32%). Also, there was a history of arterial hypertension and diabetes mellitus in relatives (66.67 ± 7.55%), (23.08 ± 6.75%) in the first group and (54.55 ± 7.51%), (31.82 ± 7.02%) in the second group, respectively. But sports, a healthy lifestyle was more frequently observed in the second group (43.18 ± 7.47%)

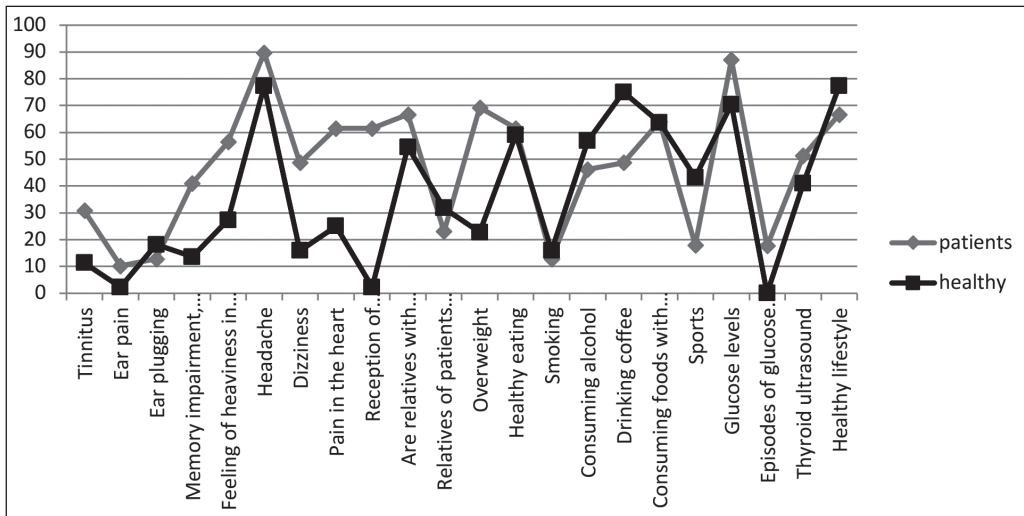


Fig. 1. The distribution of the studied factors in groups, %.

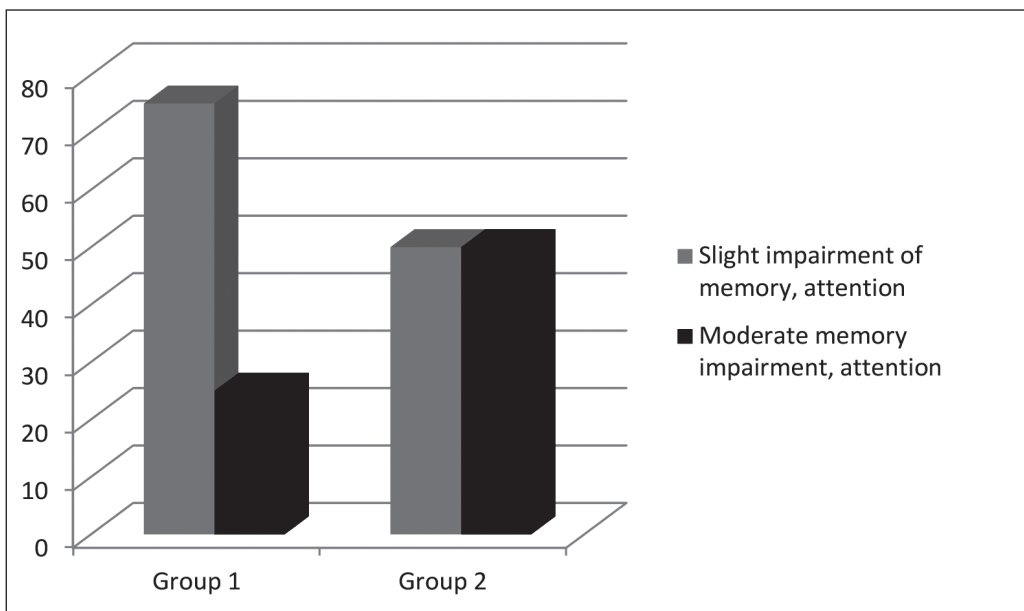


Fig. 2. The quality of sleep according to the patient, %.

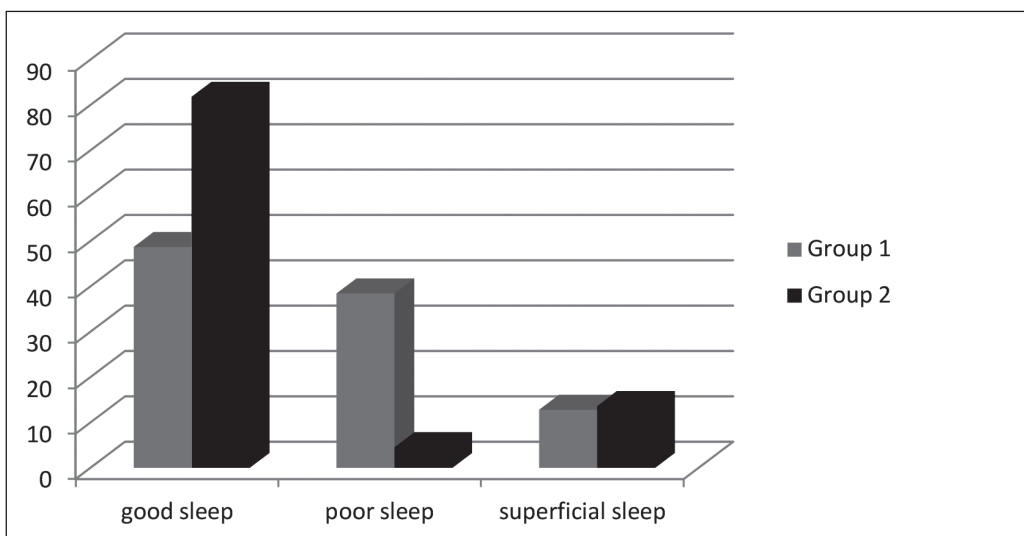


Fig. 3. Damaged memory, respect, %.

and $(77.27 \pm 6.32\%)$ as opposed to $(17.95 \pm 6.15\%)$ and $(66.67 \pm 7.55\%)$ of the first group. Determination of blood glucose level and thyroid ultrasound were performed more often by representatives of group 1, $(87.18 \pm 5.35\%)$ $(51.28 \pm 8.00\%)$, against

$(70.45 \pm 6.88\%)$ and $(40.91 \pm 7.41\%)$ of the examined group 2. In this case, episodes of glucose increase were observed exclusively in the examined the first group $(17.65 \pm 6.54\%)$. These research factors are shown in Figure 1.

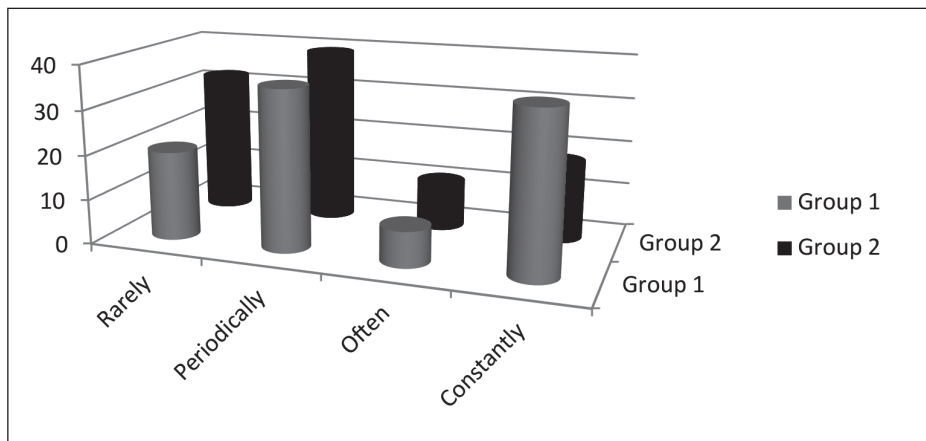


Fig. 4. Consumption of products with high salt content, %.

Table II. Prevalence of various factors in study groups among those who believe they are leading a healthy lifestyle, %.

	Group 1	Group 2
Healthy eating	61,54±7,79	59,09±7,41
Smoking	11,54±6,27	14,71±6,07
Alcohol use	42,31±9,69	55,88±8,52
Drinking coffee	46,15±9,78	70,59±7,81
Eating high-salt foods	53,85±9,78	52,94±8,56
Sport activities	23,08±8,26	55,88±8,52

Also, we conducted an analysis of the quality of sleep of the subjects in both groups. Good sleep was observed among the subjects in the second group (81.82 +%) versus (48.72 +%) in the first group, respectively. Poor sleep was noted by 38.46 + 7.79% of the examined the first group and 4.55 + 3.14% from the second group. Moreover, superficial sleep was almost evenly observed,

as in group 1 (12.82 + 5.35%). and in group 2 (13.64 + 5.17%). Figure 2 shows the relationship between sleep quality in groups.

As for impaired memory and attention, patients in the first group noted minor (75.00 + 10.83%) and (25.00 + 10.83%) mild impairments, and in the second group these changes were equally distributed as shown in Figure 3.

The constant use of foods with a high salt content of more than 2 times is observed in the first group. (36.00 + 9.60%) in relation to (17.86 + 7.24%) in the second group, respectively. Frequent and periodic use of such products slightly prevailed in group 2 (10.71 + 5.85%), (39.29 + 9.23%), versus (8.00 + 5.43%), (36.00+ 9.60%) of group 1. Rarely consumed foods with a high salt content were representatives of the second group (32.14 + 8.83%) compared with the first group (20.00 + 8.00%). This ratio is shown in details in Figure 4.

In the analysis of the factors of proper nutrition, bad habits, overuse of a number of products and prevention of hypodynamia in both groups, among those who believe that they lead a healthy

Table III. The risk of pathology (AH and CHD) in the presence of factors.

	Odds ratio	Confidence interval	Xi- square	p
Tinnitus	3,47	0,98-12,93	3,66	0,056
Ear pain	4,91	0,48-120,96	1,13	0,287
Congestion in the ears	0,66	0,17-2,54	0,14	0,713
Memory impairment, attention	4,41	1,36-14,87	6,62	0,01
Feeling of heaviness in the head	3,45	1,26-9,63	6,10	0,013
Headache	2,57	0,65-10,91	1,19	0,222
Dizziness	5,02	1,63-15,98	8,88	0,003
Heartache	5,54	1,92-16,36	11,44	<0,001
Are relatives with hypertension	1,67	0,62-4,49	0,81	0,367
Relatives of patients with diabetes	0,67	0,22-1,97	0,33	0,568
Overweight	6,80	2,28-20,87	13,90	<0,001
eating healthy	1,11	0,42-2,94	0,00	0,998
Smoking	0,76	0,19-3,01	0,02	0,897
Consuming alcohol	0,65	0,25-1,69	0,56	0,453
Drinking coffee	0,32	0,11-0,88	5,03	0,024
Eating high-salt foods	0,96	0,35-2,61	0,02	0,892
Not engaged in sports	3,66	1,19-11,59	15,37	0,02

lifestyle, it was found that in the second group, the examinees use alcohol and coffee much more often: (55.88 + 8.52%) and (70.59 + 7.81%) in the second group and (42.31 + 9.69%) and (46.15 + 9.78%) in the first group, respectively. The percentage of smokers in the second group (14.71 + 6.07%) was relatively insignificant compared to the first group (11.54 + 6.27%). Products with a high salt content were used by representatives of both groups approximately equally (53.85 + 9.78%) in the first group and (52.94 + 8.56%) in the second group. However, persons in the first group were significantly less likely to play sports (23.08 + 8.26%) compared to the second group (55.88 + 8.52%). The data are presented in Table II.

At the same time, among the smokers who do not want to stop it, one third in the group with pathology and five in the group of healthy persons.

With the help of questioning of the patients who went to the outpatient clinic, we identified and statistically confirmed the risks of the occurrence and development of pathology of arterial hypertension and coronary heart disease. The odds ratio is quite high in persons with memory impairment, attention – 4.41; feeling of heaviness in the head – 3.45; dizziness – 5.02; heartache – 5.54; overweight – 6.80; not involved in sports – 3.66 in our survey groups. Details of the risk of pathology are presented in Table III.

Thanks to monitoring and systematization of complaints of patients who applied for medical care to the outpatient clinic of general practice – family medicine, we identified negative factors affecting the health of those who addressed and identified “risk” groups among them. Conducting such an analysis in outpatient clinics of general practice – family medicine can help identify trends in morbidity in the regions and, accordingly, their early diagnosis and prevention.

CONCLUSIONS

1. The study revealed changes that show signs of cerebro-asthenic syndrome, noted the negative impact of diet and a tendency to hypodynamics, which were characteristic of persons of the first group.
2. It is established that disorders of memory, attention, heaviness in the head, dizziness, pain in the heart, predisposition to overweight are predictors of cardiovascular and cerebrovascular pathology.

REFERENCES

1. Kılıç S., Saraçoğlu E., Çekici Y. et al. Comparison of secondary prevention in coronary heart disease patients living in rural and urban areas. *Türk Kardiyol Dern Ars.* 2019; 47(2): 128-136.
2. Silina V., Kalda R. Challenges for clinical practice and research in family medicine in reducing the risk of chronic diseases. Notes on the EGPRN Spring Conference 2017 in Riga. *Eur J Gen Pract.* 2018; 24(1): 112-117.
3. Csige I., Ujvárosy D., Szabó Z. et al. The impact of obesity on the cardiovascular system. *J Diabetes Res.* 2018; 2: 125-134.
4. Parkash J., Kalhan M., Singhania K. et al. Dissemination of Arterial Hypertension and its Determinants among Police Officers in Haryana, India. *International Journal of Applied and Basic Medical Research.* 2019; V. 9: 143-147.
5. Kim X., Kim C., Yong C. et al. Prevalence and incidence of atherosclerotic cardiovascular disease and its risk factors in Korea: a nationwide population-based study. *BMC Public Health.* 2019; 19(1): 1112.

6. Gupta P., Khedar RS., Gaur K. et al. Low quality cardiovascular care is an important coronary risk factor in India. *Indian Heart J.* 2018; 70. Suppl 3: 419-430.
7. Filipets O. O., Pashkovsky V. M. Naslidki insultu v Ukraini: analiz oficijnoji statistiki insutu ta oglad na osnovi epidemiologichnih doslidzhen [Stroke Burden in Ukraine: Analysis of the Official Stroke Statistics and Overview of Population-Based Epidemiological Studies]. *J Clin Exp Pathol.* 2014; 13 (3): 189-193. (Ua)
8. Piepoli M. F., Hoes A. W., Albus C. et al. European Guidelines on cardiovascular disease prevention in clinical practice. *Eur. Heart J.* 2016; 37: 2315-81.
9. Nelson M. R. Doust J. A. Primary prevention of cardiovascular disease: new guidelines, technologies and therapies. *Med. J.* 2013; 198 (11): 606-10.
10. Trishchynska M. A. Potokozalezna vazodilyatatsiya u zhinok z pochatkovimi proyavami hronichnoyi ishemiyi mozku [Flowmediated dilation in women with initial manifestations of cerebral ischemia]. *Zdorovoje zhenschiny.* 2016; 2 (108): 56-59. (Ua)
11. Trishchynska M. A. Stan sudinoruhovoyi funktsiyi endoteliju v patcientiv z tserebrovaskulyarnoyu patologieyu riznogo stupenya tyazhkosti [State of vasomotor endothelial function in patients with cerebrovascular pathology different severity]. *Ukrayinskiy nevrologichniy zhurnal.* 2015; 3: 26-29. (Ua)

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ORIGINAL ARTICLE

CURRENT STRATEGY FOR TREATMENT OF COMORBID STATES: COMPLICATED COMMUNITY-ACQUIRED PNEUMONIA WITH ARTERIAL HYPERTENSION

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ABSTRACT

The aim: To optimize the treatment of CAP patients with hypertension, complicated by exudative pleuritis.

Materials and methods: The study included 43 CAP patients, aged 46 to 65 years, with viral lesions along with hypertension. The average age of the patients was 52.5 ± 4.5 years. Verification of the CAP diagnosis and its formulation was performed in accordance with the order of the Ministry of Health of Ukraine No. 128 of 19.03.2007 "On the approval of clinical protocols of medical care in "Pulmonology" in all patients, pneumonia was complicated by exudative pleuritis, which was confirmed by X-ray examination.

Results: The use of combination drugs, namely, torasemide with prolonged effect and tivortin aspartate in the treatment of patients with community-acquired pneumonia, complicated by exudative pleuritis, combined with hypertension led to more significant positive changes in the values of saturation, blood biochemical parameters, as well as accelerated recovery of patients, which was confirmed by the positive dynamics of X-ray examination.

Conclusions: As a result of the treatment, all parameters of the quality of life of the patients were greatly improved, which resulted in a significant reduction in functional limitations and high social activity of the patients, which significantly reduced the cost of treatment.

KEY WORDS: community-acquired pneumonia, exudative pleuritis, hypertension, L-arginine, torasemide

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INTRODUCTION

In clinical practice, the physician often encounters a combination of chronic cardiovascular disease, such as coronary heart disease (CHD) or arterial hypertension (AH) and acute respiratory system diseases: bronchitis or pneumonia. In comorbid states, the choice of adequate pharmacological therapy is of particular importance.

Currently, respiratory diseases remain very common and cause significant economic losses at the national level, ranking first in the number of days of permanent or total disability and mortality [1]. Thus, about two million people die annually of community-acquired pneumonia (CAP) worldwide [2, 3, 4]. In European countries the number of patients with CAP exceeds 4.2 million people per year [5]. With a significant percentage of development of complications and fatal cases, especially in the case of its combination with concomitant cardiovascular diseases, CAP remains a topical issue for physicians, despite the ever-increasing number of antibacterial, mucolytic, immunomodulatory drugs. In addition, the clinical course of CAP has changed markedly in recent years, and first of all it is associated with the increase of verified viral and bacterial infection as a possible etiological factor of the pathology. The study of the clinical course of CAP in patients with cardiovascular diseases, in particular, arterial hypertension (hypertension), shows a frequent complication by exudative pleuritis, which not only complicates the course of the disease, but also increases the cost of treatment.

On the other hand, cardiovascular pathology, such as coronary heart disease, hypertension, makes one of the leading places in morbidity ranking of the population of Ukraine [6] and is a high probability of severe complications, which can lead to disability of patients and have high lethality, so it is both medical and social issue. Therefore, it is easy to predict that the course of CAP in patients with coronary heart disease and hypertension will be more severe, with progressive signs of stagnation, which requires more careful prescription of drugs.

According to the reported data, vascular endothelial dysfunction is one of the leading causes in the onset and progression of ischemic heart disease and arterial hypertension [7]. The vascular endothelium is the only organ that regulates hemodynamics and perfusion according to the needs of each organ or tissue. The major role of endothelium is the release of biologically active substances, and the vascular tone (total vascular resistance, blood pressure); atrombogenicity of the vascular wall, platelet activity and coagulation, inflammation, oxidative resistance, as well as the integer layer structure of the vascular wall and manifestation of atherogenesis is dependent on the adequate functioning of the endothelial cells. Their impaired regulation leads to changes in the organs and systems that serve as the pathogenetic basis for many pathological processes, such as cardiovascular pathology. Therefore, the reduction of damage, correction and adequate functioning of the

endothelium is one of the most urgent issues of current therapy of vascular pathology. One of the drugs used in clinical practice for the endothelial function recovery is NO donors, in particular L-arginine, which led to a positive effect in endothelial dysfunction [8].

The accumulation of large amount of the cardiovascular pathogenesis data alters the treatment paradigms for these patients. Along with ACEI, beta-blockers, blockers of mineralocorticoid receptors, and even with minor signs of stagnation (hypokinesia) the use of diuretic therapy is rational. According to the European Association of Cardiologists recommendations (2012), diuretics can be used, when necessary, to relieve signs and symptoms of fluid retention, regardless of the functional ejection of the left ventricle indicator, whereby loop diuretics prescription is preferable to thiazide. Loop diuretics by their effect outperform other groups of diuretics, so their use is at the basis of treatment of congestion and edema in chronic heart failure. Currently, the advantage of slow infusion of diuretic over bolus intravenous injection has been repeatedly demonstrated for the prevention of ricochet syndrome. Thus, the diuretic should be selected so that its activity prolongs for the maximum possible period of time during a day. Torasemide, an advanced loop diuretic with prolonged effect, possesses relevant pharmacological characteristics.

Many publications report on the etiopathogenesis and treatment strategies of CAP; however, the issue of differential selection of CAP treatment for patients with various concomitant diseases is underestimated. For this reason, we draw the attention of family physicians to the CAP development, complicated by exudative pleuritis in patients with hypertension.

THE AIM

The study was conducted to optimize the treatment of CAP patients with hypertension, complicated by exudative pleuritis.

MATERIALS AND METHODS

The study included 43 CAP patients, aged 46 to 65 years, with viral lesions along with hypertension. The average age of the patients was 52.5 ± 4.5 years. Verification of the CAP diagnosis and its formulation was performed in accordance with the order of the Ministry of Health of Ukraine No. 128 of 19.03.2007 "On the approval of clinical protocols of medical care in "Pulmonology" [9] in all patients, pneumonia was complicated by exudative pleuritis, which was confirmed by X-ray examination. Verification of the hypertension diagnosis and its formulation was carried out in accordance with the order of the Ministry of Health of Ukraine No. 54 of 14.02.2002 "On the approval of clinical protocols of medical care in "Cardiology" [9]. The diagnosis of CHD was confirmed on the basis of the WHO's standard cardiology questionnaire (Rose questionnaire) [10], the nature of changes in the resting electrocardiogram and in accordance with the recommendations of the VI National Congress of Cardiologists of Ukraine).

All patients were divided into three groups: Group I (Clinical group A) (n=17) involved standard complex treatment of CAP and concomitant hypertension, which included prescription of diuretic torasemide 5 mg 2 times a day per os; Group II (Clinical group B) (n=18) involved treatment complex consisted of administration of torasemide of prolonged effect (Britomar) at a dose of 10 mg a day; Group III (Clinical group C) (n=18) involved treatment complex with torasemide of prolonged effect (Britomar) 10 mg a day per os in combination with tivortin aspartate 4.2%, administered intravenously 100 ml 1 time a day for 10 days.

Patients underwent complete blood count and biochemical blood test, chest X-ray; the level of oxygen saturation in the capillary blood was determined by transcutaneous method using a pulse oximeter CMS50B *Pulse Oximeter*.

All studies were conducted according to a common scheme: at the time of admission to the clinic, on the 7th and 15th day of treatment. A version of the MOS SF-36 Common Questionnaire (MOS SF Item Short Form Health Survey) was used to study the dynamics of the quality of life of CAP patients at different stages of treatment. In addition to the MOS SF-36 questionnaire, tests were performed to assess the impact of ongoing therapy on the quality of life of CAP patients, with a global assessment of the status and quality of treatment for patients and physicians. The test results were based on a score system. Patients filled in the SF-36 questionnaire individually: before treatment at the time of admission to the hospital, at the end of inpatient treatment (14-16 days), within 1 month.

Statistical processing of the results was made on a personal computer using the standard MS Excell and Statistica for Windows. Version 6.0 software.

RESULTS AND DISCUSSION

The analysis of the initial findings of the studies showed that all patients had significant saturation disorders, leukocytosis, ESR, distortion of leukocyte differential count; the X-ray examination revealed signs of exudative pleuritis, and biochemical studies revealed a slight increase of blood sodium and creatinine.

Within 5 days of treatment, patients of different clinical groups showed positive dynamics of clinical symptoms with amelioration of shortness of breath and cough, decreased purulence and volume of sputum, normalization of body temperature, overall health state, absence of pain in the chest, normal sleep. Improvement was accompanied by clinical benefits in physical functioning (PF).

The analysis of dynamics of rates in patients of different clinical groups showed that the saturation level in group A improved to 94.67 ± 0.82 , but had no significant value compared with the score of 92.11 ± 0.23 before treatment, while maintaining a significant deviation from the norm of 98.53 ± 0.12 . Saturation level in clinical group B also showed a positive shift to 95.21 ± 0.51 ($p \geq 0.05$), which had a significant score compared to the score before treatment, but did not reach the normal value and still had a significant deviation. In clinical group C only, the saturation score reached 97.83 ± 0.34 , which

almost coincided with the normal value of 98.53 ± 0.12 , and had a significant deviation from the result of the score of 92.11 ± 0.23 before treatment. X-ray examination showed the improvement in clinical group A on the 10th day on the average of $12,88 \pm 0,33$, in clinical group B on the 7th day, which accelerated recovery by the average of $9,83 \pm 0.35$, and in clinical group C exceeded the value of group A by almost 2 times, lasted for 5-6 days, on the average of 5.37 ± 0.36 and had a significant deviation. The analysis of the dynamic pattern of saturation and a positive presentation in the lungs clearly demonstrates the advantage of prescribing combined therapy with torasemide and tivortin of prolonged effect for CAP treatment complicated by exudative pleuritis in combination with hypertension, which accelerates the recovery of patients. It should be noted that all these changes was accompanied by normalization of complete blood counts; in all clinical groups WBC count, ESR was normalized, but there were no significant deviations among these scores. No statistically significant deviations were observed in the biochemical blood test, in particular sodium presence. Patients before treatment had natriemia up to 148.20 ± 0.26 , a significant deviation from normal rates, which was most likely associated with administration of diuretics of various pharmacological groups before hospitalization. The study of this parameter showed that in clinical group A it increased slightly to 153.45 ± 0.62 ($p \geq 0.05$), in clinical group B it was 152.12 ± 0.43 and also had a significant deviation from the score before treatment, however, still had a significant deviation from the norm, and only in clinical group C, this score reached the norm of $141,12 \pm 0,86$ and had a significant deviation from the score before treatment. In addition, in all clinical groups, normalization of blood pressure was observed, with changes without significant differences, but in clinical group B and C blood pressure scores were restored to the target figures more smoothly, preserving the natural daily rhythm of blood pressure, and did not have a zigzag pattern as in the group A.

The assessment of the dynamics of quality of life parameters of patients in clinical groups showed a significant improvement in all parameters of quality of life of patients in clinical group C. Moreover, tivortin therapy in combination with torasemide with prolonged effect (Group C) contributed to the improvement of the parameters of vital activity (VA) and physical functioning (PF), as well as the overall health (OH); the resulting data were significant, and only in clinical group A these parameters were not significant. To a lesser extent positive dynamics of treatment were related to these results in clinical group B, although the physical functioning (PF) had significant values as well. Patients in clinical groups B and C noted improvements in social functioning (SF), and this value was significant. All the obtained data favorably affected not only the quality of life of the patients but the compliance as well.

CONCLUSIONS

The use of combination drugs, namely, torasemide with prolonged effect and tivortin aspartate in the treatment of patients with community-acquired pneumonia, com-

pllicated by exudative pleuritis, combined with hypertension led to more significant positive changes in the values of saturation, blood biochemical parameters, as well as accelerated recovery of patients, which was confirmed by the positive dynamics of X-ray examination, and to a large extent improved all parameters of the quality of life of patients, which was reflected in a significant decrease in functional limitations and high social activity of patients.

It should be noted that the findings of the studies confirm the prospectivity of use of combination drugs that affect different components of pathogenesis in comorbid states of patients, which will allow a physician in clinical practice not only to treat each patient individually, but also to reduce the cost of treatment and establish a high level of compliance.

REFERENCES

1. Nakaz MOZ Ukrainy №128 vid 19.03.2007 "Pro zatverdzhennia klinichnykh protokoliv nadannia medychnoi dopomohy za spetsialnistiu "Pulmonolohiia" [Order of the Ministry of Health of Ukraine No. 128 as of 19.03.2007 "On approval of the clinical protocols for the provision of medical care in the specialty "Pulmonology"]:21. (In Ukrainian).
2. Feshchenko Yu.I. et al. Nehospitalna pnevmoniiia u doroslykh: etiologiia. Patohenez, klasyfikatsiia, diahnozyka, antybakterialna terapiia (metodychni rekomendatsii) [Community-acquired pneumonia in adults: etiology. Pathogenesis, classification, diagnosis, antibacterial therapy (methodological guidelines)]. Ukr. khimioterapev. zh. 2001; 3:58 – 64. (In Ukrainian).
3. Fernandes-Alnemri T. et al. Apoptosis. Scientist. 1997; 24(1):33 – 44.
4. Holt P.G. Alveolar macrophages. J. Immunol. 1999; 2 (27):189 – 198.
5. Shuba N.M., Voronova T.D. Sovremennyye podhody k lecheniyu negospitalnykh pnevmoniy u bolnykh s faktorami riska: materialy III zizdu ftyziatrii i pulmonolohiv Ukrainy, Kyiv, 25-28 travnia 2003 r [Current approaches to the treatment of community-acquired pneumonia in patients with risk factors: Proceedings of the Third Congress of Phthysiologists and Pulmonologists of Ukraine, Kyiv, May 25-28, 2003]. Ukr. pulmonol. zh. 2003; 2:43 – 49. (In Russian)
6. Babushkina A.V. Effektivnost peroralnogo primeneniya L-arginina u patsientov s endotelialnoi disfunktsiiey [The effectiveness of peroral application of L-arginine in patients with endothelial dysfunction]. Ukr. med.chasopys. 2010; 1(75):24 – 30. (In Russian).
7. Zinkovskiy M.F. Oksid azota I legochnaya gipertenziya [Nitric oxide and pulmonary hypertension]. Zdorovie Ukrainy. 2008; 13 – 14:62. (In Russian).
8. Konoplieva L.F., Kushnir L.V. Otsenka effektivnosti primeneniya L-arginina pri legochnoy arterialnoy gipertenzii razlichnogo geneza [The assessment of the efficacy of the use of L-arginine in pulmonary arterial hypertension of different genesis]. Ukr.med.chasopys. 2013; 1(93):115 – 119. (In Russian).
9. Nakaz MOZ Ukrainy № 54 vid 14.02.2002 "Pro zatverdzhennia klinichnykh protokoliv nadannia medychnoi dopomohy za spetsialnistiu "Kardiolohiia" [Order of the Ministry of Health of Ukraine No. 54 as of 14.02.2002 "On approval of the clinical protocols for the provision of medical care in the specialty "Cardiology"]:29. (In Ukrainian).
10. Mayanskiy A.N. Sovremennaya evolyutsiya idei I.N.Mechnikova o vnutrisudistom vospalenii [Current evolution of I.N.Mechnikov idea about intravascular inflammation]. Immunologiya. 1995; 4:8 – 11. (In Russian).

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ORIGINAL ARTICLE

DYNAMICS OF THE NUMBER OF PERSONS WITH SPECIAL NEEDS LIVING IN ZAKARPATTIA OBLAST, UKRAINE

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ABSTRACT

The aim: To study and analyze indicators of the number of persons with special needs living in Transcarpathian region of Ukraine: disabled persons, orphans and children deprived of parental care.

Materials and methods: National statistical reports on the disability of the population, the number of orphans and children deprived of parental care for the period 2010-2019. Statistical method was applied in the course of study.

Results: Analysis of the dynamics of the number of persons with special needs in Transcarpathian region for the period 2010-2019 showed an increase of the number of disabled persons by 27% with 75415 persons, 6826 disabled children, 2125 orphans and children deprived of parental care. The number of orphans and children deprived of parental care residing in the region have a tendency to reduce and in the year 2019 equals to 2125 orphans and children deprived of parental care. This requires improving of the system of social and medical care for persons with special needs for adults with the formation of a system of provision of services in accordance with the actual needs of the population with the maximum approximation of the service to the place of residence of the client with the maximum use of opportunities of the united territorial communities.

Conclusions: The growth of the number of persons with special needs in Transcarpathian region and directly of the persons with disabilities with the tendency to reduce the number of orphans and children deprived of parental care is established.

KEY WORDS: disabled persons, orphans, children deprived of parental care

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INTRODUCTION

Up to 15% of Ukraine's residents are disabled. The annual primary disability rate is up to 36 per 10 thousand people and it tends to increase [1, 2]. The number of orphans and children deprived of parental care is also increasing [3].

Due to health problems, persons with special needs require special measures to be taken by state and public institutions to ensure their full participation in social life, equally with the others. [6, 7]. At the present stage of society's development, the activities of all national institutions, including state authorities, public associations, etc., should be aimed at creating conditions in which persons with special needs can lead an independent lifestyle and take an active part in all spheres of life. [8, 9].

THE AIM

Aim of the study: to study and analyze indicators of the number of persons with special needs (persons with disabilities, orphans and children deprived of parental care) living in Zakarpattia oblast.

MATERIALS AND METHODS

The sources of the study were data from the scientific literature on the research problem and state statistical

reports on the numbers of disabled persons, orphans, and children deprived of parental care. The study covered the period from 2010 to 2019.

During the study, the following methods were used: a systematic approach, biblical semantic and medical statistical methods.

RESULTS AND DISCUSSION

At the beginning of the study, the amount of people with disabilities living in Zakarpattia oblast was examined. The study covers the period from 2010 to 2019. The obtained data are shown in Table I.

The analysis of the data in Table 1 reveals that there are 75415 disabled persons in Zakarpattia oblast, which is 12337 more than in 2010. The structure of the number of persons with disabilities includes 8.0% – the first disability group, 27.3% – the second disability group and 64.7% – the third disability group.

The number of children with disabilities living in Zakarpattia oblast was further examined. The results obtained are shown in Figure 1.

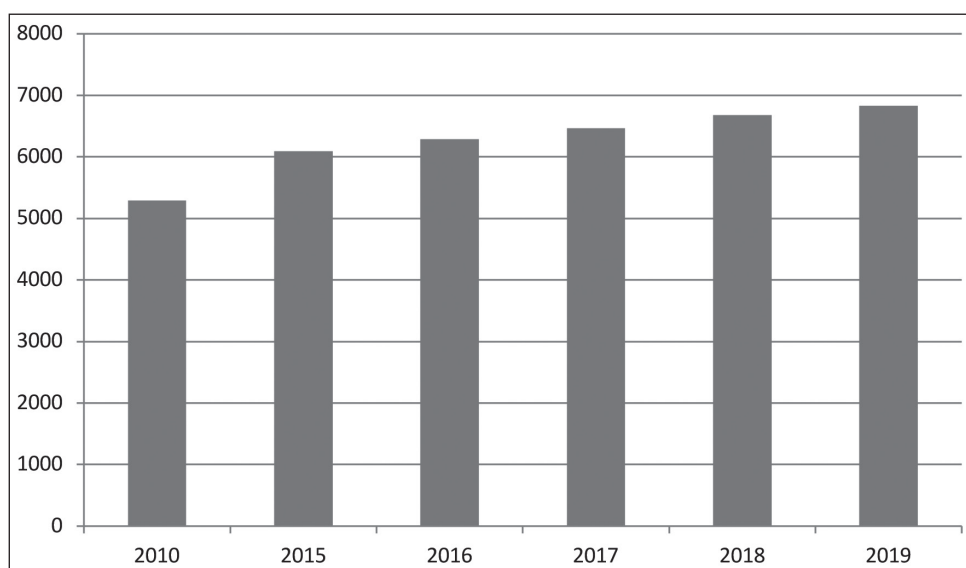
As of the end of 2019, there were 6826 children with disabilities living in Zakarpattia oblast, which is 1536 (29.0%) more than in 2010. Disabled children make up 2.34% of the total amount of children living in the region.

Table I. Number of persons with disabilities, Zakarpattia oblast (2010-2019).

Year	Total	Group I		Group II		Group III	
		abs	%	abs	%	abs	%
2010	63078	6114	9,7	24581	38,9	27093	51,4
2015	71930	6274	8,7	22160	30,8	37403	60,5
2016	72334	6189	8,6	21557	29,8	38303	61,6
2017	73197	6119	8,4	21152	28,9	39458	62,7
2018	74206	6101	8,2	20873	28,1	40557	63,7
2019	75415	6054	8,0	20556	27,3	41979	64,7
2019 to 2010	+12337	-60	-1,7	-4025	-11,6	+14886	+13,3

Table II. Statistical data on orphans and children deprived of parental care and their adoption, Zakarpattia oblast (2010-2018).

Indicator	2010	2015	2016	2017	2018	2018 to 2010
The total number of orphans and children deprived of parental care	2326	2301	2261	2216	2125	-201
Number of children adopted during a year (abs)	120	106	99	87	107	-13
Percentage of children adopted during a year (%)	5,2	4,6	4,4	3,9	5,0	-0,2

**Fig. 1.** Number of children with disabilities, in Zakarpattia oblast, 2010-2018.

The next step of the research was to study statistical data on orphans and children deprived of parental care and their adoption in Zakarpattia oblast. The data obtained in the dynamics of 2010-2018 are shown in the Table II.

For the period 2010-2018, the number of orphans and children deprived of parental care in the region decreased by 201 to 2125, which is 0.73% of the total amount of children living in the region. The share of adopted children decreased from 5.2% to 5.0% and in 2018 amounted to 107 children.

The analysis of the dynamics of the number of persons with special needs in Zakarpattia oblast for the period 2010-2019 showed an increase in the number of persons with disabilities by 27% with their number 75415 persons, with a tendency to decrease the number of orphans and children deprived of parental care with the number of 6826

children with disabilities and 2,125 orphans and children deprived of parental care.

This requires improving the system of social and medical care for persons with special needs for adults with the formation of a system of provision of services in accordance with the actual needs of the population with the maximum approximation of the service to the place of residence of the client with the maximum use of opportunities of the united territorial communities.

Care and upbringing of children should be carried out in a family-friendly environment, providing conditions for living close to family conditions (food, clothing, footwear, hard and soft equipment, housekeeping, leisure activities, etc.), developing and maintaining self-care skills, household skills necessary for the organization of independent life; education and development of individual abilities,

assistance in obtaining educational, medical, rehabilitation and social services in appropriate institutions.

CONCLUSIONS

The growth of the number of persons with special needs in Transcarpathian region and directly of the persons with disabilities with the tendency to reduce the number of orphans and children deprived of parental care is established.

REFERENCES

1. Ipatov, A. V., Moroz, O. M., Holyk V. A. [And Others]. Osnovni pokaznyky invalidnosti ta diialnosti medyko-sotsialnykh ekspertnykh komisii Ukrainy za 2015 rik [Main indicators of disability and activity of medical and social expert commissions of Ukraine in 2015]. Analytical and information guide. Dnipropetrovsk: Accent Private Enterprise; 2016, 162 p. (UA)
2. Shevchuk, V. I., Belyayeva, N. M., Storozhuk, L. O. [and others]. Osnovni pokaznyky medyko-sotsialnoi reabilitatsii osib z invalidnistiu v Ukraini za 2017 rik [The main indicators of medical and social rehabilitation of persons with disabilities in Ukraine for 2017]. Analytical and information guide. Vinnytsia: Rohalska I.O. Individual Entrepreneur; 2018, 122 p. (UA)
3. Voronenko, Y.V., Hoyda, N.H., Moiseyenko, R.O. Suchasni aspekty rozvytku systemy medyko-sotsialnykh posluh dlia urazlyvykh hrup ditei v Ukraini [Current aspects of development of the system of medical and social services for vulnerable groups of children in Ukraine]. *Sovremennaia pedyatryia*. 2014; 8 (64): 39-43. (UA)
4. World Health Organization / World Bank World report on disability. — Geneva: WHO, 2011. — 38 p. URL: http://www.who.int/disabilities/world_report/2011/report/en
5. World Health Organization. Disability и rehabilitation. Medical care and rehabilitation: what WHO is doing. URL: <http://www.who.int/disabilities/care/activities/ru/>
6. Teoriya sotsyalnoy raboty. 2nd edition supplemented and revised. Under the scientific editorship of S.G. Furdeia. Rostov-on-Don: Nauka-Press Publishing House; 2006, 256 p. (RU)
7. Shoshmin, A. V., Martynova, N. V., Besstrashnova, Y. K. i dr. Osnovy upravleniya reabilitatsionnyimi resursami. St. Petersburg: Federal State Budgetary Institution «Federal Scientific Center of Rehabilitation of the Disabled named after G.A. Albrecht». 2009, 96 p. (RU)

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ORIGINAL ARTICLE

METHODS OF SALIVATION REDUCTION ASSESSMENT AT A DENTAL APPOINTMENT

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ABSTRACT

The aim: To develop and study the methods of assessing the decrease in salivation during a dental appointment.

Materials and methods: We formed an observation group of 185 people (61 men and 124 women), which complained of dry mouth.

Results: According to the results of the survey, we found that 10.3% (19 patients) had moderate xerostomia and 89.7% (166 patients) had pronounced xerostomia. In 179 patients (96.8%) with complaints of dry mouth and with a subjective assessment as pronounced xerostomia, salivation rate was, on average, 0.08 ± 0.01 ml/min. That was reliably objectified by laboratory indicator of hyposalivation – less than 0.1 ml/min.

Conclusions: In our studies, we proved a direct relationship between patient complaints of dry mouth and laboratory-confirmed data. This makes it possible for a stomatologist to quickly identify this pathology, analyze it and choose the right treatment tactic during clinical appointment.

KEY WORDS: oral fluid, decreased salivation, xerostomia

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INTRODUCTION

Saliva – the main fluid, the biological environment of the oral cavity, produced by many salivary glands, performs crucial role in maintaining the structural and functional balance in the oral cavity [1, 2]. Oral fluid is actively involved in local immune responses, trophic processes, protection against bacterial infections, digestion, endocrine regulation, maintaining physiochemical oral homeostasis.

Some studies [3, 4, 5] indicate that maintenance of the oral cavity homeostasis is ensured by quantitative and qualitative balance of the oral fluid components, which depends on the body general condition, the functional usefulness of the salivary glands, the hygienic state of the oral cavity and physiochemical characteristics of saliva. Many studies have convincingly proven that saliva is an indicator of the health and morbidity of not only the oral cavity, but also the whole body.

“Xerostomia” defined by Hutchinson in 1889 as a condition, caused by dry mouth. Bivona P.L. in 1998 described xerostomia as “a personal feeling in the oral cavity on the background of hyposalivation” [6]. Denisov A.B. (2003) defines xerostomia as a cumulative symptom of dryness in the oral cavity sensation associated with a change or cessation of the salivary glands secretion [7].

THE AIM

To develop and study methods for assessing the decrease in salivation at a dental appointment.

MATERIALS AND METHODS

The clinical data of the patients who complained of dry mouth in 2018–2020 were analyzed. We formed an observation group of 185 people (61 men and 124 women).

Criteria for inclusion in the study: complaints about the presence of dryness in the oral cavity, the age of patients not younger than 30 and not older than 75 years; voluntary consent of the patient to participate in the research program.

RESULTS AND DISCUSSION

The observation group was dominated by women (67%), less often by men (33%), mainly (72.5%) in the age groups of 50–59 years (46.6%) and 60–69 years (25.9%).

To assess the decrease in salivation in dental patients, we conducted an in-depth survey, clarified the nature of complaints of dry mouth, its duration during the day (constant, episodic, daytime, nightly, etc.), and collection of anamnestic data. Patient complaints were examined in chronological order: the onset of the first manifestations of the “dry mouth” symptom and the duration of its existence were revealed. Also we clarified whether complaints of dry mouth were symptoms of the disease. We clarified the possible causes that, according to the patient, contributed to the occurrence of dryness in the oral cavity. The causes of exacerbation (intensification) of dryness in the oral cavity were revealed. The nature of nutrition, the patient’s attitude to oral hygiene, the presence of occupational hazards, bad habits (smoking), allergic reactions, concomitant and transferred diseases were revealed.

To do this, we developed a table that consists of 10 statements, each of which has three possible answers (no, this is not so; sometimes; right), which the patient gives himself with the guidance of a dentist. Also, for the diagnosis and detection of dryness in the oral cavity, we carried out an in-depth analysis of the patient's complaints: the duration of dryness during the day (constant, episodic, night, etc.). Patient complaints were examined in chronological order: they showed the onset of the first manifestations and their duration. We determined the possible derivative causes that, according to the patient, caused the disease of the oral mucosa and the symptoms of dry mouth. The causes of exacerbation of xerostomia were shown, special attention was paid to a combination of complaints with a feeling of pain, burning and numbness of the oral mucosa. Attention was paid to the indirect detection of dryness in the cavity: a feeling of dryness during excitement, sleep, prolonged conversation, the inability to eat food without drinking water, the need for drinking water at night due to dryness in the oral cavity. Data were entered into the patient's questionnaire.

After analyzing the questionnaires that the patients were filling out, we found that most patients noted dry mouth in the morning – 100% (185 patients) and a dry mouth throughout the day – 97.8% (181 patients), and 174 respondents indicated that they drink water with food to facilitate swallowing and the fact that they have discomfort when chewing solid food. 89.5% patients noted the frequent need for water intake due to nighttime oral cavity dryness, and also complained of dry lips.

In the category of answers according to the “sometimes” criterion, complaints of discomfort during a conversation, due to dryness in the oral cavity and the need to wake up at night to drink water dominated. 30.8% (57 patients) gave negative answers (the category “not, this is not so”) to the question that they constantly use lollipops or chewing gum to reduce dryness in the oral cavity.

To evaluate the results, we calculated the scores in patients with complaints of dryness in the cavity and found that 10.3% (19 patients) had moderate xerostomia and 89.7% (166 patients) had pronounced xerostomia.

The second stage to confirm the subjective sensations of the patient is an objective examination. During its implementation, attention was focused on the clinical assessment of dry mouth and the condition of the oral mucosa. To confirm the data of an objective examination, we determined the secretory function by the rate of salivation flow (speed of salivation of unstimulated oral fluid), estimating the volume obtained per unit time. Given that during the day, the flow of saliva may vary significantly, the collection of oral fluid was performed in the clinic from 9.00 to 10.00.

The oral fluid was collected according to the Navazesh technique, in which the oral fluid was collected on an empty stomach by draining it into a measuring cup for 5 minutes. 2 hours before the start of the procedure, patients were advised to refrain from chewing gum, drinking any food and drink other than water. To obtain reliable results,

patients are advised, if possible, not to use drugs for 6-8 hours before the start of the examination.

The salivation rate was determined by the ratio of the obtained volume of oral fluid (ml) to the regulated time (5 min) for which it was obtained (normal – 0.12-0.16 ml/min). The presence of hyposalivation in patients is fixed at a salivation rate of less than 0.10 ml/min.

In 179 patients (96.8%) with complaints of dry mouth and with a subjective assessment as pronounced xerostomia, salivation rate was, on average, 0.08 ± 0.01 ml/min. That was reliably objectified by laboratory indicator of hyposalivation – less than 0.1 ml/min.

At the dentist's appointment, patients very often complain of dry mouth and its consequences. At the same time, we see a catastrophically small number of publications on xerostomia and hyposalivation. In our opinion, this indicates an underestimation of the problem.

CONCLUSIONS

In our studies, we proved a direct relationship between patient complaints of dry mouth and laboratory-confirmed data. This makes it possible for a dentist at a clinical appointment to quickly identify this pathology, analyze and choose the right treatment tactic.

REFERENCES

1. Arkelyan M., Tambovtseva N., Arzukanyan A. Osnovnyie prichiny i klinicheskie proyavleniya kserostomii [The main causes and clinical manifestations of xerostomia]. *Rossiyskiy stomatologicheskii zhurnal*. 2016; 20(2):74-78. (In Russian).
2. Martin-Piedra M., Aguilar-Salvatiera A., Herrera D. et al. Effectiveness of a recent topical sialogogue in the management of drug-induced. *J. Clin. Exp. Dent*. 2011; 3 (4): 268-273.
3. Uspenskaya O. Suhost v polosti rta: uchebnoe posobie [Dry Oral: Tutorial]. N.Novgorod: Izdatelstvo NGMA. 2007: 32 s. (in Russian).
4. Ryabushko N. Dvornik V. Osnovni etiologichni faktori viniknennya [Basic etiologicheskyy factors winnings xerostomy]. *Ukrayinskiy stomatologichnij almanah*. 2018; 4:78-80. (In Ukrainian).
5. Dvornik V., Riabushko N., Dvornik I. Vpliv ishemicnoyi hvorobi sertsya ta farmakoterapiyi tsogo zahvoryuvannya na tkanini porozhnini rota [Absorption of ischemic twig of the heart and pharmacotherapy of total seizure on the fabric of an empty company]. *Aktualni problemi suchasnoyi meditsini: Visnik UMSA*. 2014; 14,1(45): 119-123. (In Ukrainian).
6. Juras D., Lukac J., Cekic-Arambasin A. et al. Effects of low-level laser treatment on mouth dryness. *Coll Antropol*. 2010; 34:1039-43.
7. Denisov A. Slyuna i slyunnyie [Saliva and salivary glands]. Moskva: Izdatelstvo RAMN; 2006, 372 p. (In Russian).

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ORIGINAL ARTICLE

STERNAL CLEFT AND SEGMENTAL FACIAL HEMANGIOMAS IN CHILDREN WITH PHACES SYNDROME: EFFECTIVENESS AND SAFETY OF CONSERVATIVE MANAGEMENT AND SURGICAL CORRECTION

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ABSTRACT

The aim is to determine the risk factors of sternal cleft and segmental facial hemangiomas association in children with PHACES syndrome.

Materials and methods: 32 inpatient children with segmental facial hemangiomas and 19 children with sternal cleft were investigated concerning the Metry criteria of PHACES syndrome.

Results: In 6 children PHACE syndrome was diagnosed. Patients with bilateral S3 hemangiomas (50%, 3/6) had airway involvement with respiratory disorders. Conservative treatment was propranolol monotherapy (66.7%, 4/6), or combination of prednisolone and propranolol (33.3%, 2/6). Duration of propranolol treatment in children with PHACES syndrome was on an average 24.25 ± 4.49 months exceeding the duration of propranolol therapy in children with isolated soft tissue lesions ($p < 0.05$). Primary surgical treatment of sternal cleft performed in children aged 2 ($n=3$) and 4 ($n=1$) months. The later period of surgery associated with the localization of hemangioma in the surgery region. Primary repair of sternal cleft was completed successfully in all cases; partial resection of the thymus made closure easier.

Conclusions: Primary surgical correction of a sternal cleft performed in young children provides good results. Partial resection of the thymus prevents respiratory and cardiovascular complications. Preoperative propranolol treatment averts the hemorrhagic complications in children with hemangiomas in surgical region.

KEY WORDS: PHACES syndrome, segmental hemangioma, propranolol, sternal cleft

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INTRODUCTION

According to last updated of International Society for the Study of Vascular Anomalies (ISSVA) classification for vascular anomalies (2018), infantile hemangiomas has three patterns – focal, multifocal, and segmental [1]. “Segmental” was defined as a hemangioma with plaque-like morphology, showing linear and/or geographic patterning over a specific cutaneous territory [2]. This type of hemangioma can associate with PHACES syndrome which is an acronym of Posterior fossa malformations, Hemangioma of the cervicofacial region, Arterial anomalies, Cardiac anomalies, Eye anomalies, and Sternal or abdominal clefting. It was first described in 1996 by Frieden and colleagues [3] and named PHACE syndrome. Two years later, Boulinguez et al changed the acronym to PHACES syndrome by adding sternal defects (S) [4].

Segmental hemangioma is the hallmark feature and is usually what leads the provider to consider a diagnosis of PHACE syndrome. Until 1996, cases of these complex abnormalities were described using a variety of acronyms: CHVD syndrome (“cutaneous hemangioma and vascular disorders”), ocular-cerebral-acral syndrome, 3C syndrome (cerebral hypoplasia, cavernous hemangioma, and coarctation of aorta), etc. Introduction of unified terminology

and the multidisciplinary approach is the best option in diagnosis and treatment of patients with PHACE syndrome, as different organs and systems are affected, and there is a need for different methods of treatment.

THE AIM

The aim of the study is to determine the risk factors of association of sternal cleft and segmental facial hemangiomas in children with PHACES syndrome, evaluation of effectiveness and safety of conservative and surgical treatment.

MATERIALS AND METHODS

Retrospective analysis of clinical cases of 32 children with infantile facial hemangioma and 19 children with sternal cleft for the period January 1990 – March 2018 was performed. Including criteria were the diameter of hemangioma more than 5 cm, diagnosis and treatment in a single hospital, age less than 6 month, the follow-up period more than 10 month. All children were investigated concerning the study protocol considering Metry 2009 criteria [5] of PHACES syndrome. Frontotemporal segment (S1) includes the lateral part of the forehead, the lateral frontal and the

Table I. Clinical characteristics of 6 children with PHACES syndrome

No	Hemangiomas topography	Airway involvement	Brain abnormalities	Aortic and cardiac abnormalities	Midline defects	Treatment	Follow-up (month)
1.	S2,3 left side	No	Dandy-Walker anomaly	Coarctation of the aorta, left side aortic arch	No	Propranolol, cardio surgery	38
2.	S3 bilateral	Yes	Dandy-Walker anomaly		Sternal cleft	Prednisolon, propranolol	33
3.	S1, S2 right side, S3 bilateral	Yes	No	No	Sternal cleft	Prednisolon, propranolol, surgery	25
4.	S3 bilateral	Yes	No	No	Sternal cleft, supraumbilical raphe	Propranolol, surgery	24
5.	S1 bilateral	No	No	Coarctation of the aorta	No	Propranolol, cardio surgery	15
6.	S1 left side	No	No	Coarctation of the aorta	Sternal cleft	Propranolol, surgery	10

anterior temporal portions of the scalp. Maxillary segment (S2) involves the upper part of the cheek and the upper lip. Mandibular segment (S3) applies to the preauricular region, mandible, chin, and lower lip. Clinical evaluations, including photographs, ultrasound investigation with a linear transducer in gray scale mode, color Doppler scan and partially in Doppler mode were used to document clinical characteristics of hemangioma concerning its different stages of growth. Mapping of segment location was performed in all cases using pre-defined segments which have been reported by Haggstrom et al. [6]. The next investigations included computed tomography (CT), both native and intravenous enhanced; brain magnetic resonance imaging (MRI), cardiologic evaluation (electrocardiogram and echocardiography), neurological, and ophthalmological investigation. Statistical analysis was conducted using IBM SPSS Statistics Base (version 22). A value of $p < 0.05$ was considered statistically significant. Quantitative data are expressed as mean and with 95% confidence interval (CI).

All studies were carried out in accordance with World Medical Association Declaration of Helsinki Ethical Principles for Medical Research Involving Human Subjects. It has been complied with the principle of privacy and respectfulness for the child's as an individual incapable of self-defense. The study was approved by Ethics Committee of Bogomolets National Medical University (protocol No 11, 23/02/2016). All parents/ guardians have signed a written informed consent form.

RESULTS

Based on analysis of this study results, 6 of 32 children (18.75%) with cervicofacial hemangiomas and 4 children of 19 with sternal cleft (21.05%) met criteria for PHACE syndrome. A diagnosis of PHACE syndrome requires the

presence of a face segmental hemangioma in addition to one big or more than two small criteria which are recognized as congenital structural defects of the brain, cerebrovasculature, cardiovascular, eye, or sternum, or a supraumbilical raphe [7]. Congenital anomalies related to PHACES syndrome specific to each of our patients are described in table I.

All patients were girls. Bilateral segment 3 hemangioma was the most common, occurring in 3 patients (50%). Two (33.3%) had involvement of multiple segments, and one has left-sided S1 lesion (Fig. 1).

All patients with bilateral S3 involvement had subglottic and mediastinal hemangiomas with respiratory disorders. Stridor occurred in two patients in age of 10 and 12 weeks, other patient had resistant to antibacterial treatment dry cough. Other complications of hemangioma were ulcerations ($n=4$), and visual axis obstruction due to upper eyelid lesion ($n=1$).

Except hemangiomas, patients had the next criteria of PHACE syndrome: posterior fossa malformations (variants of Dandy-Walker malformation) ($n=2$), coarctation of the aorta ($n=2$), right-sided aortic arch ($n=1$), supraumbilical raphe ($n=1$), and four children (66.7%) had superior sternal cleft (Fig. 1, 2). All patients were treated with systemic therapies, including propranolol monotherapy (66.7%, 4/6), and oral prednisolone plus propranolol (33.3%, 2/6). Oral prednisolon was used in two patients with tracheal and mediastinal hemangioma and severe stridor as first line therapy before propranolol dose selection. Medical treatment was effective and we avoided tracheostomy in patients with airway obstruction. Oral administration of propranolol was started at 1 mg/kg/day or 0.5 mg/kg/day in children weighing less than 2500 g and was gradually increased to 2 mg/kg/day without any adverse reactions. For patient safety, treatment was started in the hospital with monitoring of blood pressure, heart rate (before and one



Fig. 1. One month patient with S1 (frontotemporal) right side hemangioma and sternal cleft



Fig. 2. a-b. Patient with PHACES syndrome, S1,2,3 segmental hemangiomas and hemangioma in sternal region. Picture before treatment, 2 month old (a). Picture after two month prednisolone treatment (b).

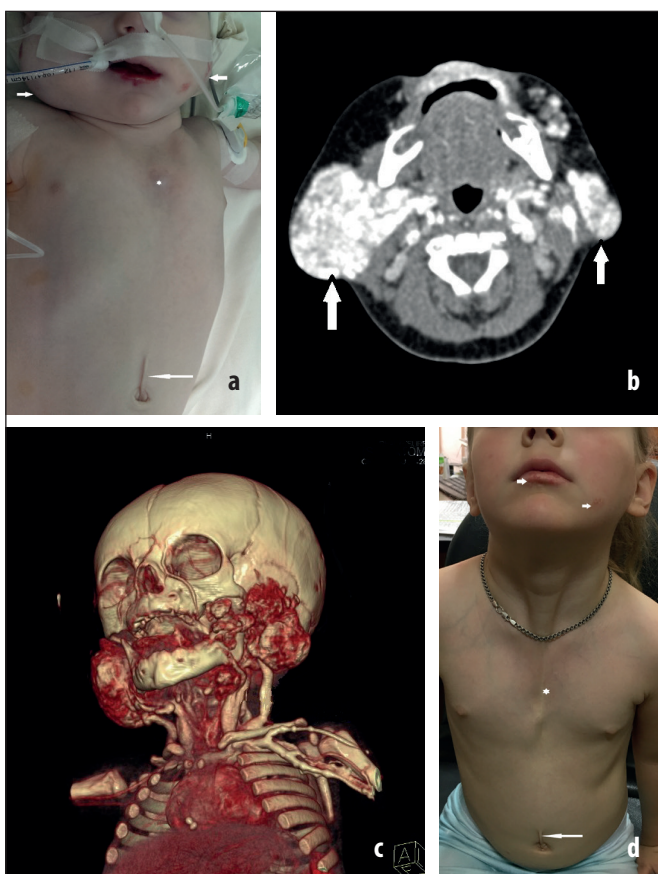


Fig. 3. a-d Patient with S3 bilateral hemangioma, subglottic hemangioma with stridor, sternal cleft, and supraumbilical raphe. Picture before treatment (a). CT with intravenous enhanced (b). CT: 3D reconstruction shows the extension of hemangioma (c). Picture after treatment; 3 years old (d).

hour after taking the medication), determination of blood glucose once a day for 3-5 days during hospital staying. Patients with PHACE syndrome have the high risk of pediatric arterial ischemic stroke described first by Burrows et al. in 1998 [8] so neurological investigation is important.

During inpatient care, mothers were trained in identify the adherence to medication, which also included informing them of alarming symptoms that may indicate complications of therapy, as well as signs of stroke. Propranolol was continued on an outpatient period at a defined dose. All children were assigned to one-month outpatient examinations. Duration of propranolol treatment in children with PHACE syndrome ranged from 18 to 36 months, with an average (24.25 ± 8.49) months exceeding the duration of propranolol therapy in children with isolated soft tissue infantile hemangiomas, lasted (8.81 ± 3.20) months ($p < 0.05$).

Five children (83.3%) with PHACE syndrome needed the surgery. There were two cases of cardiovascular malformations and four cases of sternal cleft. Two patients were operated in specialized cardiosurgery hospital. Patients with sternal clefts were treated in general pediatric hospital. We prefer early operation to achieve the primary closure. Two children were treated surgically at the age 2 month and one child aged 4 month. The later period of surgical correction for this patient is associated with the localization of hemangioma in the surgery region (Fig.2 a, b).

Preoperative administration of propranolol during two month was effective in decreasing the size of hemangioma, leading to the non-complicated surgical intervention. In one case sternal cleft correction was performed as simultaneous operation with surgery of coarctation of the aorta.

For surgery, all the patients were placed in a supine position, a midline skin incision was made and the defect and intact lower end of the sternum was exposed. Sternal bars were dissected from underlying intrathoracic fascia, parietal pleura, and pericardium. The sternal bars were cut transversely at the site of their join just above the costal arch. We usually perform a partial resection of the thymus to make closure easier. The sternal bars were approximated on the midline to complete restoration of the sternum by non-absorbable sutures. Follow-up period ranged from 10

months to 3 years, with an average (24.17 ± 10.53) months. Primary repair of sternal cleft was completed successfully in all patients with PHACES syndrome, without any cardiovascular or respiratory impairment (Fig.3 a, b, c, d).

DISCUSSION

In one study PHACE patients represented 2.3% of all children with hemangiomas, and approximately 20% of those with segmental hemangiomas of the face [9]. Airway hemangiomas can be a life-threatening complication of PHACE syndrome with described frequency from 52% [10] to 82% [9], it also characterized by a long duration of symptom persistence, from 13 to 76 months. In our study, respiratory tract involvement with impaired of their patency was diagnosed in 50% of children with PHACE syndrome. All children had S3 bilateral segmental hemangioma. Given the high rates of airways involvement, we recommend performing CT in all patients with segmental facial hemangiomas.

Following the first report in 2008, the non-selective beta-blocker propranolol was used as a first-line therapy for the treatment of “problematic” hemangiomas [11]. The method is effective and safe, but there are some caveats to prescribing propranolol in children with PHACES syndrome. Metry et al. published results of treatment of 32 patients with PHACE syndrome and arterial abnormalities, in 7 patients the authors observed a high risk of ischemic stroke [12]. Siegel et al. described possible mechanisms of cerebrovascular accident in patients with PHACES syndrome. It may be artery-to-artery embolisms, in which a thrombus forms in a stenotic or dysplastic cervical or cerebral artery, ischemia from reduced blood flow and inadequate cerebral perfusion, cardioembolisms due to structural abnormalities of the heart or proximal aorta [13]. There is a hypothesis that propranolol could increase the hemodynamic risks associated with an otherwise asymptomatic cerebral arteriopathy, in the worst case causing watershed infarct [12]. Fortunately, ischemic stroke is extremely rare complication of PHACE syndrome, and main efforts have focused on identifying which patients are at greatest risk. More than 50% patients with PHACES syndrome need the surgery. Perioperative stress is a potential risk factor for strokes and seizures in patients with cerebrovascular and cardiac or aortic arch anomalies often occur in the same patients. It is essential to examine cerebral abnormalities, to check the glucose tolerance and electrolyte balance, performer the cardiological examination before starting propranolol in this category of patients.

Monitoring of patients with PHACE syndrome has been going on for over 20 years, new publications are emerging, and so-called “big” signs of the syndrome include pathological conditions that are not in the acronym. One of the major associate malformations that require surgical correction is sternal cleft [4]. This is a rare developmental pathology characterized by complete or partial defect of the chest bone and is the result of impaired fusion of the sternal plates during embryogenesis. In 1985 Kaplan LC et

al hypothesized that a premature rupture of a chorionic or yolk sac during lowering of the heart causes damage to the mesodermal structures, which prevents midline fusion of the developing chest wall and cause the sternal cleft [14]. Involvement of skin tissues in this process of mesodermal injury has been suggested as an explanation for the association of hemangiomas and sternal cleft [15]. The disease is usually asymptomatic, but incomplete anterior wall of the chest skeleton is the cause of the paradoxical movement of this part of the chest with possible respiratory and cardiovascular disorders. Surgery is the treatment of choice. Although pathology is rare and publications are usually clinical cases, the authors claim that early correction is the best option. It allows easy approximation of bars and defect closure due to the chest’s flexibility with a lesser risk of cardiac compression and respiratory distress [16].

CONCLUSIONS

Children with S3 segmental face hemangiomas have high risk of airway involvement. Primary surgical correction of a sternal cleft performed in young children provides good results. Partial resection of the thymus averts respiratory and cardiovascular complications. Preoperative propranolol treatment of hemangiomas prevents the hemorrhagic complications in children with hemangiomas in surgical region.

REFERENCES

1. International Society for the Study of Vascular Anomalies. ISSVA classification for vascular anomalies. Published April 2014. Revised May 2018. Available from: <http://www.issva.org/UserFiles/file/ISSVA-Classification-2018.pdf>
2. Chiller K.G., Passaro D., Frieden I.J. Hemangiomas of infancy: Clinical characteristics, morphologic subtypes, and their relationship to race, ethnicity, and sex. *Arch Dermatol.* 2002;138:1567–76.
3. Frieden I.J., Reese V., Cohen D. PHACE syndrome. The association of posterior fossa brain malformations, hemangiomas, arterial anomalies, coarctation of the aorta and cardiac defects, and eye abnormalities. *Arch Dermatol.* 1996;132(3):307-11.
4. Boulinguez S., Teillac-Hamel D., Bédane C. et al. Cervicofacial hemangioma and a minor sternal malformation: inclusion in PHACES syndrome? *Pediatr Dermatol* 1998;15(2):119-21.
5. Metry D., Heyer G., Hess C. et al. Consensus statement on diagnostic criteria for PHACE syndrome. *Pediatrics* 2009;124:1447–56.
6. Haggstrom A.N., Lammer E.J., Schneider R.A. et al. Patterns of infantile hemangiomas: new clues to hemangioma pathogenesis and embryonic facial development. *Pediatrics* 2006;117(3):698–703.
7. Garzon, M., Epstein, L., Heyer et al. PHACE syndrome: Consensus-derived diagnosis and care recommendations. *J Pediatr* 2016; 178:24-33.
8. Burrows P.E., Robertson R.L., Mulliken J.B. et al. Cerebral vasculopathy and neurologic sequelae in infants with cervicofacial hemangioma: Report of eight patients. *Radiology* 1998; 207:601–7.
9. Haggstrom A.N., Skillman S., Garzon M.C. et al. Clinical spectrum and risk of PHACE syndrome in cutaneous and airway hemangiomas. *Arch Otolaryngol Head Neck Surg* 2011; 137(7):680-7.
10. Durr M.L., Meyer A.K., Huoh K.C. et al. Airway hemangiomas in PHACE syndrome. *Laryngoscope* 2012; 122 (10):2323–9.

11. Léauté-Labrèze C., Harper J., Hoeger P. Infantile haemangioma. *The Lancet* 2017; 390(10089):85-94.
12. Metry D., Frieden I.J., Hess C. et al. Propranolol use in PHACE syndrome with cervical and intracranial arterial anomalies: collective experience in 32 infants. *Pediatr Dermatol* 2013;30(1):71-89
13. Siegel D., Tefft K., Kelly T. et al. Stroke in children with posterior fossa brain malformations, hemangiomas, arterial anomalies, coarctation of the aorta and cardiac defects, and eye abnormalities (PHACE) syndrome: a systematic review of the literature. *Stroke*. 2012; 43(6):1672–1674.
14. Kaplan L.C., Matsuoka R., Gilbert E.F. et al. Ectopia cordis and cleft sternum: evidence for mechanical teratogenesis following rupture of the chorion or yolk sac. *Am J Med Genet*. 1985; 21:187-202.
15. Ashok Raja J., Mathevan G., Mathiarasan K., Ramasubramaniam P. Closing the cleft over a throbbing heart: neonatal sternal cleft. *BMJ Case Rep* 2014; 4:1-4.
16. Karamustafaoğlu Y.A., Yanık F., Yörük Y. et al. Congenital Superior Sternal Cleft Repair Using Primary Closure. *Balkan Med J* 2019; 36(2):141-2.

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REVIEW ARTICLE

ORGANIZATION AND LEGISLATIVE REGULATION OF REHABILITATION ASSISTANCE TO PARTICIPANTS OF JOINT FORCE OPERATIONS

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ABSTRACT

The aim of our study was to investigate the mechanisms of rehabilitation, primarily medical, of participants in the armed conflict in the eastern regions of Ukraine (anti-terrorist operation/Joint Forces operation).

Materials and methods: Standard statistical methods were used to accomplish these tasks – bibliosemantic and content analysis methods. So, as can be seen from the conducted research, in Ukraine there is a legal regulation of the process of providing rehabilitation assistance (social, psychological, medical) for the participants of armed conflict in the eastern regions of Ukraine (ATO / JFO).

Review: It should be noted separately that the organizational mechanisms for the provision of rehabilitation are constantly improving: introduction of the International Classification of Functioning, Restrictions of Life and Health and the International Classification of Functioning, Restrictions of Life and Health of Children and Adolescents in Ukraine introduced the qualification characteristics of rehabilitation specialists and rehabilitation specialists, physical therapist, ergotherapist, physical therapist assistant, ergotherapist assistant.

Conclusions: It was also determined that despite the constant improvement of the organizational and regulatory frameworks for the provision of rehabilitation, there is a problem of the lack of unified protocols for the provision of medical rehabilitation – there is only a protocol of measures for post-traumatic stress disorder. Available and applicable the “road map” of providing of medical assistance, reparative treatment and rehabilitation measures in health care facilities for ATO participants.

KEY WORDS: medical rehabilitation, anti-terrorist operation, Joint Force operation, organization or rehabilitation

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INTRODUCTION

The current situation in the eastern regions of Ukraine constantly requires from our state resources – both material and human. An increasing number of Ukrainians are forced to take up arms in order to protect their homeland and promote a peaceful situation [1, 2]. Despite all measures taken by the government of the country and the world community (Minsk negotiations, sanctions and restrictions on the aggressor and other measures), the armed conflict continues and constantly leads to human casualties among Ukrainian civilians and military men [3]. It should be noted that in addition to irreversible human losses, there is a large amount of financial, social and psychological damage to military personnel who take part in the defense of the state [4, 5]. The problem of restoration and preservation of health, as well as of working capacity of the persons who have faced military actions in Ukraine is very urgent today [6, 7, 8, 9].

The basic concepts of rehabilitation, developed by WHO experts, focus on a system of measures aimed at the quickest and most complete restoration of a patient's physical, psychological and social status in order to actively integrate the patient into society with a view to achieving possible social and economic independence for him. In the conditions of constant increase of the number of participants of

hostilities, conducting a complex of measures for rehabilitation treatment and further social integration of veterans of the anti-terrorist operation in the society is one of the priority directions of the social policy of the state [10, 11].

THE AIM

The aim of our study was to investigate the mechanisms of rehabilitation, primarily medical, of participants in the armed conflict in the eastern regions of Ukraine (anti-terrorist operation/Joint Forces operation).

MATERIALS AND METHODS

Standard statistical methods were used to accomplish these tasks – bibliosemantic and content analysis methods.

REVIEW AND DISCUSSION

The issue of obtaining the status of a participant in the anti-terrorist operation. It is the responsibility of the state and the government to provide of social protection of the members of the anti-terrorist operation (Joint Forces operation(JFO)) and they do it [12, 13].

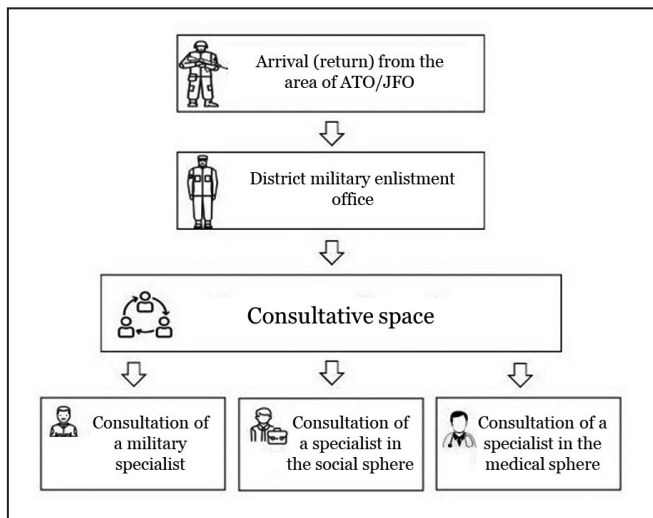


Fig. 1. Scheme of determining the need of the ATO/JFO participant in the rehabilitation program.

According to 6th Article of the Law of Ukraine “On the Status of War Veterans, Guarantees of their Social Protection” [14], military personnel (reservists, conscripts) and workers of military formations of Ukraine, who defended the independence, sovereignty and territorial integrity of Ukraine and participated directly in anti-terrorist operation (ATO), ensuring its carrying out, being directly in areas of carrying out the ATO, and also employees of the enterprises, establishments and the organizations which were involved and participated directly in ATO in areas of its implementation.

Procedure for granting and denying the status of a participant of hostilities to persons who defended the independence, sovereignty and territorial integrity of Ukraine and participated directly in the anti-terrorist operation, ensuring its realization or in the implementation of national security and defense measures, repulsion and restraint of armed aggression of the Russian Federation in Donetsk and Lugansk regions, ensuring their implementation was

approved by the Cabinet of Ministers of Ukraine of August 20, 2014 № 413. The legislative changes from February 19, 2020 to this Resolution were introduced the procedure for obtaining of this status by volunteers who participated directly in the ATO/JFO. [15, 16].

Rehabilitation and readaptation of participants of ATO/JFO. The Decree of the Cabinet of Ministers of Ukraine of December 5, 2018 №1021 approved the State target program for medical, physical rehabilitation and psychosocial re-adaptation of the victims of the Revolution of Dignity, participants of the anti-terrorist operation and persons who participated in the implementation of national security and defense measures, curbing the armed aggression of the Russian Federation in Donetsk and Luhansk regions, ensuring their implementation, for the period up to 2023 [17].

Complex rehabilitation of disabled military personnel and combatants (ATO/JFO participants) provides for statutory guarantees and aspects of rehabilitation and adaptation, including: medical rehabilitation; prosthetics and orthotics, provision of technical means of rehabilitation; psychological rehabilitation; social rehabilitation; vocational rehabilitation [14, 18, 19].

A generic algorithm for determining need and providing rehabilitation assistance is presented in Figure 1.

After counseling, the individual needs of each demobilized soldier are determined, and a plan and a clear program of rehabilitation activities are developed accordingly.

At the level of a military specialist, the task is to identify military personnel who have a morbid mental reaction and refer them to health care facilities. Particular attention is paid to the diagnosis of acute reactions to stress, the detection of signs of physical and mental fatigue, severe asthenisation, mental maladaptation and the like. It is obligatory to carry out specialized individual psychological counseling on problems of alcohol and drug abuse, asocial behavior, problems in acute psychological crises, etc [20].

Speaking about social problems, it is established that different types of trainings – specialized, professional, communicative, social and psychological, etc. are very effective

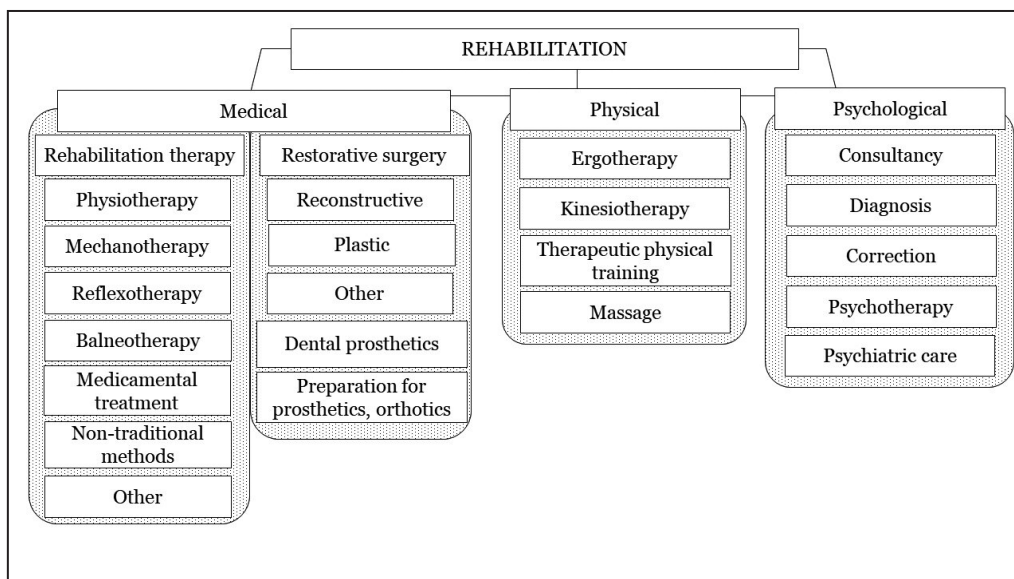


Fig. 2. The types of medical rehabilitation.

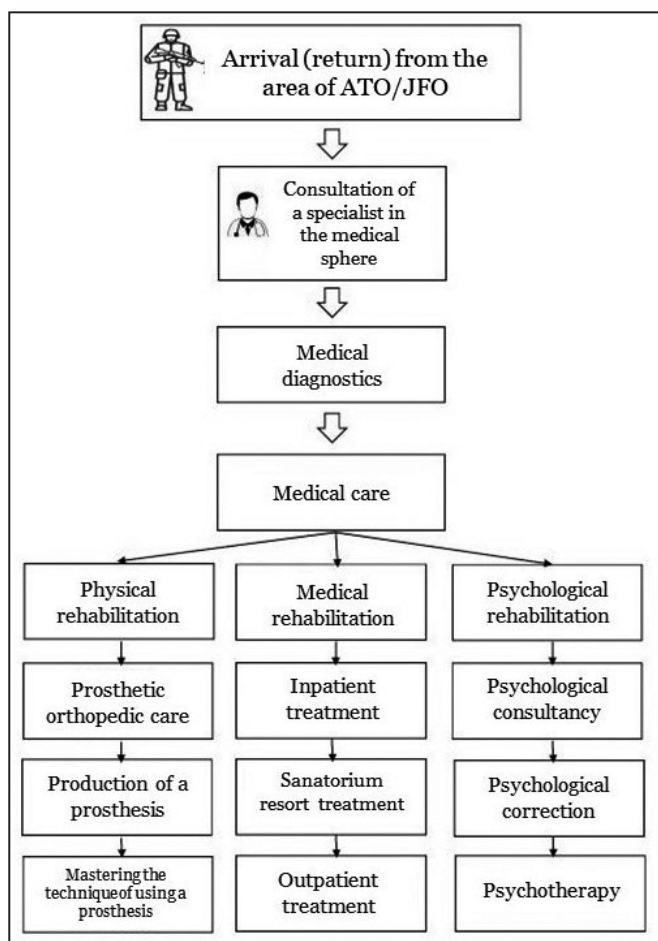


Fig. 3. The scheme of choice of the rehabilitation program.

in the development of the rehabilitation complex. When conducting such activities, social services professionals should pay attention to the creation of a clear algorithm for structural elements, focusing on adaptive issues with emphasis on specific features, principles and rules, a set of methods and techniques. Family therapy, which provides individual and family counseling as well as group psychotherapy separately with military personnel and separately with their family members, aimed at correction of interpersonal relationships in family and family relations, is very important and valuable for effective rehabilitation of the participants of the fighting [21, 22].

Events in the area of anti-terrorist operation have a strong impact on the mental and, often, physical health of its participants. Analyzing the causes that lead to the loss of health and the need for rehabilitation measures, we can say that the main part consists of various post-traumatic conditions and disorders: traumas, injuries, as well as psychological disorders (post-traumatic stress disorder, psychological disorders, etc.). It should also be noted that in addition to post-traumatic health loss, often persistent health loss (disability) is caused by various infectious and parasitic diseases, as well as by various conditions of the therapeutic profile: pathology of blood and hematopoietic organs, endocrine disorders, diseases of the nervous system, the eye and its appendix, the ear and the mastoid

process, the circulatory system, the respiratory system, the digestive system, the genitourinary system [24].

Based on the above, it should be noted that along with sociological and psychological rehabilitation special attention should be paid to the organization of medical rehabilitation. Medical rehabilitation is a system of curative measures aimed at restoring impaired or lost functions of the body of the person, to identify and activate the compensatory capacity of the body in order to provide conditions for the person to return to normal life, to prevent complications and relapses of the disease.

The importance of medical rehabilitation for armed conflict participants was underlined by Presidential Decree No.150 of March 18, 2015, which required that steps be taken to introduce a mandatory medical examination of the health status of demobilized anti-terrorist operation participants [25]. The Cabinet of Ministers issued the Order “On Approval of the Plan of Measures for Medical, Psychological, Professional Rehabilitation and Social Adaptation of the Participants of the Anti-Terrorist Operation” No. 359-r dated 31.03.15, which provides for mandatory medical examination of military personnel after participating in the ATO [26]. According to Article 35-5 of the legislation of Ukraine on health it is determined that medical rehabilitation assistance is provided only after recognition of a person with a disability in accordance with the established legislation and is carried out according to medical indications in a certain order and ensures the formation of state health policy [27].

To improve the mechanism of medical rehabilitation and increase its efficiency in Ukraine, a plan of measures for implementation of the International Classification of Functioning was developed and implemented, as well as the qualification characteristics of most specialists of rehabilitation: physician of physical and rehabilitation medicine, physical therapist, ergotherapist, assistant therapist. The Ministry of Health of Ukraine has drafted the Concept of Reform of the Medical and Social Expertise, which is changing the approach to disability – medical rehabilitation services should start from the moment of a health problem, and not only after establishing the disability status. This approach should increase the level of recovery of body functions to the maximum possible level of recovery. Medical rehabilitation is included in the program of medical guarantees in accordance with the Law of Ukraine on “On State Financial Guarantees of Public Health Services” [19].

It should be noted that medical rehabilitation is a heterogeneous concept and has different directions and approaches in its structure (Fig. 2).

The process of medical rehabilitation involves the formation of multidisciplinary rehabilitation teams that, working mainly within the framework of evidence-based rehabilitation, will focus not only on the treatment and elimination of the disease by all possible traditional medical methods, but also on the elimination of activity limitations due to that disease or injury.

Generally, a medical rehabilitation scheme for demobilized soldiers returning from the ATO/JFO Area involves

conducting a comprehensive medical examination, followed by the establishment of a diagnosis, followed by the provision of appropriate medical care, the results of which determined the rehabilitation mechanisms (Fig.3).

The following rehabilitation periods are identified in the planning of rehabilitation activities:

- stabilization period – focused on stopping the progression of the damaging agents and stopping the deterioration of body functions;
- mobilization period – efforts focus on restoring the functional state of the organism or on empowerment in the altered state of damage;
- supporting period – consolidation of the results achieved in the previous stages and prevention of their reverse development.

The leading methods of medical rehabilitation are rehabilitation therapy and surgery with subsequent (if it necessary) prosthetics. Restorative therapy is carried out, first of all, with the help of standard medicament treatment.

In carrying out of medical rehabilitation, the following tasks are put to specialists:

- restoration of health status;
- elimination of pathological process;
- prevention of complications and recurrences;
- restoration or, if impossible, partial or full compensation of lost functions;
- adaptation to household and professional production loads;
- prevention of permanent disability (early onset) or worsening of the already established degree of disability. [28]

Specialists in medical rehabilitation: physicians, physical therapists, ergotherapists, traumatologists, neuropathologists, surgeons or other specialists (depending on the nature of the diseases of the persons to be rehabilitated), nurses [29].

In medical rehabilitation various and unequal means are used in different stages. The complex of rehabilitation therapy includes various medical treatment, various types of hardware physiotherapy, hydrotherapy, climatotherapy, physical therapy, mechanotherapy, therapeutic massage, ergo and kinesitherapy, psychotherapy and psychological correction, diet therapy, non-traditional therapy, diet therapy, phytotherapy, etc.), speech correction, occupational therapy, rehabilitation mode [30].

Medical rehabilitation usually begins with active treatment, which is dominated by pathogenetic drug therapy or surgical treatment aimed at eliminating or reducing the activity of the pathological process.

Standard drug treatment is gradually being replaced by supportive pharmacotherapy and various non-drug therapies. The role of non-drug rehabilitation is gradually increasing in the next stages of rehabilitation and is intended to accelerate recovery, achieve long-term remission, restore disability, prevent disability and return the patient to society (Fig. 4).

Medical rehabilitation can be carried out according to the appropriate rehabilitation programs (Fig. 4) according

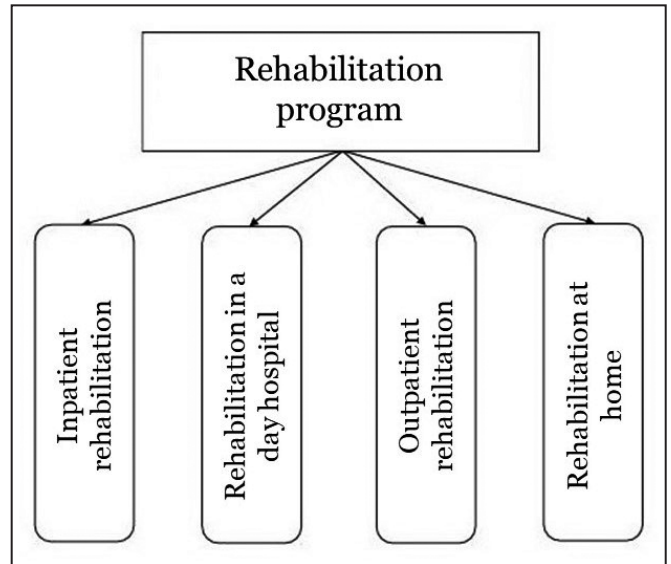


Fig. 4. Types of medical rehabilitation programs.

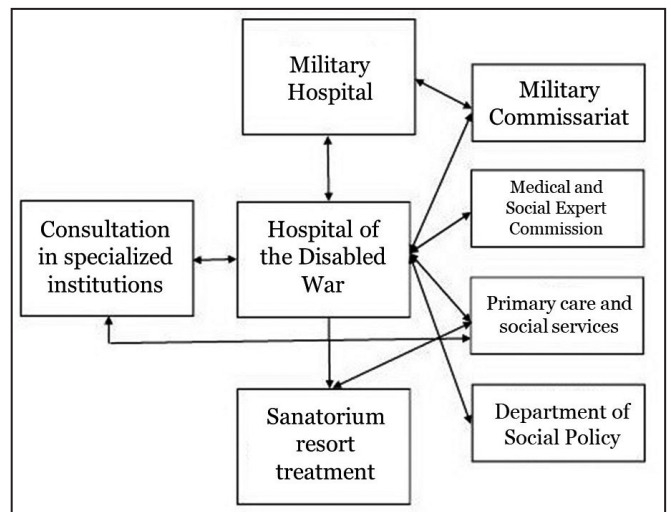


Fig. 5. Scheme ("road map") of providing of medical assistance, reparative treatment and rehabilitation measures in health care facilities for ATO participants, incl. demobilized.

to which treatment regimen is selected. The most common non-medication remedies are adherence to the appropriate regimen. Guard mode, which involves depriving the patient of excessive mental and physical activity. In hospitals when undergoing treatment use: bed mode (severe and extended bed), semi-bed (within the ward) and free (general) regimens. In sanatoriums and during outpatient clinic treatment, patients are prescribed sparing, sparingly-training, training, and more recently – intensively training regimes.

Protocols on standardization of medical care for post-traumatic stress disorder (PTSD), approved by the Order of the Ministry of Health "On approval and implementation of medical and technological documents for standardization of medical care for post-traumatic stress disorder" No. 121 of 23.02.16, which is the only document that is approved servicemen. However, the protocols regulate the highly specialized issue of PTSD and the provision of assistance to

military personnel in institutions subordinate to the Ministry of Health. The procedure for providing assistance with other diseases and disorders that may befall a person who has gone through combat has not yet been established by law [31].

Departments of health care of regional administrations have developed and implemented a “road map” of medical rehabilitation of servicemen, employees of the Armed Forces of Ukraine, National Guard, and other law enforcement agencies that participated in the anti-terrorist operation (Fig. 5).

Based on this “roadmap” and based on medical history, analysis and instrumental findings, a doctor may recommend medical, physical or psychological rehabilitation at a regional hospital or hospital in subordinate of the Ministry of Armed Forces of Ukraine (there are 30 such institutions in Ukraine). The decree of the Ministry of Defense of Ukraine No. 703 of 09.12.2015 approved the lists of medical indications and contraindications to sanatorium treatment and medical rehabilitation in the health resorts of the Armed Forces of Ukraine.

CONCLUSIONS

So, as can be seen from the conducted research, in Ukraine there is a legal regulation of the process of providing rehabilitation assistance (social, psychological, medical) for the participants of armed conflict in the eastern regions of Ukraine (ATO / JFO). It should be noted separately that the organizational mechanisms for the provision of rehabilitation are constantly improving: introduction of the International Classification of Functioning, Restrictions of Life and Health and the International Classification of Functioning, Restrictions of Life and Health of Children and Adolescents in Ukraine introduced the qualification characteristics of rehabilitation specialists and rehabilitation specialists, physical therapist, ergotherapist, physical therapist assistant, ergotherapist assistant.

It was also determined that despite the constant improvement of the organizational and regulatory frameworks for the provision of rehabilitation, there is a problem of the lack of unified protocols for the provision of medical rehabilitation – there is only a protocol of measures for post-traumatic stress disorder.

Available and applicable the “road map” of providing of medical assistance, reparative treatment and rehabilitation measures in health care facilities for ATO participants.

REFERENCES

1. Topol O. V. Soczi`al`no-psikhologi`chna reabi`li`taczi`ya uchasniki`v antiteroristichnoyi operaczi`yi. [Socio-psychological rehabilitation of participants of anti-terrorist operation]. Bulletin of Chernihiv National Pedagogical University. 2015; 124: 230-233. (In Ukrainian).
2. Koczyuruba R. M. Soczi`al`no-psikhologi`chna reabi`li`taczi`ya uchasniki`v antiteroristichnoyi operaczi`yi. [Socio-psychological rehabilitation of participants of anti-terrorist operation]. Topical Problems of Designing, Manufacturing and Operation of Weapons and Military Equipment: Proceedings of the All-Ukrainian Scientific and Technical Conference, Vinnitsa, May 17-19 2017. Vinnitsa, 2017. p.183-187. (In Ukrainian).

3. Wittke C. The Minsk Agreements – more than “scraps of paper”? East European Politics. 2019; 35 (3): 264-290.
4. Visochina I. L., Moroz S.M., Vasilevska I.V. et al. Osobennosti mediczynskogo soprovozhdzheniya uchastnikov ATO na pervichnom urovne okazaniya mediczynskoj pomoshhi. [Features of medical support of ATO participants at the primary level of providing medical care]. Medical perspectives. 2016; XXI. 2(1):35-39. (In Ukrainian).
5. Reabi Mojsa B., edited by O. Pavlichenko, O. Martynenko. `li`taczi`ya zhertv konfli`ktu. Chi proponuye derzhava shhos` , kri`m vstanovlennya i`nvali`dnosti` ta milicz`? [Rehabilitation of the victims of the conflict. Does the state offer anything other than disability and crutches?]. Ukrainian Helsinki Human Rights Union. K.; 2018, 64 p. (In Ukrainian).
6. Agaev N.A., et al. Algoritm roboti vi`js`kovogo psikhologa shhodo psikhologi`chnogo zabezpechennya profesi`jnoyi di`yal`nosti` osobovogo skladu Zbrojnikh Sil Ukrainy (metodichni` rekomendaczi`yi) [Algorithm of work of military psychologist on psychological support of professional activity of personnel of Armed Forces of Ukraine (methodical recommendations)]. K.: Humanitarian Problems Research Center of the Armed Forces of Ukraine; 2016, 147 p. (In Ukrainian).
7. Pro skhvalennya Koncepctzi`yi rozvitku sistemi gromads`kogo zdorov`ya [About Approval of the Concept of Public Health System Development]: Ordinance of the Cabinet of Ministers of Ukraine from 30.10.2016 p. № 1002-p URL:<https://zakon.rada.gov.ua/laws/show/1002-2016-%D1%80>. (In Ukrainian).
8. Didach V., Vasylenko L., Lavreniuk V., Stanislav I. Vikonannya Planu zakhodi`v shhodo medichnoyi, psikhologi`chnoyi, profesi`jnoyi reabi`li`taczi`yi ta soczi`al`noyi adaptaczi`yi uchasniki`v antiteroristichnoyi operaczi`yi: anali`tichnij zvi`t. [Implementation of the Plan of Measures for Medical, Psychological, Professional Rehabilitation and Social Adaptation of Participants in the Anti-Terrorist Operation: An Analytical Report]. Kyiv: Public organization «All-Ukrainian human rights organization» Legal hundred»; 2017, 44 p. (In Ukrainian).
9. Osnovi reabi`li`taczi`jnoyi psikhologi`yi: podolannya nasli`dkiv`v krizi. Navchal`nij posi`bnik. Tom 1. [Fundamentals of rehabilitation psychology: overcoming the effects of the crisis. Tutorial. Volume 1]. Київ; 2018, 208 p. (In Ukrainian).
10. Kokun O.M. et al. Psikhologi`chna robota z vi`js`kovosluzhbovczyami – uchasnikami ATO na etapi`vi`dnovlennya: Metodichnij posi`bnik. [Psychological work with military personnel – participants of anti-terrorist operation during the recovery phase: A manual]. K.: Humanitarian Problems Research Center of the Armed Forces of Ukraine; 2017, 282 p. (In Ukrainian).
11. Brindikov Yu. L. Teori`ya ta praktika reabi`li`taczi`yi vi`js`kovosluzhbovczi`v uchasniki`v bojovikh di`j`v sistemi`soczi`al`nikh sluzhzb [Theory and Practice of Rehabilitation of Servicemembers in the System of Social Services]: the dissertation for the degree of Doctor of Pedagogical Sciences in the specialty 13.00.05 / Khmelnytsky National University of the Ministry of Education and Science of Ukraine, Khmelnytsky, 2018. 559 p. (In Ukrainian).
12. Gayda I. M. Mediko-soczi`al`ne obgruntuvannya udoskonalennya sistemi medichnoyi reabi`li`taczi`yi vi`js`kovosluzhbovczi`v na regi`onal`nomu ri`vni` [Medico-social justification for improving the system of medical rehabilitation of servicemen at the regional level]: the dissertation for the degree of Candidate of Medical Sciences in the specialty 14.02.03 / Ukrainian Military Medical Academy of the Ministry of Defense of Ukraine. Uzhgorod National University of the Ministry of Education and Science of Ukraine, Kyiv, 2018. 180 p. (In Ukrainian).

13. Yavorovenko, O. B. Potrebi uchasniki v antiteroristichnoyi operaczi yi z i`nvali` dni` styu vnasli` dok somatichnoyi patologii` yi v tekhnii` chnikh zasobakh reabi` li` taczi` yi ta virobakh medichnogo priznachennya. [Needs of participants of anti-terrorist operation with disability due to somatic pathology in technical means of rehabilitation and medical products]. Bulletin of social hygiene and health organization of Ukraine, 2019; 3: 69-77. (In Ukrainian).
14. Pro status veterani` v vi` jni, garanti` yi yikh soczi` al` nogo zakhistu [On the status of war veterans, guarantees of their social protection]: Law of Ukraine from 22.10.1993. № 3551-XII. Renewal data: 01.01.2020. URL: <https://zakon.rada.gov.ua/laws/show/3551-12>. (In Ukrainian).
15. Pro zatverdzhennya Poryadku nadannya ta pozbavlenyya statusu uchasnika bojovikh di` j osi` b, yaki` zakhishhali nezalezhnii` st`, suvereni` tet ta teritori` al` nu czi` li` sni` st` Ukrayini i` brali bezposerednyu uchast` v antiteroristichni` j operaczi` yi, zabezpechenni` yiyi provedennya chi u zdi` jsnenni` zakhodi` v i` z zabezpechennya naczi` onal` noyi bezpeki` i` oboroni, vi` dsi` chi` i` strimuvannya zbrojnoyi agresii` yi Rosi` js` koyi Federaczi` yi v Donec` ki` j ta Lugans` ki` j oblastiakh, zabezpechenni` yikh zdi` jsnennya [On approval of the Procedure for granting and denying the status of a member of hostilities persons who defended the independence, sovereignty and territorial integrity of Ukraine and participated directly in the anti-terrorist operation, ensuring its carrying out or in the implementation of measures for national security and defense, repulsion and deterrence of the Armed Forces of the Russian Federation in Donetsk and Luhansk regions, ensuring their implementation]: Resolution of the Cabinet of Ministers of Ukraine from 20.08.2014. № 413. Renewal data: 04.03.2020. URL: <https://zakon.rada.gov.ua/laws/show/413-2014-%D0%BF> (In Ukrainian).
16. Pro vnesennya zmi` n do deyakikh postanov Kabi` netu Mi` ni` stri` v Ukrayini ta viznannya takoyu, shho vtratil chinni` st`, postanovi Kabi` netu Mi` ni` stri` v Ukrayini vi` d 12 zhovtnya 2000 r. № 1545 [On Amendments to Some Resolutions of the Cabinet of Ministers of Ukraine and Recognition as Expired, Resolution of the Cabinet of Ministers of Ukraine of October 12, 2000 No. 1545]: Resolution of the Cabinet of Ministers of Ukraine from 19.02.2020. № 132. URL: <https://zakon.rada.gov.ua/laws/show/132-2020-%D0%BF#n283> (In Ukrainian).
17. Pro zatverdzhennya Derzhavnoyi czi` l` ovoyi programi z medichnoyi, fi` zichnoyi reabi` li` taczi` yi ta psikhosoczi` al` noyi readaptaczi` yi postrazhdalikh uchasniki` v Revolyuczi` yi Gi` dnosti`, uchasniki` v antiteroristichnoyi operaczi` yi ta osi` b, yaki` brali uchast` u zdi` jsnenni` zakhodi` v i` z zabezpechennya naczi` onal` noyi bezpeki` i` oboroni, vi` dsi` chi` i` strimuvannya zbrojnoyi agresii` yi Rosi` js` koyi Federaczi` yi v Donec` ki` j ta Lugans` ki` j oblastiakh, zabezpechenni` yikh zdi` jsnennya, na peri` od do 2023 roku [Approval of the State Target Program on Medical, Physical Rehabilitation and Psychosocial Re-adaptation of Victims of the Dignity Revolution, Members of the Anti-Terrorist Operation, and Persons Participated in National Security and Defense, Suppression and Suppression of Armed Aggression in the Russian Federation and Luhansk ensuring their implementation, for the period up to 2023]: Resolution of the Cabinet of Ministers of Ukraine from 05.12.2018. № 1021. Renewal data: 22.10.2019. URL: <https://zakon.rada.gov.ua/laws/show/1021-2018-%D0%BF> (In Ukrainian).
18. Sokrut V.M., Alekseeva L.A. Medichna reabi` li` taczi` ya [Medical Rehabilitation]: Guidelines. Liman: Donetsk National Medical University, Ministry of Health of Ukraine, 2016. URL: http://kaf-fis-reab.dsmu.edu.ua/?page_id=445 (In Ukrainian).
19. Pro derzhavni` fi` nansovi` garanti` yi medichnogo obslugovuvannya naselennya [About the state financial guarantees of health care of the population]: Law of Ukraine from 30.01.2018 №2168-VIII. Renewal data: 20.03.2020. URL: <https://zakon.rada.gov.ua/laws/show/2168-19>. (In Ukrainian).
20. Pro zatverdzhennya Polozhennya pro psikhologii` chnu reabi` li` taczi` yu vi` js` kovosluzhbovczi` v Zbrojnikh Sil Ukrayini, ta Derzhavnoyi speczi` al` noyi sluzhbi transportu, yaki` brali uchast` v antiteroristichni` j operaczi` yi, zdi` jsnuyvali zakhodi` z zabezpechennya naczi` onal` noyi bezpeki` i` oboroni, vi` dsi` chi` i` strimuvannya zbrojnoyi agresii` yi Rosi` js` koyi Federaczi` yi u Donec` ki` j ta Lugans` ki` j oblastiakh chi vikonuvali sluzhbovi` (bojovi`) zavdannya v ekstremal` nihkh umovakh [On approval of the Regulation on the psychological rehabilitation of the military of the Armed Forces of Ukraine and the State Special Transport Service, which participated in the anti-terrorist operation, carried out measures to ensure national security and defense, to repel and deter the armed aggression of the Russian Federation in Donetsk and Luhansk regions) tasks in extreme conditions]: Order of the Ministry of Defense of Ukraine from 09.12.2015 № 702. Renewal data: 14.02.2020. URL: <https://zakon.rada.gov.ua/laws/show/z0237-16/>. (In Ukrainian).
21. Lebedinec N. V., Pliska O. I., Melnitchenko O. S., et al. Aktual` ni` pitannya mediko-soczi` al` noyi reabi` li` taczi` yi uchasniki` v bojovikh di` j: dosvi` d ta perspektivi. [Topical issues of medical and social rehabilitation of combatants: experience and perspectives]. Scientific and pedagogical problems of physical culture (physical culture and sport): Coll. of sciences. works. Kiev: Publishing in NPU named M. P. Dragomanov, 2019. 2(108): 105-110. (In Ukrainian).
22. Vorona P. V., Gurin A. M. Sistema kompleksnoyi reabi` li` taczi` yi uchasniki` v antiteroristichnoyi operaczi` yi [System of complex rehabilitation of participants of anti-terrorist operation]. Economy and the State. 2019: 4. (In Ukrainian).
23. Shevtchuk V.I., Yavorovenko O.B., Belyayeva N.M., et al. Organi` zaczi` ya medichnoyi reabi` li` taczi` yi v provi` dnikh krayinakh svi` tu. [Organization of medical rehabilitation in the leading countries of the world]. Bulletin of problems of biology and medicine, 2019: 2, 1(149): 51-54. (In Ukrainian).
24. Yavorovenko, O. B., Belyayeva, N. M., Kurylenko, I. V. et al. Potrebi uchasniki` v antiteroristichnoyi operaczi` yi z i`nvali` dni` styu vnasli` dok somatichnoyi patologii` yi v tekhnii` chnikh zasobakh reabi` li` taczi` yi ta virobakh medichnogo priznachennya. [Needs of participants of anti-terrorist operation with disability due to somatic pathology in technical means of rehabilitation and medical products]. Bulletin of social hygiene and health organization of Ukraine. 2019; 8 (3): 69-77. (In Ukrainian).
25. Pro dodatkovi` zakhodi` shhodo soczi` al` nogo zakhistu uchasniki` v antiteroristichnoyi operaczi` yi [On additional measures for social protection of participants of the anti-terrorist operation]: Decree of the President of Ukraine from 18.03.2015 № 150. Renewal data: 07.10.2015. URL: <http://zakon3.rada.gov.ua/laws/show/150/2015>. (In Ukrainian).
26. Pro zatverdzhennya planu zakhodi` v shhodo medichnoyi, psikhologii` chnoyi, profesi` jnoyi reabi` li` taczi` yi ta soczi` al` noyi adaptaczi` yi uchasniki` v antiteroristichnoyi operaczi` yi [On approval of the plan of measures for medical, psychological, vocational rehabilitation and social adaptation of participants of the anti-terrorist operation]: Ordinance of the Cabinet of Ministers of Ukraine from 31.03.2015. № 359-p. URL: <https://zakon.rada.gov.ua/laws/show/359-2015-%D1%80>. (In Ukrainian).
27. Osnovi zakonodavstva Ukrayini pro okhoronu zdorov` ya [Fundamentals of Ukrainian legislation on health care]: Law of Ukraine from 19.11.1992 №2801-XII. Renewal data: 02.04.2020. URL: <https://zakon.rada.gov.ua/laws/show/2801-12>. (In Ukrainian).

28. Marunich V.V., Shevtchuk V.I., Yavorovenko O.B. Metodichnij posi`bnik z pitan` reabi`li`taczi`yi i`nvali`di`v [A handbook on disability rehabilitation]:. Vinnitsa: Ukrainian State Research Institute of Disabled Rehabilitation; 2006, 210 p. (In Ukrainian).
29. Ustinov O.V. Medichna reabi`li`taczi`ya: potochna situaczi`ya i`plani na majbutnye. [Medical Rehabilitation: Current Situation and Future Plans]. Ukrainian Medical Journal online. URL: <https://www.umj.com.ua/article/119087/zatverdzheno-plan-zahodiv-iz-vprovadzheniya-mizhnarodnoyi-klasifikatsiyi-funktsionuvannya>. (In Ukrainian).
30. Ustinov O.V. Medichna reforma: priinyato nizku vazhlyvikh normativnykh dokumenti`v. [Medical reform: A number of important regulatory documents have been adopted]. Ukrainian Medical Journal online. URL: <https://www.umj.com.ua/article/167302/medichna-reforma-priinyato-nizku-vazhlyvih-normativnih-dokumentiv>. (In Ukrainian).
31. Pro zatverdzhennya ta vprovadzhenya mediko-tehnologi`chnik dokumenti`v zi` standartizaczi`yi medichnoyi dopomogi pri posttravmatichnomu stresovomu rozladi` [On approval and introduction of medical-technological documents on standardization of medical care in post-traumatic stress disorder]: Order of the Ministry of Health of Ukraine from 23.02.2016 №121 URL: <https://ips.ligazakon.net/document/view/moz25625>. (In Ukrainian).
32. Pro zatverdzhennya pereli`ki`v medichnykh pokazan`ta protipokazan`do sanatornogo li`kuvannya i` medichnoyi reabi`li`taczi`yi v sanatorno-kurortnykh zakladakh Zbrojnykh Sil Ukrayini [On approval of the lists of medical indications and contraindications to sanatorium treatment and medical rehabilitation in sanatorium-resort establishments of the Armed Forces of Ukraine]: Order of the Ministry of Defense of Ukraine from 09.12.2015 № 703. URL: <https://zakon.rada.gov.ua/laws/show/z1681-15>. (In Ukrainian).

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REVIEW ARTICLE

THE STUDY OF THE ELECTROMAGNETIC COMPONENT OF THE HUMAN BODY AS A DIAGNOSTIC INDICATOR IN THE EXAMINATION OF PATIENTS WITH NON-COMMUNICABLE DISEASES: PROBLEM STATEMENT

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ABSTRACT

The aim of the publication is to substantiate a conceptual system of views on the role of internal electromagnetic fields and the scientific feasibility of studying the direction of their possible use as a diagnostic indicator in the examination of patients with NCDs.

Materials and methods: The of the presented data was carried out during a search study of methods for the rapid assessment of valeological status, prenosological early diagnosis of NCDs, analysis of existing methods for studying the electromagnetic phenomena of the human body.

Review: The authors systematized the existing technical capabilities and instrumental methods in the framework of systemic medicine. The article proposes a working classification of methods, justifies the choice of methods for further research.

Conclusions: 1) The study of the electromagnetic component of the human body as a diagnostic indicator in the examination of patients with NCDs is a relevant and promising scientific direction at the present stage. 2) Methods for assessing heart rate variability in a short recording, computerized hardware segmental diagnostics, a computerized digital study of Gas-discharge Electrophotonic Analysis, determination of the PBS-activity of body tissues were selected to further examine the value of their diagnostic parameters in examining patients with NCDs in the first and second levels of therapeutic care.

KEY WORDS: Non-Communicable Diseases, Heart Rate Variability

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INTRODUCTION

The modern level of scientific and technical capabilities allows us to study electromagnetic phenomena in living systems. Registration and assessment of local electromagnetic parameters of the human body became possible due to technological progress and they are constantly being improved [1,2]. However, the possibilities of using many of the techniques in clinical medicine have not been fully studied. Further study of this scientific direction is extremely important for medicine. Deepening knowledge about the role of electromagnetic phenomena in the human body determines the further way of understanding the organization and functioning of a living human body unambiguously. This causes science to understand the essence of the phenomena of biological life and health as objective states from the standpoint of evidence as well.

THE AIM

The aim of this publication is to substantiate a conceptual system of views on the role of internal electromagnetic fields and the scientific feasibility of directing the possibility of their use

as a diagnostic indicator in the examination of patients with Non-communicable diseases (NCDs) at the first and second levels of therapeutic care. This scientific direction is interdisciplinary and fundamentally new for internal diseases. Therefore, the statement of the problem is necessary for further research.

MATERIALS AND METHODS

The analysis of the presented data was carried out in the course of a search study of methods for the rapid assessment of valeological status, beforenosological early diagnosis of NCDs, analysis of existing methods for studying the electromagnetic phenomena of the human body and it is a fragment of the initiative research project "Development of algorithms and technology for introducing a healthy lifestyle in patients with non-communicable diseases based on the study of psycho-emotional status" (State registration No. 0116U007798, UDC 613:616-052:159.942:616-03). Scientific work is carried out on the basis of the Ukrainian Medical Stomatological Academy (Ukraine, Poltava). The project manager is the Head of the Department of Internal Diseases and Emergency Medicine, prof., MD M.M. Potiazhenko.

Scientific work is carried out in conjunction with the following scientific institutions: 1) P.L.Shupyk National Medical Academy of Postgraduate Education (9, Dorogozhytska St., 04112, Kiev, Ukraine), the cooperation coordinator is the Head of the Department of Medical Informatics, prof., DM Mintser O.P.; 2) Kharkiv National University of Radio Electronics (14, Pr. Nauki, 61166, Kharkiv, Ukraine), the cooperation coordinator is Rector, MD in Technical Science Semenets V.V., the cooperation subcoordinator is Podpruzhnykov P.M.; 3) V.T.Zaitseva State institution Institute of General and Emergency Surgery NAMS of Ukraine, (1, Balakirev Entrance, 61166, Kharkiv, Ukraine), the cooperation coordinator is the Head of Integrated Programming and Emergency Surgery and Intellectual Property Protection Department, prof., MD Zamiatin P.N.; 4) National Technical University «Kharkiv Polytechnic Institute» (2, Kyrpychova Str., 61002, Kharkiv, Ukraine) the cooperation coordinator is the Head of the Department of Industrial and Biomedical Electronics, prof., DM in Technical Science Zhemerov G.G., the cooperation subcoordinator is prof., DM in Technical Science Schapov P.F. Joint research activities are carried out with Altimed LLC (13D, Anna Akhmatova St, 02068, Kiev, Ukraine) with the aim of conducting research aimed at increasing the effectiveness of measures to prevent and treat NCDs in Ukraine. The main basis for conducting clinical research is the Educational and practical Center of Biophotonics and Valeology (the Head of the center is DM Potiazhenko M.M., the Main investigator is the Associate Professor, Ph.D. Nevoit G.V.). It operates in stationary and mobile (using portable equipment) modes at the clinical bases of the Department of Internal Medicine and Emergency Medicine of the Ukrainian Medical Stomatological Academy: Municipal enterprise Poltava Regional Clinical Medical Cardiovascular Center of the Poltava Regional Council (Ukraine, 36039, Poltava region, Poltava, Makarenko St., 1A), pulmonology department of the Municipal enterprise M.V. Sklifosovsky Poltava Regional Clinical Hospital Poltava Regional Council (Ukraine, 36011, Poltava, Shevchenko St., 23), therapeutic department of the Communal Enterprise 2nd City Clinical Hospital of the Poltava City Council (Ukraine, 36003, Poltava, Monastyrskaya St., 7A). The study was approved by the Ethics Committee of the Ukrainian Medical Stomatological Academy and is being carried out in compliance with the rules of the Helsinki Declaration of the World Medical Association on ethical principles for scientific and medical research, as amended (2000, as amended 2008), Universal Declaration on Bioethics and Human Rights (1997), Council Convention European Human Rights and Biomedicine (1997). A study using advanced instrumental techniques for assessing electromagnetic phenomena will be carried out exclusively after the patient has signed an informational consent. All measures to ensure patient anonymity and ethical standards will be performed during the study.

REVIEW AND DISCUSSION

Formulation of the problem.

World science has accumulated a significant layer of fundamentally new fundamental knowledge about the

role of electromagnetic phenomena in the functioning of the human body since the scientific discovery of electricity and the phenomena of biomagnetism [3]. It has been established that electromagnetic phenomena form the fundamental basis for the occurrence of intermolecular processes in living systems, namely: – each living cell generates electromagnetic radiation/field of a high degree of coherence during metabolic processes [4-7]; – each living cell emits ultra-weak intensity biophotons without external stimulation, which is a manifestation of its electromagnetic activity [4,7-10]; – the rhythm of electromagnetic oscillations is individual for each tissue structure of a living organism [4,6,11]; – electromagnetic radiation of all organ structures is ordered at the organism level and they form coherent electromagnetic waves [2,4,6]; – biophotons travel through a network of optical channels in the human body, these channels are described in the scientific literature under the name “primary vascular system” [2,6,11]; – the energy properties of a biological molecule are determined by its chemical composition, electronic structure, and wave functions of the state of electrons in its atoms [6,9]; – the vital activity of biomolecules in the cell is determined by the energetic functioning of the collectivized system of delocalized π -electrons, therefore π -electrons are called “Life electrons”, and the way of converting solar energy with their participation in biological systems is called the “Electronic circuit of life” [9]; – a biomolecule is an “energy machine” that transforms the non-specific chemical energy of adenosine triphosphate into electromagnetic energy vibrations/quanta specific to a given molecule — Solitons, which are an elongated depolarization wave [6,11,12]; – almost all the energy consumed by the body is converted into solitons in the processes of functioning of the living; Solitons are transmitted mainly through biopolymer chains, supporting their structure, mechanical conformations, and chemical interactions [4,6,11,12]; – electromagnetic structuring of a water molecule into energy-intense crystalline fractal chains associated with a biopolymer by hydrogen bonds takes place in living systems, and they are able to provide the movement of energy quanta/Solitons without energy absorption [6,11,12]; – water chains of various biopolymers are closed to each other, forming a single system of electromagnetic bonds between each biomolecule of a cell and all cellular systems of the body, providing control of vital processes in cells by resonant absorption of energy quanta of control flows and causing the phenomenon of “life”; biophysically, the phenomenon of “life” is the existence of molecular-water systems supported by energy flows in the form of low-frequency electromagnetic field quanta (Solitons) [6,11,12] etc. Magnetocardiography and magnetoencephalography have gained practical application in world medicine along with electrographic methods (electrocardiography, electroencephalography) at the present stage [8]. Such fundamental discoveries were made in the XXI century: – the phenomenon of Ultra-Weak Photons Emission has proved the constant emission of photons by living human tissues [2,6,7,10]; – The Piezobiosynthesis (PBS) is a new way of generating energy in living systems;

it filled the knowledge gap about the way of transforming mechanical energy into electrical energy [6,13]; Primo Vascular System (PVS) is a new anatomical structure of mammals, it is responsible for the transport and distribution of electromagnetic energy in the tissues of the body according to scientists [6,11]. All this new physical and biological knowledge needs to be integrated into medicine and they necessitate the rethinking of many paradigms of the pathogenesis of diseases.

Thus, medicine has a significant layer of fundamentally new scientific knowledge with a paradigm-transforming potential on the one hand, and it has a number of problems that have not been completely resolved in the diagnosis and treatment of Non-communicable diseases (NCDs) on the other hand. NCDs kill 41 million people each year, according to the World Health Organization. Of these, 15 million people die before they reach old age. All this happens despite the success of pharmacotherapy, cardiac surgery, the popularization of a healthy lifestyle [3,14]. Solving the problem of NCDs is of great importance for Ukraine. Cardiovascular diseases are one of the main biomedical and social problems of Ukraine. They determine the indicators of loss of life potential of the country, and they are the cause of 67% of all deaths. This is the reason for more than 400,000 deaths annually and more than 1000 people die on average daily from cardiovascular diseases in Ukraine [15]. Therefore, it is very important for the victory over NCDs to continue to work out all new scientific discoveries, to consider all hypothetical possibilities for optimizing their diagnosis and treatment, integrating new knowledge of the fundamental study of the essence of pathology at the field level of metabolism from the perspective of systemic medicine. Our study of the historical aspect of the development of the methodology for assessing the bioelectric and biomagnetic fields of the human body [2] gave reason to believe that the development of this research area can contribute to solving the problem of NCDs by optimizing diagnostics in the initial diagnosis and in the dynamic observation of patients during treatment. This necessitates the development of a fundamentally new magneto-electromagnetic concept of metabolism and quantum medicine in the future, and this may be the next stage in the development of medical knowledge. An analysis of the existing technical capabilities and instrumental methods of the current stage was carried out on the basis of this. Systematization and generalization of methods for studying electromagnetic phenomena from the perspective of systems medicine were made by us.

A working classification of methods for assessing the electromagnetic phenomena of the human body has been developed:

I. By the degree of implementation in practical medicine:
 1.1. Traditional methods are methods that have received wide practical application (for example, electrocardiography, electromyography, heart rate variability, encephalography, etc.).
 1.2. Promising methods: 1.2.1. Actual promising methods are methods that have received full or local scientific recognition, but they have limited implementation so

far (for example, magnetocardiography, magnetoencephalography, recording potentials from skin points and areas, bioluminescence, ultra-weak photon emission, etc.); 1.2.2. Hypothetically promising methods are methods whose clinical capabilities are still being studied (Gas-discharge Electrophotonic Analysis, PBS etc.).

II. By registering the electromagnetic component: 2.1. methods examining the electrical component; 2.2. methods examining the magnetic component; 2.3. combined methods.

III. By the nature of the evaluation and data processing: the methods can be graphic, computerized, remote, intended for home use by the patient, etc.

IV. By the volume of diagnostic data: 4.1. local methods – they give an electromagnetic characteristic of the data of individual organs (for example, magnetoencephalography, magnetocardiography, electrocardiography, etc.); 4.2. systemic methods – they are able to give a holistic assessment of the functional state of the organism by organs and systems (for example, assessment of the functional state of the organism by heart rate variability, by a number of methods of frequency-wave diagnostics, etc.).

The classification of the diagnostic capabilities of methods for assessing electromagnetic phenomena remains a difficult methodological problem. The level of knowledge of the twentieth century made it possible to interpret certain electromagnetic parameters of the human body as symptoms of a particular disease only (for example, changes in the electrocardiogram – a symptom of heart disease, etc.). However, in our opinion, today scientific material regarding the role of electromagnetic phenomena in the human body allows many methods to have independent diagnostic value as screening methods for nosological and prenatal diagnostics, assessment, overall characteristics of the functioning of organs and systems, and the general valeological status of the body. Such techniques can become an independent additional diagnostic tool for a doctor provided that the hypothesis is confirmed and after the development of appropriate recommendations for their practical application. Since the possibility of widespread application of the method and its accessibility to each doctor or local medical clinic is of the greatest practical interest, the economic criterion was taken into account when conducting a scientific search for methods of studying the electromagnetic phenomena of the human body with similar characteristics as well.

Electrocardiography with an assessment of heart rate variability and variability of the duration of the respiratory cycle of short records lasting 2-5 minutes were selected for further research from traditional methods as the most worthy of further study. The choice of methodology was due to its increasing diagnostic value when interpreted in the framework of the new paradigm, namely [16]: 1) The modern definition defines the assessment of heart rate variability in a short record as a method for studying the current functional state of the body based on a qualitative and quantitative analysis of the variability of the RR-intervals of the electrocardiogram, due to the modulating effect of the autonomic nervous system and

humoral factors on the pacemaker activity of the sinus node of the heart for a specified period of time; 2) there is a possibility of using non-linear methods of analysis, such as “entropy”, “periodic oscillations”, “fractals”, “chaos”, “bifurcation”, etc.; 3) Now it has a refined understanding of the boundaries of the frequency ranges and the physiological essence of oscillations of a particular frequency, including the allocation of special high-frequency oscillations due to the electrical instability of the atrial pacemaker complex; 4) New functional tests and refined capabilities of some routine functional tests developed now; 5) It has the ability to be used in health-saving technologies (for example, assessing the current functional state, adaptive reserves of the body, assessing the level of health and physiological price of activity under the influence of a stress factor, planning and controlling physical activity, assessing the quality of life, environmental monitoring by the criterion of a person’s functional state, professional selection); 6) It makes it possible to evaluate the sympatho-parasympathetic balance and, to a certain extent, the patient’s humoral regulation system, this allows stratification of patients by the degree of risk of complications in a number of cardiovascular and endocrine diseases, to predict the presence and / or likelihood of development of pathological reflex reactions, to perform adequacy control ongoing drug therapy and evaluate the effectiveness of ongoing therapeutic measures. Magnetocardiography and magnetoencephalography were excluded due to the high cost of equipment and very limited availability for practical healthcare [8].

Presented promising methods may have diagnostic potential for use in therapeutic practice at the first and second levels of therapeutic care, namely: 1) Variants of frequency-wave instrumental techniques for a comprehensive assessment of electromagnetic data from biologically active points / areas of the body (for example, hardware segmental diagnostics); 2) Gas-discharge Electrophotonic Analysis. The choice of these methods is due to the following: 1) Significant experimental and clinical material has been accumulated over 70 years of clinical use of the first samples of this equipment, and it indicates sufficient diagnostic value of these methods [5,8, 12,13]; 2) Modern computerized hardware systems for segmental diagnostics have a higher information level; the use of digital gas discharge registration cameras with subsequent computerized processing and image analysis increases the practical value of the technique [8]; 3) Modern computerized versions of devices are compact, mobile, characterized by relative financial availability; this makes it possible to universally equip therapeutic rooms of doctors with them; 4) These methods have proven themselves both as rapid screening tests, and as those that are suitable for an individual nosological diagnosis in severe clinical cases with a significant amount of combined pathology [5,8,12,13]; 5) The methods have a high throughput in terms of the number of subjects (standard test time from 5 minutes to 15 minutes); they do not require highly professional training to carry out the study itself. Their widespread introduction into the work of medical rooms and inpatient departments can significantly optimize the clinical examination of patients both during the initial examination and in the dynamics of

treatment, increasing the degree of medical objectivity. This is very important because of the polymorbidity of modern patients and this may become important additional objective evidence of the correctness / validity of the actions of the internist when working in insurance medicine [8].

The method for determining the PBS activity of body tissues deserves separate scientific attention. The phenomenon of PBS is the synthesis of organic substances in biological objects under the influence of piezoelectricity, which occurs in the liquid crystal structures of cells, mainly biological membranes, during their mechanical deformation. The effect of PBS manifests itself in different ways in healthy and diseased cells. The piezobiopotential of cells in cancer is 10 times higher than normal. This may increase the sensitivity of their diagnostic methods in the early stages [6,13]. This necessitates further study of the diagnostic value of PBS for its further use in diagnosis in the examination of patients with NCDs.

CONCLUSIONS

1. The study of the electromagnetic component of the human body as a diagnostic indicator in the examination of patients with NCDs is a relevant and promising scientific direction at the present stage.
2. Methods for assessing heart rate variability in a short recording, computerized hardware segmental diagnostics, a computerized digital study of Gas-discharge Electrophotonic Analysis from human fingers, determination of the PBS-activity of body tissues were selected to further examine the value of their diagnostic parameters in examining patients with NCDs in the first and second levels of therapeutic care.

The design and protocol of further research work were created on the basis of the conclusions made. The clinical part of the developed protocol provides for the further conduct of an open nonrandomized controlled retrospective clinical stage study to determine the clinical diagnostic potential and the advisability of using objective and additional examination of the indicated methods as instrumental procedures.

REFERENCES

1. Potyazhenko M.M., Nevojt A.V. Innovacionnye metodiki obektivnogo obsledovaniya s kompyuternym testirovaniem v evolyucii registracii fizicheskikh fenomenov vrachem terapevticheskogo profilya: istoriya, realnost, perspektivy. [Innovative methods of objective examination with computer testing in the evolution of registration of physical phenomena by a doctor of therapeutic profile: history, reality, prospects] *Medical informatics and engineering*. 2018; 4: 58-65. (in Russian).
2. Mintser O.P., Potyazhenko M.M., Nevojt G.V. Evaluation of the human bioelectromagnetic field in medicine: the development of methodology and prospects are at the present scientific stage. *Wiadomości Lekarskie*, 2019;5, II: 1117-1121. (in English).
3. Potyazhenko M.M., Nevojt A.V. Neinfekcionnye zabolevaniya: poisk alternativnykh reshenij problemy s biofizicheskikh pozicij [Non-communicable diseases: search for alternative solutions to the problem of biophysical positions]. *Practitioner doctor*. 2019; 1: 57-62. (in Russian).

4. Bojko V.V., Krasnogolovec M.A., redaktory. Kvantovo-biologicheskaya teoriya [Quantum-biological theory]. Fakt. Harkov; 2003. 967s. (in Russian).
5. Gotovskij M.Yu., Mejzerov E.E. Opyt effektivnogo primeneniya sovremennykh apparatnykh metodov diagnostiki i lecheniya zabolevaniy, osnovannykh na holisticheskoy modeli zdorov'ya [Experience in the effective use of modern hardware-based methods for diagnosing and treating diseases based on a holistic health model]. Komplementarnaya medicina: sostoyanie i perspektivy pravovogo regulirovaniya. Izdanie Gosudarstvennoy Dumy. Moskva; 2015. 54-61. (in Russian).
6. Potyazhenko M.M., Nevojt A.V. Energeticheskaya sistema cheloveka v svete sovremennykh fiziko-biologicheskikh znaniy, koncepcij, gipotez [The human energy system in the world of modern physico-biological knowledge, concepts, hypotheses]. Ukrayinskij medichnij chasopis. 2019; 4(132), 2: 24–29. (in Russian).
7. Tinsley J.N., Molodtsov M.I., Prevedel R. et al. Direct Detection of a Single Photon by Humans. Nat. Commun. 2016; 7: 12-17.
8. Potyazhenko M.M., Nevojt A.V. Energeticheskaya sistema cheloveka: chto izvestno ofitsialnoy nauke [Human energy system: what is known to official science]. Ukrayinskij medichnij chasopis. 2018; 6(2): 22-24. (in Russian).
9. Samojlov V.O. Medicinskaya biofizika [Medical Biophysics]. SpecLit. SanktPeterburg; 2013. 591s (in Russian)
10. Cifra M., Pospíšil P. Ultra-weak photon emission from biological samples: definition, mechanisms, properties, detection and applications. Journal of Photochemistry and Photobiology B: Biology. 2014; 139: 2-10.
11. Stefanov M., Potroz M., Kim J. et al. The Primo Vascular system as a New Anatomic System. Journal of Acupuncture and Meridian Studies. 2013; 6(6): 331-338.
12. Gall L.N., Gall N.R. Kollektivnye processy v biomolekulyarnykh sistemah [Collective processes in systems]. Scientific and technical statements of SPbGPU. 2010; 2: 141–151. (in Russian).
13. Bojko V.V., Sokol E.I., Zamyatin P.N., redaktory. Pezobiosintez: predposylki, gipotezy, fakty [Piezobiosynthesis: prerequisites, hypotheses, facts]. Monografiya, v 4 t. Kharkov Polytechnic Institute. (in Russian).
14. WHO. Non-communicable diseases. 2018; [Elektronnyi resurs]. – Rezhym dostupu: <http://www.who.int/news-room/fact-sheets/detail/noncommunicable-diseases>.
15. Stefanov M., Potroz M., Kim J. et al. The Primo Vascular system as a New Anatomic System. Journal of Acupuncture and Meridian Studies. 2013; 6(6): 331-338.
16. Mihajlov V.M. Variabelnost ritma serdca (novyj vzglyad na staruyu paradigmu) [Heart rate variability: a new look at the old paradigm]. 000 «Nejrosoft». Ivanovo; 2017. 516s. (in Russian).
17. Potyazhenko M.M., Nevojt A.V., Nastroga T.V., Kitura O.V. Mozhlivosti klinichnogo zastosuvannya kartuvannya suputnoyi patologiyi v ocinci valeologichnogo statusu za dopomogoyu ATM-ekspres metodiki segmentarnoyi diagnostiki [Possibilities of clinical application of mapping of concomitant pathology in the evaluation of valeological status using ATM-express method of segmental diagnostics]. Materials of the international scientific-practical conference «Biological, medical and scientific-pedagogical aspects of human health». Astraya. Poltava; 2018: 73-74. (in Ukraine).

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REVIEW ARTICLE

HEART REMODELING, TREATMENT OF MYOCARDIAL INFARCTION WITH DIABETES MELLITUS 2ND TYPE AND HEART FAILURE

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Scientific 42 articles were analyzed, which for analysis were taken from scientometric databases: Web of Science, Scopus, PubMed, Medline, on topics related to: heart remodeling, treatment of myocardial infarction with type 2 diabetes mellitus and heart failure. Analysis of current medical studies and the data obtained indicate both availability in the usage of new HF biological markers – suppressor of tumorigenesis 2 (ST2), and the efficiency in the use of antagonists of mineralocorticoid receptors and sodium-glucose linked transporter-2 inhibitors, which is complicated by HF and type 2 diabetes by slowing down the processes of LV myocardial remodeling, which promotes control of blood pressure and fluid volume and causes a decrease and gradual regression of HF regardless of its origin.

KEY WORDS: myocardial remodeling, acute myocardial infarction, heart failure, diabetes mellitus type 2

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INTRODUCTION

Cardiovascular disease (CVD) is a leading cause of death worldwide [1,2,3]. According to the data of the World Health Organization, annually 18 million deaths are registered worldwide due to the pathology [2,3]. The countries of Europe and the USA show examples of successful struggle against this problem: within 20 years the mortality rate has decreased by more than 50% [1,3].

Diabetes mellitus (diabetes) is an important risk factor for acute myocardial infarction (MI). Although modern MI treatment has significantly favoured survival for both patients with and without diabetes. The presence of diabetes doubles twice as much the risk of mortality rate in the acute phase of MI and with long-term follow-up of patients. Higher risk of mortality among those with diabetes indicates a special need for better options in treating such patients and suggests that intensive medical treatment, long-term follow-up and strict control of other risk factors should be carefully performed and maintained [4, 5, 6].

The risk of CVD (myocardial infarction, stroke, peripheral vascular disease) is twice as high in patients with type 2 diabetes compared with patients who do not have diabetes. Besides, CVD is a major cause of mortality among patients with type 2 diabetes [5].

THE AIM

The aim: review of current medical studies on diagnosing and treatment of complicated comorbid pathology: acute myocardial infarction (MI) complicated with heart failure

(HF) of type 2 diabetes patients, with structural and geometric changes in shape and function of the heart and the possibility of their pharmacological correction.

MATERIALS AND METHODS

42 scientific articles were analyzed, which for analysis were taken from scientometric databases: Web of Science, Scopus, PubMed, Medline, on topics related to: heart remodeling, treatment of myocardial infarction with type 2 diabetes mellitus and heart failure. Research methods: systematic approach, bibliosystematic analysis.

REVIEW AND DISCUSSION

The term “heart remodeling” was suggested by N.Sharp in the late 1970's to refer to heart structural and geometric changes after acute myocardial infarction (MI).

The main geometric types of left ventricular (LV) remodeling are related to the conditions under which they are developing. Pressure overload (aortic valve stenosis, hypertension) leads to increase in the number of sarcomeres and thickness of cardiomyocytes, wall thickness and formation of LV geometry concentric type. Volume overload (valve regurgitation) leads to the increase in the length of cardiomyocytes, decrease of wall thickness, increase in its volume and formation of LV geometry eccentric type. Myocardial infarction (MI) is a combination of pathogenetic mechanisms when stretching and enlarging the area of infarcted tissue leads to an increase in LV volume with overload and pressure of uninfected myocardial sections [7, 8].

The myocyte is the main cardiac cell involved in the remodeling process. Other components involved in heart structural change are interstitium, fibroblasts, collagen, coronary vessels.

Pathogenetic postinfarction remodeling is a special type of left ventricular remodeling (LV) that develops in the result of increase in pre- and postload on the myocardium, increasing of the size of the left ventricle and hypertrophy of a healthy viable myocardium [7,8]. An increase in preload leads to a phenomenon of infarct expansion and increase in the volume of a healthy ventricular wall that is "resisted" by the infarcted ventricular wall [7]. The contraction of the heart muscle is not symmetrical because of the fact that necrotized segments lose their ability to contract [8]. As a result, the force generated by the unaffected myocardium during contraction is not counterbalanced by a similar retroactive force. As a consequence, the "infarcted" wall of the LV is stretched by the force of healthy walls contractions, which is not distributed evenly throughout the ventricle [7]. Thus, the situation is formed when the "infarcted" area must counteract a greater force of a healthy myocardium, which leads to asynchronous movement of the ventricular walls [7,9]. However, some affected segments may return to normal contractile capacity, though not immediately, but within months after the MI, it is the case of so-called "hibernated" myocardium (reperfusion injury reverse). However, under transmural myocardial lesions, some segments still remain dis-, hypo-, or akinetic, thereby causing permanent regional contractile dysfunction [8,9]. It has also been shown that in order to maintain a normal stroke volume with a reduced number of normally functioning segments, a healthy myocardium is forced to produce more pressure required to increase the postload on a healthy myocardium [7].

Myocardial remodeling is commonly developing in patients with ST segment elevation myocardial infarction (STEMI), where the scar is transmural. There are many predictors of this phenomenon and they can be evaluated by a variety of visualizing (ultrasound, CT, MRI) and laboratory techniques. The best predictor of remodeling is undoubtedly the size of infarction, which can be measured by the percentage ratio to the mass of myocardial mass [10]. During acute MI, serum troponin I and MB fraction of creatine phosphokinase correlate positively with MI size; their very high levels may indicate an increase in the volume of cameras, as well as a decrease in global and segmental contractility [9,10].

The development of postinfarction LV remodeling puts the patient at risk of sudden cardiac death (for instance, due to the development of fatal arrhythmias) [11]. Qualitative disorders of LV geometry and myocardial structure, together with the increased process of fibrosing of the heart walls, may lead to possible extraconductive transmission, which can contribute to the development of arrhythmia by the mechanism of micro- and macro-re-entry [7, 11]. It is also proved that structural changes can increase the electric automatism of cardiomyocytes [11]. There is sufficient evidence that eccentric LV hypertrophy is associated with a

threefold increase in the risk of major cardiovascular events, including sudden death, recurrent heart attack, heart failure, stroke [7, 8, 11]. Scar expansion often results in pronounced dilatation of the ventricle and aneurysm, the wall of which consists of myocardial segments, which are usually akinetic [10]. Slow blood flow in the aneurysm can lead to thrombus formation. LV thrombosis is usually asymptomatic but is often associated with a high risk of systemic thromboembolism, including transient ischemic attacks and strokes [8,10].

Thus, taking into account things mentioned above, it should be emphasized that myocardial remodeling occurs by restructuring of components – cardiomyocytes, their vessels and the intracellular matrix [7, 10]. Normally, the wall of the ventricle consists of three layers of fibres: longitudinal, circular, and helical, which rotate from subepicardial to subendocardial layer ranging almost to 180 degrees. In a healthy myocardium, the thickness of all three layers is identical. [7,8]. All the fibers consist of tightly grouped cardiomyocytes. The layers of the fibers are separated by furrows. The laminar architecture of the myocardium is due to a complex system of extracellular matrix proteins and fibrillar collagen. Approximately 85% of all cardiac collagen is type I collagen, which has contractile force [10]. Type III collagen occupies 11%; it is formed as thin filaments and provides elasticity of the walls. Based on the morphological characteristics, the entire cardiac matrix can be divided into three components: epic, peri, and endomyzes [12]. Epimysium is located on the endocardial and epicardial surfaces and supports meso- and endothelial cells. The perimysium surrounds the muscle fibers and therefore connects the muscle fibers together. The endomysium diverge from the perimysium and surrounds separate muscle fibers. Endomysium binds muscle fibers and supply nourishment [7, 12]. Postinfarction magnetic resonance mapping shows the disappearance of subendocardial fibers and hypertrophy of the subepicardial layer in the affected segments. Zones without muscle fibers refer to a postinfarction scar. Cardiomyocytes at those places are replaced by collagen [10, 12]. Hypertrophied cardiomyocytes are longer than other normal heart cells and surround the scar area, although they may also be present in remote areas of the myocardium. This type of hypertrophy is called eccentric. In this case, the deterioration of the ventricle due to volume overload is observed [9, 10]. Due to the extremely limited regenerative supply, hypertrophy that occurs in the postinfarction period is accompanied by an increase in the extracellular matrix (ECM), which is mostly composed of collagen fibers [7, 10]. It is due to the increased activity of cardiac fibroblasts, which are activated by various fibrogenic mediators [8,9]. Increase of the load on the walls in infarcted myocardium leads to thinning of the affected wall by Laplace law and activates the synthesis of collagen by fibroblasts. Extension of the ECM reduces the load on cardiomyocytes but impairs their contractile function [13]. As a result, there appears negative correlation between ECM volume and left ventricular (LV) ejection fraction (EF) [12, 13]. There is also evidence that ECM volume correlates positively with mortality [10,13].

The term “myocardial remodeling” was suggested to characterize the response of the myocardium to the development and progressing of acute myocardial infarction to chronic heart failure (HF) [14]. Regardless the fact that remodeling is most commonly associated with cardiovascular events, its effects are directly dependent on the size of the necrosis [8, 15]. Postinfarction remodeling develops in 30% of patients with MI, and as it is a predictor of HF, this phenomenon is considered prognostically unfavorable [8,12,14]. Low-EF HF affects more than 20 million people worldwide [15]. Left ventricular HF within the patients older than 65 is the leading cause of hospitalization. Recently, It was noticed recently, that there exists a different category of HF – HF with functioning EF. [10,12]. Such kind of patients is represented by a completely different phenotype with biochemical features different from traditional ones. Therefore, it became necessary to identify the characteristics and predictors of both negative myocardial remodeling and recovering myocardial function of patients with HF after AMI. [12,13]. Clinical symptoms of HF are also the consequence of cardiac remodeling, which includes damage of cardiac cells and extracellular matrix [7] followed with cell hypertrophy, apoptosis and necrosis of myocytes, activation and proliferation of fibroblasts, which ultimately leads to fibrosis and myocardial dysfunction.

Among patients with HF, the evolution of the disease and response to therapy differ as well as the consequences that depend on the cause of the HF, the pathophysiological characteristics (systolic or diastolic dysfunction), the severity of HF, the speed of its progression. [16,17]. In diabetes, postinfarction impairment of heart pumping function is usually associated with a subclinical disturbance of LV function that occurred before MI [8,17]. In the stage of acute ischemia, patients have “compensatory” hyperkinesia of the myocardium unaffected areas; this hyperkinesia can normalize the overall ejection fraction and correlate with hemodynamic status and survival of patients [10]. A number of studies show that after MI LVEF [7] and regional EF of intact myocardium [17,18] are lower in diabetes than without it. The results of early angiography in TAMI (Thrombolysis and Angioplasty in Myocardial Infarction) studies show that the function of the ventricular myocardium intact sections in diabetes is worse than when it is absent [18,19,20].

Speaking about pathogenic processes of myocardial remodeling, a special group of patients, namely, the individuals with high and very high risk of fatal cardiovascular events, individuals with MI and concomitant type 2 diabetes [4,18,20] should be of special interest. Chronic hyperglycemia promotes morphofunctional myocardial remodeling, which leads to diabetic cardiomyopathy (DCM). DCM is described as HF with functioning LVEF, the first distinguishing feature being diastolic dysfunction (DD) in combination with concentric cardiac hypertrophy. [4,20,21]. DCM initially reveals as a decrease in the elongation of the left ventricle on the background of normal systolic function [21,22]. Asymptomatic disorders of diastolic function develop in 27-69% of patients with

diabetes mellitus (microcirculatory disorders in this case are either absent or poorly expressed) [22,23]. Concomitant arterial hypertension develops in diabetic patients about twice as often as in general population [24], and more grave cardiomyopathy were noticed within them [22]. Hypertension leads to LV hypertrophy and helps to reduce its elongation [22,24]. However, dysfunction of diastolic relaxation in diabetes patients was also registered in the absence of concomitant hypertension [23]. Evident signs of impaired systolic function usually occur with prolonged diabetes, severe microangiopathy or concomitant arterial hypertension [24]. Thus, DCM, occurring subclinically without atherosclerotic lesions of large vessels, reduces the compensatory capacity of the myocardium, which is not damaged by heart attack. When the degree of myocardial necrosis is the same, the clinical picture depends on the severity of diabetic cardiomyopathy [22,24].

Because of the peculiarities of the pathophysiological processes that lead to the development of HF as a result of myocardial remodeling after MI, there occurred the need to stratify the risk of prognostically unfavorable myocardial changes based on certain parameters. Besides clinical signs which refer to existing assessment prognostic scales, recently biomarkers are also used [24,25].

Biomarkers can be useful for diagnosing processes, choice of the way of treatment, in monitoring treatment efficacy and predicting outcomes of the disease due to their high sensitivity and specificity in case of thorough laboratory control. Within the patients with HF, the evolution of the disease and the response to therapy differ as well as the consequences that depends on the cause of the HF, pathophysiological characteristics (systolic or diastolic dysfunction), the severity of the HF, the rate of its progression [25,26,27].

During two last decades, the prognosis and clinical approaches to the treatment of patients with heart failure have been based on the study of biomarkers such as B-type brain natriuretic peptide (BNP) and N-terminal brain natriuretic peptide fragment (NT-proBNP). NT-proBNP is a highly sensitive to ischemia biological marker that is secreted in the myocardial lesion and reflects profile of myocardial structure and function disorders [25,27]. In addition to mechanical stretching of the ventricles, there are probably other mechanisms that stimulate the formation of NT-proBNP, namely: ischemia of different localization, rhythm disturbance, myocardial hypertrophy, endothelial dysfunction [27,28]. However, as an indicator of adverse course of myocardial infarction, NT-proBNP has low diagnostic specificity and sensitivity. Besides, in some cases, especially in the presence of concomitant pathology, the data of the biomarker was not always reliable because such indicators as age, sex, renal function, body mass index, thyroid function and anemia can effect it. [27,29]. The amount of NT-proBNP in the blood may also change in case of a infectious diseases. Therefore, there is now a search for new biomarkers capable of detecting HF at an earlier stage, assessing the prognosis for the patient, determining the severity of the disease, possible consequences

and response to the treatment. One of the most promising among the new biomarkers is the suppressor of tumorigenesis 2 (ST2) [26,30,31]. It was discovered in 1989, but only in 2002 Weinberg E.O. et al. reported that it can be secreted by cardiomyocytes in response to biomechanical stress of the myocardium, that attracts attention of researchers to the role of this marker in the cardiovascular system [29,32].

ST2 is a member of the interleukin-1 receptor family and exists in two different forms: transmembrane isoform (ST2L) and soluble isoform (sST2). ST2 is an interleukin-33 (IL-33) receptor, which is an IL-1-like cytokine secreting with living cells in response to their damage. The main function of ST2 is the potentiation of interleukin 33 (IL-33) effects, which exerts its effect by binding to the isoforms of the transmembrane receptor ST2L. It was proved experimentally that interaction of IL-33 and ST2L is cardioprotective and reduce myocardial fibrosis, cardiomyocyte hypertrophy, apoptosis, and improve cardiac muscle function. [33]. This cardioprotective effect is performed solely through the ST2L receptor and not through the soluble receptor. The IL-33 / ST2 system is activated in cardiomyocytes and fibroblasts in response to myocardial damage, sST2 binds to IL-33 that competes with ST2L. The interaction of this soluble receptor with IL-33 blocks the IL-33 / ST2L system and, as a result, eliminates the cardioprotective effects described above, and sST2 is considered to be a bait receptor [34]. Thus, the ST2 system acts not only as a mediator of IL-33 function in its transmembrane isoform ST2L, but also as an inhibitor of IL-33 due to its soluble sST2 isoform [30,32]. However, a sharp increase in ST2 levels in the damage is accompanied by suppression of the favorable antihypertrophic effects of IL-33 [33]. Therefore, the reasout of ST2 in MI may have prognostic value for patients, as it will allow to evaluate the course of the acute period and the possibility of complications.

The major sources of sST2 are cardiac fibroblasts and cardiomyocytes, which release it in response to biomechanical stress or damage, but there are also non-myocardial sources of soluble ST2. Such sources of sST2 are endothelial cells from both macrovascular (aortic and coronary) and cardiac microvascular systems [31,32].

There is no currently a convincing evidence for the treatment of HF with functioning LV EF, thus, interest to detecting biomarkers that reflect multiple mechanisms associated with the pathogenesis of syndrome of this HF variant is growing [25]. Bhardwaj A. and Januzzi J,'s review of the role of ST2 as a new biomarker of HF compares the prognostic value of NT-proBNP and ST2 [26,27,32].

Considerable attention is paid to comorbid conditions, especially with coronary heart disease in combination with diabetes. The results of epidemiological studies indicate that the risk of coronary complications in patients with diabetes without coronary heart disease can be compared with the risk in patients who already have clinical manifestations of coronary heart disease [18,29]. Such patients may have no clinical symptoms or signs of moderate diastolic dysfunction at an early stage, and shortness of breath, fatigue, weakness and swelling of shin may develop in the

course of progressing pathology [21,22]. Interstitial and perivascular fibrosis is a histological indicator of diabetic cardiomyopathy, and the degree of fibrosis correlates with myocardial hypertrophy [21,22]. Taking into account the pathophysiological indicators, echocardiographic changes, and serological biomarkers, one can assume that the initial stage of DCM is characterized with mixed hypertrophic and restrictive phenotype. At this stage, microangiopathy and hypertension promote the development of DD, with the progression of which the systolic function is impairing in the result of dilatation, fibrosis, micro- and macroangiopathy [21,22,24].

Special researches, when analyzed, vividly prove that applying the principles of pharmacological impact on myocardial remodeling is appropriate and may be a useful strategy for the treatment of patients with STEMI / NSTEMI. Usage of pharmacological devices at an early stage to effects myocardial remodeling is necessary to prevent possible new cardiovascular events, accelerate the processes of restoring normal functioning of the cardiovascular system, improve rehabilitation measures and reduce the probability of death.

It is clear that the main way to reduce the fatal and non-fatal consequences of HF is primary prevention [20,35,36,].

In the pathogenetic mechanisms of postinfarction LV myocardial remodeling a significant role belongs to the fact how active the angiotensin-aldosterone system is. Numerous studies indicate that aldosterone impairs the contractility and metabolic functions of ischemic myocardium, increases systemic vascular resistance, and enhances the vasoconstrictor effect of angiotensin II in the coronary arteries [37]. Activation of mineralocorticoid receptors leads to myocardial fibrosis, inflammation, ruining of cardiomyocyte, and LV hypertrophy [38]. It was reaffirmed that mineralocorticoid receptor antagonists (AMCR), which are represented by the nonselective agent spironolactone [44] and selective eplerenone [39], favour the survival of patients with HF and MI with LV systolic dysfunction. This clinical bonus are associated with improved LV remodeling and reduced myocardial fibrosis [38]. Spironolactone and eplerenone differ in their molecular structure, pharmacodynamics and pleiotropic effects [37,38,39,40], however, the significant clinical differences between the two agents are not clearly defined and their usage in case of preserved LV EF that functios, requires further studies.

According to multicenter studies, AMCRs affect the level of fibrosis markers. It is important to note that the development of myocardial fibrosis is not only a factor contributing to the progression of HF, but also causes electrical instability of the myocardium, conductivity disorders, which in its turn leads to an increased risk of ventricular arrhythmias and SCD [11].

DM is one of the predictors of HF [24]. This is especially true for HF with normally functioning LV EF [21]. Intracellular metabolic disorders and increased oxidative stress due to hyperglycemia, insulin resistance and chronic inflammation are pathogenic mechanisms that affect LV diastolic dysfunction against the background of type 2

diabetes. These mechanisms lead to structural changes in the heart, such as LV hypertrophy and interstitial fibrosis, which lead to HF [8,20,21].

The risk of death in combination of MI with diabetes is much higher than in the acute period of MI, or when lasting for several years [5,18]. HF of such comorbid patients is more pronounced and there exists a higher probability of recurrent MI [5,21].

In current clinical practice, type 2 diabetes therapy should aim not only at achieving glycemic control but also at influencing other modified CVD risk factors, including hypertension, overweight, frequent hypoglycemia, etc. [41]. Many antipyretics have a high potential for reducing glycosylated hemoglobin (HbA1c) level. Taking into account complex pathophysiological bindings between diabetes mellitus, obesity, arterial hypertension, and atherosclerosis it is very important that all glycemia controlling camicals, available and those new ones that just appear should be able not only control glycemial, but also effect the factors of CD risk in patients with type 2 diabetes [4,18]. Increased reabsorption of glucose in the kidneys is an important pathogenetic mechanism that supports chronic hyperglycemia in diabetes mellitus. About 90% of glucose is reabsorbed in the proximal renal tubule by sodium-glucose transporters of the second type (SGLT-2), and the remaining 10% by means of glucose transporters of the first type (SGLT-1) located distally. In type 2 diabetes, the activity of SGLT-2 increases, the capacity of the renal glucose transport increases, and, as a consequence, the renal glucose threshold increases [18,42]. Glyphlozins inhibit SGLT-2, which causes a decrease in sodium and glucose reabsorption from the lumen of the proximal renal tubule and leads to glucosuria. In the course of retrospective analysis of the EMPA-REG OUTCOME, which covered adult patients with type 2 diabetes and confirmed CVD, the beneficial effect of SGLT-2 on the cardiovascular system was evaluated. The analysis performed showed that SGLT-2 determined cardiovascular benefits, namely the reduction of cardiovascular mortality and hospitalization for HF in patients with diabetes mellitus and CVD based on an assessment of cardiovascular risk factors.

CONCLUSIONS

According to the analysis of scientific literature, these data indicate the prospect of using new biological markers – ST2, for the early diagnosis of heart failure (HF). However, the use of mineralocorticoid receptor antagonists and inhibitors of type 2 sodium glucose cotransporter in the treatment of patients with acute myocardial infarction complicated by HF and concomitant type 2 diabetes slows down gradual regression of manifestations of HF, regardless of its origin.

REFERENCES

- Berger J.S., Jordan C.O., Lloyd-Jones D., Blumental R. Screening for cardiovascular risk in asymptomatic patients. *J.Am.Coll.Card.*; 2010; 55: 1169-1177.
- Go, A. S. Heart disease and stroke statistics—2013 update: a report from the American Heart Association. *Circulation.*; 2013; 127: 6-245.
- Yancy C.W., Jessup M., Bozkurt B. et al. American College of Cardiology Foundation; American Heart Association Task Force on Practice Guidelines. 2013 ACCF/AHA Guideline for the management of heart failure: a report of the American College of Cardiology Foundation/ American Heart Association Task Force on Practice Guidelines. *J Am Coll Cardiol.* 2013;62(16):e147–239. doi:10.1016/j.jacc.2013.05.019/.
- Dauris M., Targher G., Laroche C. et al. For the ESC-HFA Heart Failure Long Term Registry. Association between diabetes and 1-year adverse clinical outcomes in multinational cohort of patients with chronic heart failure: results from the ESC-HFA Heart Failure Long Term Registry. *Diabetes Care*; 2017; 40: 671-678.
- Lehrke M., Marx N. Diabetes Mellitus and Heart Failure. *Am J. Med.* 2017;130(6S):S40-S50. doi: 10.1016/j.amjmed.2017.04.010.
- Shah A.D., Langenberg C., Rapsomaniki E. et al. Type 2 diabetes and incidence of cardiovascular diseases: a cohort study in 1.9 million people. *Lancet Diabetes Endocrinol.* 2015;3:105–13.
- Galli A., Lombardi F. Postinfarct left ventricular remodeling: a prevailing cause of heart failure. *Cardiology research and practice*, vol.2016, 12p.
- Heusch G., Libby P., Gersh B., et al. Cardiovascular remodeling in coronary artery disease and heart failure. *Lancet*; 2014; 383:1933-43
- Chan W., Duffy S., White D., et al., Acute left ventricular remodeling following myocardial infarction: coupling of regional healing with remote extracellular matrix expansion, *JACC: Cardiovascular Imaging*, 2012;5(9): 884-893
- Downey J.M., Cohen M.V. Reducing infarct size in the setting of acute myocardial infarction. *Progress in Cardiovascular Diseases.* 2006;48:363-376
- Bauer A. Improved Stratification of Autonomic Regulation for risk prediction in post-infarction patients with preserved left ventricular function (ISAR- RISK) *Eur. Heart. J.*; 2009;30:576-583.
- Borlaug B.A. The pathophysiology of heart failure with preserved ejection fraction. *Nat. Rev. Cardiol.*2014; 11: 507-515.
- Seropian I.M., Toldo S., Van Tassel B.W., Abbate A. Anti-inflammatory strategies for ventricular remodeling following ST-segment elevation acute myocardial infarction. *J Am Coll Cardiol.* 2014;63(16):1593-603. doi: 10.1016/j.jacc.2014.01.014.
- Perk J., Bucker G., Gohlke H. European Guidelines on cardiovascular disease prevention in clinical practice (version 2012). *Eur Heart J.*; 2012; Vol. 33 (13): 1635-1701.
- Townsend N., Wilson L., Bhatnagar P. et al. Cardiovascular disease in Europe: epidemiological update 2016. *Eur Heart J* 2016;37(42):3232–3245.
- Braunwald E., Libby P., Bonow R. Heart diseases. A textbook of cardiovascular medicine. NY: Saunders.; 2009; 2300.
- De Boer R.A., Yu L., Van Veldhuisen D.J. et al (2010) Galectin-3 in cardiac remodeling and heart failure. *Curr Heart Fail Rep* 7(1):1-8
- Type 2 Diabetes Mellitus and Heart Failure. A Scientific Statement From American Heart Association and Heart Failure Society of America; 2019; 139:00-00. DOI:10.1161/CIR.0000000000000691.
- Frassdorf J., De Hert S., Schlack W. Anaesthesia and myocardial ischaemia/reperfusion injury. *Br J Anaesth.*; 2009; 103(1):89-98.
- Johanson I., Dahlstrom U., Edner M. Prognosis implication of type 2 diabetes mellitus in ischemic and non ischemic heart failure. *J Am Coll.* 2016; 68: 1404-1416.
- Lam C.S. Diabetic cardiomyopathy: An expression of stage B heart failure with preserved ejection fraction. *Diabetes and Vascular Disease Research.* 2015;12(4):234–8

20. Chong C-R., Clarke K., Levelt E. Metabolic remodelling in diabetic cardiomyopathy. *Cardiovasc. Res.* 2017;113(4):422–430. doi: 10.1093/cvr/cvx018.
21. Miki T., Yuda S., Kouzu H., Miura T. Diabetic cardiomyopathy: pathophysiology and clinical features. *Heart Fail Rev.* 2013;18(2):149–66. doi: 10.1007/s10741-012-9313-3.
22. Nichols M., Townsend N., Scarborough P. Cardiovascular disease in Europe 2014: epidemiological update. *Eur. Heart J.*; 2014; 35 (42): 2929.
23. Biomarkers Definitions Working Group. Biomarkers and surrogate end-points: preferred definitions and conceptual framework. *Clin. Pharmacol. Ther.* 2001;69: 89–95.
24. Lin Y-H., Zhang R-C., Hou L-B. et al. Distribution and clinical association of plasma soluble ST2 during the development of type 2 diabetes. *Diabetes Research and Clinical Practice.* 2016;118:140–5.
25. Fu S., Ping P., Zhu Q. et al. Brain Natriuretic Peptide and Its Biochemical, Analytical, and Clinical Issues in Heart Failure: A Narrative Review. *Front Physiol.* 2018; 9: 692. doi: 10.3389/fphys.2018.00692.
26. Kalsmith B.M. Role of the Brain Natriuretic Peptide in Heart Failure Management. *Circulation: Heart Failure.* 2009; 2:379. doi: 10.1161/CIRCHEARTFAILURE.108.816264.
27. Lichtenauer M., Jirak P., Wernly B. et al. A comparative analysis of novel cardiovascular biomarkers in patients with chronic heart failure. *Eur J Intern Med.* 2017;44:31–38. doi: 10.1016/j.ejim.2017.05.027.
28. Ky B., French B., McCloskey K. et al. High-sensitivity ST2 for prediction of adverse outcomes in chronic heart failure. *Circ Heart Fail* 2011;4:180–7.
29. Weir R.A., Miller A.M., Murphy G.E. et al. Serum soluble ST2: a potential novel mediator in left ventricular and infarct remodeling after acute myocardial infarction. *J Am Coll Cardiol.* 2010;55(3):243–50. doi: 10.1016/j.jacc.2009.08.047.
30. Bhardwaj A., Januzzi J.L. ST2: a novel biomarker for heart failure. *Expert Rev. Mol. Diagn.* 2010;10(4):459–64.
31. Sanada S., Hakuno D., Higgins L.J. et al. IL-33 and ST2 comprise a critical biochemically induced and cardioprotective signaling system. *J. Clin. Invest.* 2007;117:1538–49.
32. Seki K., Sanada S., Kudinova A.Y. et al. Interleukin-33 prevents apoptosis and improves survival after experimental myocardial infarction through ST2 signaling. *Circ. Heart Fail.* 2009;2 684–91.
33. Bulluck H. et al. Reducing myocardial infarct size: challenges and future opportunities. *Heart.* 2016;102:341–348
34. Marwick T., Ritchie R., Shaw J., Kaye D. Implication of underlying mechanisms for recognition and management of diabetic cardiomyopathy. *J Am Cardiol.* 2018;71:339–351.
35. Talman V., Ruskoaho H. Cardiac fibrosis in myocardial infarction—from repair and remodeling to regeneration. *Cell Tissue Res.* 2016;365(3):563–81. doi: 10.1007/s00441-016-2431-9.
36. Vizzardi E., Regazzoni V., Caretta G. et al. Mineralocorticoid receptor antagonist in heart failure: Past, present and future perspectives. *Int J Cardiol Heart Vessel.* 2014;3: 6–14. doi: 10.1016/j.ijchv.2014.03.005
37. Wu C.T., Wang Z.H., Li Z.Q., Wang L.F. Effect of spironolactone on cardiac remodeling after acute myocardial infarction. *World J Emerg Med.* 2013;4(1):48–53. doi: 10.5847/wjem.j.issn.1920-8642.2013.01.009.
38. Potyazhenko M.M., Skripnik I.M., Vakulenko K. Et al. Efektyvnist' antahonistiv al'dosteronu u khvorykh na infarkt miokarda, uskladneny hostroyu livoshlunochkovoyu nedostatnistyu z zberezhenoju systolichnoju funktsiyuju livoho shlunochka. [Efficiency of aldosterone antagonists for patients with myocardial infarction, complicated with acute leftventricle insufficiency] Артеріальна гіпертензія. 2018; 2(58):52–56. (in Ukrainian).
39. Gielen S., Landmesser U. The year in cardiology 2013: cardiovascular diseases prevention. *Eur. Heart J.*; 2014; 35(5): 307–312.
40. Gilca G-E., Stefanescu G., Badulescu O. et al. Diabetic Cardiomyopathy: Current Approach and Potential Diagnostic and Therapeutic Targets. *J Diabetes Res.* 2017;2017:1310265. doi: 10.1155/2017/1310265.

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REVIEW ARTICLE

ORGANIZATIONAL, REGULATORY AND LEGAL ASPECTS OF EUROPEAN INTEGRATION OF HIGHER MEDICAL EDUCATION IN UKRAINE: A CRITICAL REVIEW

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ABSTRACT

The aim: The main purpose of this research is to conduct the theoretical and applied study of the legal profile enforcement for state attestation of medical graduates, the relevant legislative system, and its effectiveness; to identify the issues of special legislative requirements, as well as the search for ways to resolve it.

Materials and methods: Basic methods: analysis, synthesis and comparison. Object of research: system of state certification of graduates of medical sciences. Investigation of this topic in the paper is carried out in the following logical sequence: firstly, the basic principles of the state integrated qualification exam were determined and analyzed; then the legal enforcement for integrated state qualification exam of master's degree in discipline "22 Health Care" was considered. Also, a critical review of Ukrainian normative base for holding the state attestation of medical graduates was conducted.

Conclusions: In view of foregoing, we can make a conclusion that in the modern globalization world, competition of national educational services should be ensured by a range of different activities: legal, organizational, financial, etc. The legal direction, domestic rules should correspond to similar, uniform rules and practices of the most effective state (regional, international) systems.

KEY WORDS: state attestation of medical graduates, higher medical education, organizationa and legislative requirements for the qualification exam and its results' identifying

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INTRODUCTION

Reforming the healthcare sector in Ukraine, bringing it into line with current world standards, requires first and foremost a change in the training of medical personnel. Implementation of the principles of evidence-based medicine in medical and preventive activities, using of the latest techniques and medicines, ability and desire to use information and computer technologies, the desire to learn something new is what society expects and expects from young doctors. However, this new qualitative level of medical personnel is possible only under the conditions of radical changes in higher medical education and its successful integration into a common European educational space.

The introduction and implementation of reforms in higher medical education entails a restructuring of the educational process system, its content, teaching methods and technologies themselves, development of common criteria and standards according to the basic documents of the Bologna Agreements. The ultimate goal of these transformations is the formation of a common European educational and scientific space. In the context of globalization, there is competition in the field of human resources

between providers of educational services in the world, including in the medical, so the priority of training a highly qualified specialist is the quality of education services both in the undergraduate stage and throughout life.

Integrated state qualification exam is a new complex attestation of medical students' substantive knowledge. It was introduced in 2019 as a cutting-edge tool for evaluating medical students' educational level, which should meet the needs of the main stakeholders in the healthcare systems. So, graduates are highly qualified professionals, prepared for the expanding and changing healthcare environment that they will step into. Patients will gain benefits by obtaining more compassionate care with better healthcare outcomes. Community receives the medical education system, which meets societal needs for highly professional health workers. Higher medical institutions have possibility to create the educational environment, focusing on skill approach training.

THE AIM

The *main goal* of this paper is theoretical and applied study of the legal profile enforcement for state attestation

of graduates of higher medical schools, the relevant legislative system, and its effectiveness; identification of issues of special legislative requirements, as well as the search for ways to resolve it.

MATERIALS AND METHODS

Analysis, presented in this paper, was conducted in two parts. Firstly, the basic principles of the state integrated qualification exam were determined and analyzed; then the legal enforcement for integrated state qualification exam of master's degree in discipline "22 Health Care" was considered. The object of research is the system of state attestation of medical graduates.

The key methods used in this research are data analysis, summarization and comparison. The data synthesis and analysis are the key value-added elements of this research, which could help to find out the relevant legislative system for the new forms of state attestation of graduates of higher medical school in Ukraine.

REVIEW AND DISCUSSION

This issue is not clearly spelled out in the scientific works of domestic researches. Kyryan in [1; 2] identifies major trends in the development of the system of Ukrainian higher medical education of the XXth century. Osiychuk analyzes influence of Euro integration processes on the higher medical education development in Ukraine [3]. Humeniuk studies the issues of evaluation of medical higher education quality within the context of foreign students' education in Ukraine [4]. But nevertheless, the questions of search of new forms and methods of the state attestation of graduates of higher medical school are not highlighted in the research papers of Ukrainian scientists.

Foreign researches have this issue explored in a greater degree. One of the most effective and up-and-coming assessment methods for medical students, graduates and specialists is OSCE, proposed by H. Harden [5; 6]. Further literature review allows us to mention use of OSCE as a part of medical training on the principles of reliability and validity [7; 8]. Issues of OSCE implementation and evaluation within a variety of programs were analyzed in research papers of Brand and Schoonheim-Klein [9], Turner and Dankoski [10], Furlong [11], Major [12].

Thus, we see that the question of studying the legal profile for state certification of graduates of higher medical schools remains open.

The official substantiation (on the part of state departmental bodies) of the need for improvement state attestation of medical graduates of branch of study "22 Health Protection" in the form of integrated state qualification exam can be reduced, with some considerations, to the following:

1) It is an identical, uniform attestation approach for determining the education level and quality of medical students. As a counterargument on this provision, we can talk about the non-use of the greatest possible effectiveness of

the educational competition, provided by the national and foreign leading scientific and educational medical schools in this case. Averaged by standards equalization or yearning for it by the public authorities can deprive the originality and uniqueness of the highly professional doctors' training, as well as the unique competitive development of scientific and educational national medical schools, their prospects in competition with foreign colleagues (new methods, new scientific approaches, new developments, etc.).

2) It enables integration into the global medical and educational space. It's hard to argue with such motivation. But it should be noted that the trained specialists' focus on the external specialized labor markets should not be from top-down at the final stage of the educational process, but should be ensured by the creation of appropriate conditions in various directions throughout the specialist's training;

3) It is a part of anti-corruption component. In this part, it is disinclined to speak of objections. However, as other processes in Ukraine have shown, it is difficult to overcome corruption solely by such mechanisms, since in fact they received either geographical or qualitative transformation, or all its variations at once. The principle of intolerance to instances of corruption and co-optation, noted in government decisions on masters' attestation, is difficult to assess directly in the legal context.

Directly in the legal context, the relevance of the stated research topics for the national profile educational system of the healthcare academic discipline consists, in our opinion, at least in the pragmatic aspects faced by community. Firstly, we are talking about the novelty of the proposed form of medical students' attestation, because students have passed integrated state qualification exam in 2019 for the first time. The importance of consequences of such an innovation requires clearly established rules. Therefore, secondly, the proposed modernization requires carefully considered legal justification for such innovations.

What are the main documents of the special legal support in Ukraine for integrated state qualification exam in higher medical school, besides the basic provisions of the Constitution of Ukraine [13], as well as the constitutional legislation on education [14] and higher education [15]? The Ministry of Health of Ukraine in this matter refers primarily to decisions of the Government of Ukraine [16] as a managerial body in the field of higher education and operates on the constitutional special Law of Ukraine on Higher Education. On its official website the Office determines the legality of the state attestation of medical students by reference to Decree of the Cabinet of Ministers of Ukraine No. 344 dated 28th of March 2018 [17] by which the relevant Procedure was approved (hereinafter – the Order). At the same time, the Order, based on the name, is targeted, i.e. it relates to master's training in the specialties of the field of knowledge "22 Health Care": 221 Dentistry; 222 Medicine; 223 Nursing; 224 Technologies for medical diagnostics and treatment; 225 Medical psychology; 226 Pharmacy, industrial pharmacy; 227 Physical therapy, occupational therapy; 228 Pediatrics; 229 Public health. The list of specialties in the field of health care is determined

Table I. Legal enforcement for integrated state qualification exam of master's degree in discipline «22 Health Care»

Legislative levels	Normative legal acts	Substantive aspects of regulation (with the growing importance)
Constitutional	<i>Constitution of Ukraine</i>	Right to education; System of government; Powers of Cabinet of Ministers of Ukraine and other public authorities
Constitutional laws	<i>Laws of Ukraine:</i> "On education", "On higher education", "On the Cabinet of Ministers of Ukraine"	- Implementation of constitutional right to education, including right to higher education - Implementation of constitutional right to higher education; Attestation of candidates for higher education; Possible attestation form of candidates for master's degree is the integrated state qualification exam - Legal personality of the Government in the educational sphere, including higher education
	<i>Decree of the Cabinet of Ministers of Ukraine:</i> № 684 dated 17.07.2019	- The attestation form of medical master candidates' attestation was confirmed with special governmental legal regulation; Ministry of Health of Ukraine was defined as the responsible public authority with the involvement of Ministry of Education and Science of Ukraine
	Governmental № 354 dated 10.05.2018 № 334 dated 28.03.2018 <i>Order of the Cabinet of Ministers of Ukraine:</i> № 95-p dated 27.02.2019	- Integrated state qualification exam is for 9 academic specialties "22 Health Care" in the general list of 30 masters' specialties - The procedure of attestation is regulated in the form of qualification exam - Program with the 10-year-term of realization, also providing for implementation of integrated state qualification exam as the attestation form of students' academic achievements
Departmental	<i>Orders of the Ministry of Health of Ukraine:</i> № 419 dated 19.02.2019 № 1883 dated 19.10.2018	- Procedure and results of integrated state qualification exam is detailed - Financial and valuation issues of qualification exam

Source: composed by authors

by the Decree of the Cabinet of Ministers of Ukraine from 29th of April, 2015 No. 266 [18].

The special normative legal acts in force for attestation of medical graduates should also include acts of the Ministry of Health of Ukraine, which are directly specified in the Order. These are two departmental orders [19; 20]: first one regulates the procedural issues of organizing, conducting and evaluating attestation in the form of a qualification exam; the second one determines the cost of attestation, including the development phase.

Thus, national legislative levels, types of normative legal acts, and specific subject areas of legislative regulation as an element of legal enforcement for integrated state qualification exam in higher medical school can be comprehensively presented in Table I.

However, in our opinion, a systematic analysis of the legal enforcement, including legislative support, of the qualification exam for medical students allows us to highlight a number of legally problematic aspects.

So, the Decree of the Government was adopted at the end of March 2018, the official publication was made on May, 2018. At the same time, clause 1 of the Order determines its effect in relation to applicants who entered (recovered) in 2016. It is with the date indicated in the amended edition from 03.04.2019. But the students' attestation is a result

of their training and educational process. Therefore, it is hardly possible to recognize as effective the modernization of higher medical education with the imperative to reform only attestation itself, leaving the preparation stage in the past. Therefore, the legal purity of such a decision can be called into question. For example, questions arise about the conformity of the above provision of Article 58 of the Constitution of Ukraine, the principle of the reverse action's inadmissibility in time of legislative acts. Furthermore, as it is about the legal personality of individuals as participants in the educational process, whether it is comply with the decision of the Constitutional Court of Ukraine No. 1-rp/99 dated 09.02.1999 [21]. Legal ways out of this situation (avoiding extreme, judicial) are simple: do not indicate the date (be guided by the general rules for the entry into force of regulatory legal acts) or indicate it in advance, for example, received (restored) in 2019/2020/ etc. Moreover, it looks strange, within the original wording, as well as the targeting of the normative legal act, an indication in it on the date for the masters below, in the text of the Order. In fact, the qualification exam's schedule for 2019, presented on the official website of the Ministry of Health of Ukraine, is inconsistent with the provision on the preparation of the "CROC" exam and professional English exam specifications no later than six months before the

date of their conduct, as it is indicated in the Order of the department, which entered into force on 09.04.2019. The time countdown for an objective structured clinical exam (OSCE) is generally determined by reference (asterisk) in the order of the Ministry of Health of Ukraine No. 1883 dated 19.10.2018: from 01.01.2019 [20].

The Law of Ukraine "On Higher Education" presupposes the absence of imperativeness regarding the attestation form of persons who receive a master's degree, since the norm of the Law establishes that a single state qualification examination is a possible but not mandatory form of such attestation. There is no explanation of the motivation for the obligatory introduction of just such a form and just as an experiment in higher medical school. Moreover, clause 1 of the Decree and clause 2 of the Order approved by it contradict each other in this part, since the last one states that attestation can also be carried out in another form determined by the standard of higher education. In addition, there is no clear distinction between the respective powers of two ministries: the Ministry of Health of Ukraine and the Ministry of Education and Science of Ukraine.

The norms of the Order operate in three categories: "CROC", "CROC 1" and "CROC 2". The first document is defined as an integrated test exam. It can be carried out in one or two test stages, respectively, "CROC 1" and "CROC 2". However, the stages and required components of the qualification exam are associated exclusively with the last two categories. In fact, the legislative document, in addition to linking the stagedness of passing medical professional English, does not give any legal meaning to the CROC exam.

The Decree also establishes that the attestation form is an integrated state qualification exam, which consists of four components. But an analysis of the stages and mandatory components for separate specialties of the discipline "22 Health Care" allows us to conclude that fewer components of attestation are admissible. For example, the specialty "225 Medical Psychology" presupposes two compulsory components of the qualification exam: CROC (in the text of the Appendix to Procedure CROC 1 and CROC 2) and professional English. Thus, legally prescribed phasing and mandatory elements of an integrated state qualification exam in the refraction of specific specialties do not fully correspond to a certain form of attestation of applicants for higher medical education. Of course, the underlying internal contradiction of the content of a normative legal act requires its elimination.

There are legal defects in the choice of exclusively English as a mandatory component of an integrated state qualification exam. The question itself, as is known, is more voluminous: the ratio of the compulsory nature of such an exam to the language of the educational process in higher education institutions in accordance with national legislation. Regarding the mandatory legally binding to English language, it is necessary to note that, as well as known, Ukraine declares its European integration intentions. And in this case, we must rely on linguistic pluralism, including official spheres. In this context, it is also worth paying

attention to another technical nuance, the ambiguity of the published provisions: the Decree determines the transition to exam English from 01.09.2019, and the Ministry of Health of Ukraine on its official website declares this transition since 2020 [22].

Non-alternative payment for re-passing the qualification exam (paid by applicants), as determined by the Government, also raises legal issues. By setting such an opportunity, and in fact, the phasing of the qualification exam, applicants' attestation, providing the opportunity to retake the exam, the state includes such an opportunity in the right of the applicant, which can be transformed into a legal understanding of the competence of the subject to realize the right to higher education. Subject to the conditions of competitiveness, forms of ownership, etc., this legislative provision is contrary to Art. 53 of the Constitution of Ukraine and, accordingly, the decision of the Constitutional Court of Ukraine No. 5-rp/2000 dated 04.03.2014 [23]. Therefore, non-alternative payment for the applicant, without taking into account valid reasons for missing, could potentially be qualified as unlawful. Additional passing the exam proposed by the Ministry of Health of Ukraine in order No. 419 dated 19.02.2019 does not comply with the Order. There are no rules for passing the additional qualification exam in the text of the governmental document.

We can state that the professional legal level of providing an integrated state qualification exam leaves much to be desired. Unfortunately, this situation is aggravated by its ubiquity. Indeed, the ambiguous formulations in the governmental decisions, for example, regarding the mandatory nature of the proposed attestation form, the contradiction of each other with the regulatory provisions in this part are also confirmed in the texts of other relevant legislative documents. So, after the indicated alternative in the Decree, its obligatoriness is named here, among the basics and principles of the qualification exam. It should be reminded that the name of the Decree determines its scope: masters' attestation. However, both the text below and the differences in the indicated dates extend the scope of its action to specialists as well. Probably the differentiation of various levels of higher education in the applicants' attestation, with the corresponding legal support, is more productive.

The sequence and priority of the documents adopted by the Ministry of Health of Ukraine to ensure a qualification exam is, to put it mildly, perplexing: order No. 1883 dated 19.10.2018 has determined the financial component, and procedural issues of attestation have been established only in February 2019, and taking into account official publication, much later in April. This leads to conclusion: the main issue is departmental finances, and it is carried out ensuring the rights and interests of all other participants in the process. In the prioritization by the state body of the priorities, we would like to recall the content of Art. 1 of the Constitution of Ukraine that Ukraine is a sovereign and independent, democratic, social, legal state. In addition, the Ministry of Health of Ukraine is obliged to strictly comply with legal requirements and not allow itself

the distribution of requirements and recommendations to the heads of higher education institutions, which are not in compliance with the law. Moreover, we would like to recall that the importance of legislation is in the first place, and among the expected results of the implementation of the Strategy for the Development of Medical Education in Ukraine: “The implementation of the Strategy will provide an opportunity to create a legislative basis for the further development of medical education in Ukraine, to implement comprehensive changes in this area” [24; 25; 26].

CONCLUSIONS

In view of foregoing, we can make a conclusion that in the modern globalization world, competition of national educational services should be ensured by a range of different activities: legal, organizational, financial, etc. The legal direction, domestic rules should correspond to similar, uniform rules and practices of the most effective state (regional, international) systems. The effectiveness of this message is especially evident for the areas of knowledge and professions, their professional and educational support, which can be evaluated from the position of universal content. Medicine is a vivid confirmation of this. Indeed, fundamental medical standards are common civilizational values. Methods, approaches, high technology, including educational, reference points and levels of achievement may differ; but basic medical knowledge is universal. All this allows us to derive educational requirements for medicine to the best internal and external standards, which provides the opportunity to achieve the training of specialists in the relevant areas in a competitive section. In addition, it allows ensuring the subjective opportunities and rights of future qualified medical workers, as well as the interpenetration of the medical industry, its achievements in various “civilian registrations (registrations, incorporations)”. An example of efficiency, in our opinion, can and should serve as the legal, including legislative, enforcement of higher medical education in the country, including attestation forms and procedures of applicants.

REFERENCES

- Kyryan T. The analysis of evolutionary changes in the system of higher medical education in Ukraine in the first half of the XX-th century. *EUREKA: Social and Humanities*. 2016; 3: 53-58.
- Kyryan T. Pryntsy py peregudovy vyshchoi osvity i vyshcha medychna shkola Ukrainy [Principles of transformation of higher education and higher medical school in Ukraine]. *Scientific Journal «ScienceRise: Pedagogical Education»*. 2016; 6 (2): 26-30. (In Ukrainian).
- Osiychuk M. S. Vplyv yevrointehratsiynykh protesiv na rozvytok vyshchoi medychnoi osvity [Influence of eurointegration processes on the higher medical education development]. *Medical education*. 2013; 2: 9-13. (In Ukrainian).
- Harden R. M. What is an OSCE? *Med. Teach*. 1988; 10: 19-23.
- Furlong E., Fox P., Lavin M., Collins R. Oncology nursing students' views of a modified OSCE. *European Journal of Oncology Nursing*. 2005; 9: 351-359.
- Harden R., Stevenson W. et al. Assessment of clinical competence using objective structured clinical examination. *British Medical Journal*. 1975; 1 (5995): 447-451.
- Konstytutsiia Ukrainy [Constitution of Ukraine] (28.06.1996). URL: <https://zakon.rada.gov.ua/laws/show/254%D0%BA/96-%D0%B2%D1%80> (In Ukrainian).
- Wallenstein J., Heron S. et al. A core competency-based objective structured clinical examination (OSCE) can predict future resident performance. *Academic Emergency Medicine*. 2010; 17: 67-71.
- Brand H. S., Schoonheim-Klein, M. Is the OSCE more stressful? Examination anxiety and its consequences in different assessment methods in dental education. *European Journal of Dental Education*. 2009; 13: 147-153.
- Turner J. L., Dankoski M. E. Objective structured clinical exams: a critical review. *Fam Med*. 2008; 40(8): 574-578. Retrieved from: <https://www.ncbi.nlm.nih.gov/pubmed/18988044>.
- Chesser A., Cameron H. et al. Sources of variation in performance on a shared OSCE station across four UK medical schools. *Medical Education*. 2009; 43: 526-532.
- Major D. OSCEs – seven years on the bandwagon: The progress of an objective structured clinical evaluation programme. *Nurse Education Today*. 2005; 25: 442-454.
- Humeniuk V. Otsiniuvannia yakosti vyshchoi medychnoi osvity u konteksti navchannia inozemnykh studentiv v Ukraini [Evaluation of medical higher education quality within the context of foreign students' education in Ukraine]. *Comparatively pedagogic studio*. 2013; 2-3(16-17): 186-192. (In Ukrainian).
- Zakon Ukrainy Pro osvitu vid 05.09.2017 № 2145-VIII [Law of Ukraine on education from 05.09.2017 № 2145-VIII]. URL: <https://zakon.rada.gov.ua/laws/show/2145-19> (In Ukrainian).
- Zakon Ukrainy Pro vyshchu osvitu vid 01.07.2014 № 1556-VII [Law of Ukraine on higher education from 01.07.2014 № 1556-VII]. URL: <https://zakon.rada.gov.ua/laws/show/1556-18> (In Ukrainian).
- Zakon Ukrainy Pro Kabinet Ministriv Ukrainy vid 27.02.2014 № 794-VII [Law of Ukraine on Cabinet of Ministers from 27.02.2014 № 794-VII]. URL: <https://zakon.rada.gov.ua/laws/show/794-18> (In Ukrainian).
- Postanova Kabinetu Ministriv Ukrainy Pro zatverdzhennia Poriadku zdiisnennia yedynoho derzhavnogo kvalifikatsiynoho ispytu dlia zdobuvachiv stupenia vyshchoi osvity mahistr za spetsialnostiamy haluzi znan “22 Okhorona zdorov'ia” vid 28.03.2018 № 344 [Decree of Cabinet of Ministers of Ukraine on approval of the Procedure of the state integrated qualification exam for applicants of masters' degree of academic specialty “22 Health care” from 28.03.2018 № 344]. URL: <https://zakon.rada.gov.ua/laws/show/334-2018-%D0%BF> (In Ukrainian).
- Postanova Kabinetu Ministriv Ukrainy Pro zatverdzhennia pereliku haluzei znan i spetsialnostei, za yakymy zdiisniuietsia pidhotovka zdobuvachiv vyshchoi osvity vid 29.04.2015 № 266 [Decree of Cabinet of Ministers of Ukraine on approval of the list of knowledge and specialties, in accordance with which the training of applicant for higher education is realized from 29.04.2015 № 266]. URL: <https://zakon.rada.gov.ua/laws/show/266-2015-%D0%BF#n11> (In Ukrainian).
- Nakaz Ministerstva okhorony zdorov'ia Ukrainy Pro zatverdzhennia Poriadku, umov ta strokiv rozroblennia i provedennia yedynoho derzhavnogo kvalifikatsiynoho ispytu ta kryteriiv otsiniuvannia rezultativ vid 19.02.2019 № 419 [Order of Ministry of Health of Ukraine on approval of the Procedure, conditions and terms of developing and holding the state integrated qualification exam and criterion for results' assesment from 19.02.2019 № 419]. URL: <https://zakon.rada.gov.ua/laws/show/z0279-19#n14> (In Ukrainian).

20. Nakaz Ministerstva okhorony zdorov'ia Ukrainy Pro zatverdzhennia Metodyky rozrakhunku vartosti rozrobky ta provedennia yedynoho derzhavnogo kvalifikatsiinoho ispytu vid 19.10.2018 № 1883 [Order of Ministry of Health of Ukraine on approval of the Methodology for calculating cost of developing and holding the state integrated qualification exam from 19.10.2018 № 1883]. URL: <https://zakon.rada.gov.ua/laws/show/z1486-18#n14> (In Ukrainian).
21. Rishennia Konytutsiinoho Sudu Ukrainy u spravi za konstytutsiinym zvernenniam Natsionalnogo banku Ukrainy shchodo ofitsiinoho tлумachennia polozhennia chastyny pershoi statii 58 Konstytutsii Ukrainy (sprava pro zvorotnu diu v chasi zakoniv ta inshykh normatyvno-pravovykh aktiv) vid 09.02.1999 № 1-pn/99 [Decision of the Constitutional Court of Ukraine in the case of the constitutional appeal of the National Bank of Ukraine regarding the official interpretation of the provisions of Article 58.1 of the Constitution of Ukraine (case of retroactive effect in time of laws and other regulations) from 09.02.1999 № 1-pn/99]. URL: <https://zakon.rada.gov.ua/laws/show/v001p710-99#n54> (In Ukrainian).
22. Ministerstvo okhorony zdorov'ia Ukrainy: ofitsiinyi web-sait [Ministry of Health of Ukraine: official web-site]. URL: <https://moz.gov.ua/> edki (In Ukrainian).
23. Rishennia Konytutsiinoho Sudu Ukrainy u spravi za konstytutsiinym podanniam 50 narodnykh deputativ Ukrainy pro ofitsiine tлумachennia polozhen chastyny tretoi statii 53 Konstytutsii Ukrainy «derzhava zabezpechuie dostupnist i bezoplatnist doshkilnoi, povnoi zahalnoi serednoi, profesiino-tekhnichnoi, vyshchoi osvity v derzhavnykh i komunalnykh navchalnykh zakladakh» (sprava pro dostupnist i bezoplatnist osvity) vid 04.03.2014 № 5-pn/2000 [Decision of the Constitutional Court of Ukraine in the case of the constitutional submission of 50 People's Deputies of Ukraine on the official interpretation of the provisions of part three of Article 53 of the Constitution of Ukraine "the state ensures the accessibility and free of charge of pre-school, full general secondary, vocational and technical higher education in state and communal educational institutions" (the case of accessibility and free of charge) education) from 04.03.2014 № 5-pn/2000]. URL: <https://zakon.rada.gov.ua/laws/show/v001p710-99#n54> (In Ukrainian).
24. Rozporiadzhennia Kabinetu Ministriv Ukrainy Pro skhvalennia Stratehii rozvytku medychnoi osvity v Ukraini vid 27.02.2019 № 95-p [Order of Cabinet of Ministers of Ukraine On approval of the Strategy of development of medical education in Ukraine from 27.02.2019 № 95-p]. URL: <https://zakon.rada.gov.ua/laws/show/95-2019-%D1%80> (In Ukrainian).
25. Postanova Kabinetu Ministriv Ukrainy Pro Deiaki pytannia atestatsii osib, yaki zdo buvaiut stupin mahistra, u formi yedynoho derzhavnogo kvalifikatsiinoho ispytu vid 17.07.2019 № 684 [Decree of Cabinet of Ministers of Ukraine on Some questions of certification of the persons receiving the master's degree, in the form of the uniform state qualification examination from 17.07.2019 № 684]. URL: <https://zakon.rada.gov.ua/laws/show/684-2019-%D0%BF> (In Ukrainian).
26. Postanova Kabinetu Ministriv Ukrainy Pro zatverdzhennia pereliku spetsialnostei, za yakymy provodytsia yedynyi derzhavnyi kvalifikatsiinyi ispyt dlia zdo buttia stupenia mahistra vid 10.05.2018 № 354 [Decree of Cabinet of Ministers of Ukraine on approval of the list of specialties by which the state integrated qualification examination is conducted for the master's degree from 10.05.2018 № 354]. URL: <https://zakon.rada.gov.ua/laws/show/354-2018-%D0%BF#n8> (In Ukrainian).

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REVIEW ARTICLE

ANALYSIS OF MORBIDITY AND DISABILITY AMONG CHILDREN IN THE CITY OF POLTAVA

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ABSTRACT

The aim: analyze the morbidity and causes of disability among children of Poltava.

Materials and methods: medical and statistical – for the collection, processing and analysis of data (descriptive and analytical statistics to determine relative indicators, absolute growth indicators), a systems approach and system analysis. The work uses materials from the State Statistics Service of Ukraine, as well as data from children's hospitals of Poltava.

Review: In recent decades, the morbidity and prevalence of diseases of children's of Ukraine remained as high. In the Poltava region, the basis of medical work on the sector includes the principles of early access to medical care, early diagnosis, timely examination and adequate treatment. Over the past five years, there is a decrease in the number of newborns who visited outpatient hospitals. In the structure of causes of childhood disability over the past 5 years, the first three places are occupied by congenital malformations, diseases of the nervous system and diseases of the endocrine system. Moreover, children's disability from diseases of the nervous and endocrine systems is constantly growing.

Conclusions: One way to improve the health care system for children is to optimize it. It is aimed at improving preventive work, preserving and restoring the health of the child population, improving and updating medical institutions, and increasing the level of professionalism of medical workers.

KEY WORDS: reforming, children, morbidity, disability

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INTRODUCTION

The World Health Organization has identified that perinatal morbidity and mortality rates are considered as an indicator of the socioeconomic well-being of the nation [1]. The preservation and maintenance of children's health is a key task and an important condition for the successful economic development of the state, and the protection of children's health is one of the urgent and most significant problems of the healthcare system, the state and society, since the health of the child population is not only an integral indicator of the quality of children's health, but also it is one of the fundamental basis for the formation of the health potential of adult members of the society. Children's health determines the condition of human health in the future, its activity, creative longevity, and therefore the problems of protecting children's health should have the constant attention of the country's government [2]. As a part of the reorganization in prenatal care in Ukraine, it is implemented as the National Project "New Life – New Quality of Maternity and Childhood Protection", the goal of which is to provide the population with affordable, highly qualified medical care, comfortable conditions for the birth and care of the children, and the proper quality of the pediatric service in the context of reform [3]. The medical community has developed different ways for achieve the goal through the implementation of the main components of prenatal care.

THE AIM

The aim: analyze the morbidity and causes of disability among children the city of Poltava

MATERIALS AND METHODS

Medical and statistical – for the collection, processing and analysis of data (descriptive and analytical statistics to determine relative indicators, absolute growth indicators), a systems approach and system analysis. The work uses materials from the State Statistics Service of Ukraine, as well as data from children's hospitals of Poltava.

REVIEW AND DISCUSSION

According to the State Statistics Service, in Ukraine live about 7600000 children under the age of 17, and it includes 394 thousand of children of the first year of life. Since 2009, the child population has declined every year due to the low birth rate. Against the background of an unfavorable demographic situation, the state of health of the newborns remains unsatisfactory [4].

In recent decades, the morbidity and prevalence of diseases remained as high. Every sixth to seventh newborn has deviations in health status, in recent years. After birth, the number of sick children is increased. This situation makes necessity to strengthen the preventive orientation of the pediatric service in the terms of both formation, preservation and strengthening the health of the younger generation [5].

The existing information support system does not allow to sufficiently assess the fulfillment of the tasks assigned to health care institutions for outpatient care of the child population. The accessibility and quality of medical care

Table I. Organization of preventive care for children of the 1st year of life in the outpatient service of Poltava

Incidence / Years	2014	2015	2016	2017	2018
Total newborns were admitted to the clinic	3133	3510	3201	3002	2784
Timeliness of primary patronage of newborns	100%	100%	100%	100%	100%
Review of specialists (% of the need)	99,2%	99,4%	99%	95%	97%
Laboratory research (% of need)	98%	98%	98%	97%	97%
The total incidence of children of 1 year of life per 1000 children	1149,7	1068,3	1191,5	1359,5	1356,5
Body Mass Index (BMI) for 1 year old children	23,2	23,5	23,5	23,4	23,2

Table II. The structure of the incidence of children of the 1st year of life over the past 5 years of Poltava

Incidence / Years	2014	2015	2016	2017	2018
Respiratory diseases	22,5%	23,4%	28%	28,7%	31,2%
Skin diseases	9,8%	11,5%	10,5%	10,7%	11,4%
Prenatal pathology	8,2%	8,1%	8,8%	8,3%	7,4%

Table III. The structure of the overall incidence of children over the past 5 years

Incidence / Years	2014	2015	2016	2017	2018
Respiratory diseases	66%	65%	66%	62,8%	63,4%
Skin diseases	6,4%	6,7%	6,9%	6,0%	6,1%
Infectious and parasitic diseases	6,2%	6,3%	6,9%	5,3%	4,6%

Table IV. The structure of the causes of childhood disability over the past 5 years

Incidence / Years	2014	2015	2016	2017	2018
Congenital malformations	40,1%	38%	36,8%	35%	34,3%
Diseases of the nervous system	17%	17,1%	17,6%	17,8%	18,2%
Endocrine system diseases	11,1%	12,9%	14%	14,5%	15,1%

for children in the prehospital phase is analyzed by the main indicators: the number of children who visited doctors in outpatient facilities and at home, the frequency of breastfeeding of children up to 4 and 6 months of life, preventive examinations with the dynamics of the identified pathology, the level of hospitalization for in-patients. The criteria for accessibility and quality of care system include the number of visits per disease that was registered. In total, for one registered disease among the general child population is accounted for 3,47 visits [6, 7].

In Poltava region, the basis of medical work in the sector include all the principles of early access to medical care, early diagnosis, timely examination and adequate treatment. The local pediatric service of Poltava adjoined to the communal enterprise of primary health care № 1, 2, 3. In the ambulatory of general practice of family medicine, 57 pediatric sectors function. The staffing of pediatrician's district is 82%, while 21% of working doctors are pensioners. The number of sectors nurses is 98%, while 16% of them are pensioners [8]. Staffing by doctors of preschool and school institutions is 73%, despite the fact that 45.5% of employees are pensioners. The staffing level of nurses for preschool and school institutions is 85% (24,2% are pensioners). The average number of children on the sector is 865, including up to 1 year 48 children [8].

In Poltava region over the past five years, there is a decrease in the number of newborns who visited outpatient hospitals,

which in its turn leads to a decrease in the percentage of specialist examinations, as well as laboratory tests (Table I).

In the city of Poltava, in the structure of the general morbidity of children in their first year of life over the past 5 years, respiratory diseases take the first place, skin diseases take the second place, prenatal pathology has the third place (Table II). The increase in the morbidity of children in the 1st year of life is associated with increase in the level of hospitalization of children in inpatient units of Poltava region.

In the structure of the general morbidity, the first place is taken by respiratory diseases which has a tendency to decrease in indicators due to a decrease in the morbidity of chickenpox, whooping cough, gastroenterocolitis (Table III).

In children's hospitals and family ambulant clinics in Poltava, children with disabilities under the age of 18 are registered [8]. In the structure of causes of childhood disability over the past 5 years, the first three places are occupied by congenital malformations, diseases of the nervous system and diseases of the endocrine system. Moreover, children's disability from diseases of the nervous and endocrine systems is constantly growing (Table IV).

A decrease in the number of children with primary access to disability due to diseases, in the structure of the

Table V. The structure of primary disability among children over the past 5 years

Incidence / Years	2014	2015	2016	2017	2018
Congenital malformations	27,7%	25,7%	24,7%	20%	20%
Endocrine system diseases	24,1%	22,7%	23,5%	20%	21.1%
Diseases of the nervous system	20%	18,8%	13,5%	10,9%	8,8%

primary access to disability among the child population, was recorded, occupying the first three places in the structure (Tab. V).

CONCLUSIONS

We can say, that one of the ways to improve the system of medical care for children is to optimize it. It is aimed at ensuring the availability and quality of medical care, matching its volumes and types to the needs of the child population. The foreground task of the national child health service remains to improve preventive work by gradually reorienting the activities of institutions to primary health care, preserving and reinstating the health of the child population, completing tasks to ensure the harmonious development of the child, and reducing morbidity, disability, and mortality. Modernization involves the process of improving and updating healthcare facilities, bringing them in the conformity with new requirements, standards, specifications, quality indicators and the level of professionalism of medical workers.

In Poltava region, modern technologies for diagnosing and treating childhood diseases are consistently introduced, the latest treatment standards are developing, and the equipment of children's medical institutions and university clinics is improving.

REFERENCES

1. Pluzhnikova T.V., Krasnova O.I., Kasinets S.S. et al. Analysis of morbidity and causes of infant mortality in Poltava. *Wiad. Lek.* 2019;5:p. 1036-1140.
2. Znamenska T.K., Nikulina L.I., Rudenko N.H. et al. Analiz roboty perynatalnykh tsestriv u vykhodzhuvanni peredchasno narodzhennykh ditei v Ukraini. [Analysis of the work of perinatal centers in the emergence of premature births in Ukraine]. *Neonatology, Surgery and Perinatal Medicine.* 2017; 7(2)24 : 5-11. (UA)
3. Slabkyi H.O., Dudina O.O., Haborets Yu.Yu. Rehionalizatsiia perynatalnoi dopomohy – vazhlyvyi chynnyk zabezpechennia natsionalnoi bezpeky krainy. [Regionalization of perinatal care is an important factor in ensuring national security]. *Ukraina. Zdorov'ia natsii.* 2016; 4(1) : 196-204. (UA)
4. Pasiieshvili N.M. Analiz perynatalnoi zakhvoriuvanosti ta smertnosti v umovakh perynatalnoho tsestru ta shliakhy yii znyzhennia. [Analysis of perinatal morbidity and mortality in the perinatal center and ways of its reduction] *ScienceRise. Medical science.* 2016; 1(3): 37-43 (UA).
5. Pluzhnikova T.V., Kostrikov A.V. Analiz poshyrenosti ta zakhvoriuvanosti na osnovni klasy khvorob u naselennia Poltavkoi oblasti ta v Ukraini (2006–2015 rr.) [Analysis of the prevalence and incidence of the main classes of ailments among the population of Poltava region and in Ukraine (2006–2015 pp.)]. *Actual problems of modern medicine.* 2017; 17(3)59 : 153-156. (UA)
6. Demografiya y` social`na staty`sty`ka. Oxorona zdorovya. Derzhavna sluzhba staty`sty`ky` Ukrainy`. [Demography and social statistics. Health care. State Statistics Service of Ukraine], 2019. doi: <http://ukrstat.org>. (UA)
7. Shorichna dopovid` pro stan zdorov`ya naselennya, sanitarno-epidemichnu situaciyu ta rezul`tati diyal`nosti sistemi ohoroni zdorov`ya Ukraini. [Annual report on the state of health of the population, the sanitary-epidemic situation and the results of activity of the health care system of Ukraine]. 2016 rik / za red. O. S. Musiya. K., 2017. p. 438 . (UA)
8. Poltava Regional Information and Analytical Center for Medical Statistics. Directory of indicators of the activities of medical and prophylactic institutions of the region. 2019. Retrieved doi: <http://oiacms.poltava.ua>. (UA)

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ABSTRACT BOOK

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EPIDEMIOLOGICAL SURVEILLANCE AND ASSESSMENT OF POPULATION HEALTH AS A FUNCTION OF PUBLIC HEALTH

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Introduction: Public health is a comprehensive socio-hygienic and economic indicator that integrates the demographic, social and biological processes characteristic of the country's population. Public health is a key indicator that is used to appreciate public health policy decisions.

The aim: The aim of this work is to analyze modern methods of studying public health and the possibility of their adaptation in the conditions of development of a public health system in Ukraine.

Materials and methods: The materials of the World Health Organization were investigated. The following methods were applied: bibliosematic, analytical, systems approach.

Results: As a rule, population health is assessed by medical and demographic indicators, which in turn include indicators of fertility, mortality, average life expectancy, as well as indicators of morbidity and disability.

In Ukraine, for a long time there was a study of the incidence of the population by several methods: by referring to medical institutions, by the results of preventive examinations, by causes of death and by specially organized studies. The source of information was various types of medical records. However, each of the methods had both positive and negative sides. In many developed countries, there is no centralized system for the study of the incidence rate by treatment. This is partly due to the availability of different forms of ownership in the healthcare system, which results in the absence of a single accountability. At the same time, there is a principled approach that involves collecting only the information that can actually be processed and used in decision making. The use of the epidemiological method of studying population health is a particular approach to the study of diseases using probability theory, statistics, and specific methods for conducting scientific experiments. To assess the health of individuals using sociological methods, known to be effective by WHO experts. According to the research forming the index of disease burden and an indicator DALY (the number of years of life lost due to disability).

Conclusions: In order to comprehensively study the state of health of the population of Ukraine, one should use complex methods of studying the incidence rate (by reversibility, causes of death, specially organized studies). There is a need to assess disease risk factors. To analyze data, use standardized data by gender and age. To assess, use generally accepted indicators.

KEY WORDS: Health statistics, public health.

CONTINUING EDUCATION OF DOCTORS

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Introduction: Health care reform seeks to keep the patient at the center of the system. The Ministry of Health of Ukraine in the Strategy for the Development of Medical Education proposes to introduce qualitative changes in medical education. This requires addressing the continuing education of physicians.

The aim: Continuing education of physicians is aimed at achieving the goal of building a quality system of higher medical education and providing a health care system with qualified physicians that meets international standards.

Materials and methods: Literary sources, normative-legal base are analyzed. Methods such as sociological and forecasting are used.

Results: In accordance with the Resolution of the Cabinet of Ministers № 302 of March 28, 2018, a system of continuous professional development of healthcare professionals has been introduced. Continuing professional development requires that the doctor must score a certain number of points each year for advanced training. This allows you to score points not only once every 5 years and improve skills not only through training at the Academy of Postgraduate Education.

Doctors improve their skills through participation in conferences, study abroad, online courses, trainings.

The Public Institution Public Health Center of the Ministry of Health of Ukraine organized distance learning courses. Physicians and public health professionals are involved in the study of various sections in their spare time: 1st "Fundamentals of Public Health for Professionals." (December 2019), 2nd "Immunoprophylaxis of infectious diseases." (February – August 2020). This is listening to interesting lectures by various specialists, watching presentations, answering tests. It is very encouraging that training is free. The result is advanced training, certificates were received by all participants who completed the task.

The introduction of the e-Health system involves the transition to electronic documentation (electronic medical card, electronic referral, electronic prescription for "Available Medicines", etc.). Postgraduate specialization or master's degree program in Health Care Management has been introduced. Qualification requirements for a health care specialist: work experience in the medical specialty for the head of the regional hospital – not less than 10 years, and in the specialty "Health Care Management" – not less than 8 years; for the head of a health care institution at the city/district and oblast levels – at least 8 and 5 years, respectively. Internships at higher health care facilities.

The program of postgraduate training of heads of medical institutions in the specialty "Health Care Management" is designed for 1.5 years (18 months).

Previously, professional management training took the form of a post-appointment specialization, and the chief physician was expected to study in the workplace almost without leaving his or her job.

Conclusions: Doctors improve their skills through participation in conferences, study abroad, online courses, trainings, postgraduate specialization or master's degree in "Health Care Management", learning English, mastering computer technology, etc.

KEY WORDS: continuing education, doctors, advanced training, healthcare.

COMPARATIVE ANALYSIS OF THE FACTORS OF DEVELOPMENT OF CARDIOVASCULAR DISEASES AMONG THE POPULATION OF KAMPALA (UGANDA) AND POLTAVA (UKRAINE)

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Introduction: The main problem for the health system of any country is the problem of morbidity of cardiovascular diseases. This problem is present both in countries with a high level of economic development (USA, Western Europe), and in countries with a low level of economic development and in developing countries (Uganda, Ukraine), since cardiovascular diseases are the main causes of disability (reduced quality of life) and mortality (irreversible human losses) of the able-bodied population. Taking into account the main trends in the cardiovascular morbidity of our time, the public health system plays a big role in the successful fight against these weeds: the development of adequate and timely prevention of risk factors, health protection and the promotion of a healthy lifestyle.

The aim of our research is to study statistically influential risk factors for cardiovascular diseases among the population of Kampala (Uganda) and compare these data with data from Poltava (Ukraine), followed by identifying the dominant causes in the development of cardiovascular diseases to determine the method of their primary prevention.

Materials and methods: Statistical data on risk factors were studied by conducting a survey of the population of Kampala (Uganda) using a specially designed questionnaire. The data obtained were analyzed using methods - odds ratios (OR) and regression analysis, and as a result, significant risk factors for circulatory system diseases among the Kampala population were identified and compared with similar ones in Poltava.

Results: The analysis identified the risk factors that had a significant increase in the risk of circulatory system disease among the population of Kampala: age over 40 (OR = 7.892, $p = 0.01$), male gender (OR = 4.642, $p = 0.017$), overweight (BMI over 25) (OR = 2.128, $p = 0.034$), smoking (OR = 2.122, $p = 0.043$), pork (OR = 2.243, $p = 0.02$), lard (OR = 2.091, $p = 0.044$), sweets (OR = 2.433, $p = 0.02$), low physical activity (OR = 2.450, $p = 0.03$), stress (OR = 4.214, $p = 0.009$), working conditions (OR = 2.194, $p = 0.041$). The factors of protection were: sufficient fruit consumption (OR = 0.188, $p = 0.008$), vegetables (OR = 0.135, $p = 0.037$), fish (OR = 0.394, $p = 0.008$), poultry meat (OR = 0.466, $p = 0.031$). Following a multiple regression, an indicative model for prevention of circulatory system diseases among the population of Kampala was constructed – special preventive activities require the following: age, gender, overweight, frequent use of lard and sweets, hard working conditions. At the same time, similar prevention model in the city of Poltava (Ukraine) focus prevention activities on the following factors: age, gender, anamnesis, BMI, smoking, pork and salt consumption, relationships in the family.

Conclusions: As a result of a study of risk factors for circulatory system diseases among the population of Kampala (Uganda) and Poltava (Ukraine), it has been determined that, despite virtually similar risk factors (by the odds ratio), there are differences in prevention models - there is a difference between the more influential risk factors (according to multiple regression analysis).

KEY WORDS: cardiovascular diseases, risk factors, public health, promotion, prevention.

EVALUATION OF THE HEALTH CONDITION AND RISK FACTORS OF THE UKRAINIAN POPULATION IN 1992-2017

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Introduction: The state of health in the population is the most important social indicator of the social progress and security of the state, reflecting the well-being of the nation, its social and economic growth, ecological, demographic status, sanitary and hygienic position. The influence of such factors, as insufficiency of natural products, psychological and emotional load, poor quality of life, untimely medical attention lead to a decrease in the adaptive capacity of the human body and its resistance, which increases in the level of morbidity.

The aim: To analyze and evaluate the health of the Ukrainian population and to identify factors that affect its condition.

Materials and methods: Materials: statistic data of the State Statistics Service of Ukraine for the years 1992-2017 and materials of the Center of Medical Statistics of the Ministry of Health of Ukraine. The following methods were used: systematic analysis, bibliographic and semantic, epidemiological, medical-statistical, sociological, cartographic. Results: The dynamic of the disease prevalence illustrates the upward trend in pathologies: in 1992-2017, the prevalence rate of diseases increased one and a half times from 110.5 to 178.8 thousand cases per 100 thousand people. In the disease prevalence structure diseases of the circulatory system occupy the first position (30.9% in 2017), the second belongs to respiratory diseases (20.1% in 2017), the third place – to diseases of digestive organs (9.8%), the fourth place was taken by diseases of the musculoskeletal system and connective tissue (5.45%) among the whole Ukrainian population in 2017. One of the pressing problems in Ukraine is the development of the tuberculosis epidemic. Each year, 40 000 new cases and 10 000 deaths from tuberculosis are reported. An HIV epidemic is also a critical situation, as 50 cases are recorded daily.

The following major risk groups were identified: environmental and hygiene factors, social and cultural circumstances and lifestyle, and hereditary predisposition.

Conclusions: Following the research, the tendency of incidence rates increases during 1992-2017 was observed. Only the constant study and analysis of environmental, working and living conditions of the population, other social elements that form the risk factors affecting the state of health of the nation will allow to substantiate, formulate and implement public health management strategies.

KEY WORDS: health, risk factors, population, morbidity.

ФУНКЦІОНАЛЬНО-ОРГАНІЗАЦІЙНА МОДЕЛЬ УПРАВЛІННЯ СЛУЖБОЮ НАДАННЯ МЕДИЧНОЇ ДОПОМОГИ ХВОРИМ З ХВОРОБАМИ КРОВІ ТА КРОВОТВОРНИХ ОРГАНІВ

FUNCTIONAL ORGANIZATIONAL MODEL OF MANAGEMENT OF SERVICE OF PROVISION OF MEDICAL CARE TO PATIENTS WITH DISEASES OF BLOOD AND BLOOD-FORMING ORGANS

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Вступ: Комплексна система управління організацією медичної допомоги хворим з хворобами крові та кровотворних органів на рівні регіону базується на основі трьох головних компонентів: суб'єкту і об'єкту управління та блоку наукового регулювання.

Мета: розробити функціонально-організаційну модель управління службою надання медичної допомоги хворим з хворобами крові та кровотворних органів на регіональному рівні в сучасних умовах реформування галузі охорони здоров'я,

Матеріали та методи: Об'єктом управління є служба надання медичної допомоги хворим з хворобами крові та кровотворних органів на регіональному рівні. Суб'єктом, який керує службою надання медичної допомоги хворим з хворобами крові та кровотворних органів на рівні закладу охорони здоров'я є медичний директор закладу, а на рівні регіону – керівник управління охороною здоров'я відповідного рівня.

Результати: Встановлено такий розподіл управлінських функцій на рівні закладу охорони здоров'я (ЗОЗ): генеральний директор несе відповідальність та управляє матеріально-технічним, фінансовим, кадровим забезпеченням, медичний директор – розробляє заходи з забезпечення населення гематологічною медичною допомогою в ЗОЗ в рамках програми державних гарантій медичного обслуговування населення та контролює їх виконання, а завідувач структурним підрозділом – забезпечує надання медичної допомоги пацієнтам в рамках програми державних гарантій медичного обслуговування населення.

Об'єктом управління є ЗОЗ і медичні працівники які надають медичну допомогу хворим з хворобами крові та кровотворних органів. Склад об'єкту здійснюється на основі:

- застосування інформаційних технологій в менеджменті медичної допомоги хворим з хворобами крові та кровотворних органів;
- фінансування заходів з лабораторного обстеження пацієнтів;
- матеріально-технічних можливостей для впровадження сучасних технологій діагностики та лікування хворих з хворобами крові та кровотворних органів;
- забезпечення в достатній кількості висококваліфікованими медичними кадрами;
- забезпечення впровадження та контролю використання даних з доведеною ефективністю та клінічних протоколів, що затверджені МОЗ України і стандартів медичної допомоги хворим з хворобами крові та кровотворних органів;
- додержання деонтологічних принципів в професійній діяльності;
- доступності інформації для населення про ЗОЗ в яких надається гематологічна допомога та можливий маршрут пацієнта;
- використання міжнародних стандартів гематологічної допомоги населенню.

Весь комплекс названих факторів забезпечує зберігати цілісність системи і сприяє її ефективному розвитку.

Блок наукового регулювання, який є одним із головних компонентів моделі управління, включає організацію науково-інформаційного забезпечення з питань надання медичної допомоги населенню з хворобами крові та кровотворних органів, вивчення і поширення досвіду ВООЗ з питань надання гематологічної кваліфікованої медичної допомоги, а також досвіду охорони здоров'я України з даного питання, організацію зв'язку з науковими установами країни.

Висновки: Таким чином, в питанні забезпечення права населення з хворобами крові та кровотворних органів на якісну і доступну медичну допомогу важливим є ефективне управління організацією медичної допомоги хворим з хворобами крові та кровотворних органів на рівні регіону на основі трьох головних компонентів (суб'єкту і об'єкту управління та блоку наукового регулювання) з використанням шести аспектів системного підходу.

КЛЮЧОВІ СЛОВА: хвороби крові та кровотворних органів, медична допомога, надання, управління.

KEY WORDS: diseases of blood and hematopoietic organs, medical care, provision, management.

CHARACTERISTICS OF THE PRIMELY DISABLED PARTICIPANTS OF COUNTER-TERRORISM OPERATION FOR 2014-2019

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Introduction: The counter-terrorism and combined forces operation is leading to an increase in servicemen, participants in military operations, and persons with disabilities in Ukraine. The number of cases of military injuries, psychological disorders and social maladaptation, which have a prolonged nature and require comprehensive rehabilitation of persons with disabilities, especially participants of the counter-terrorism operation, their timely, high-quality prosthetics and creation of appropriate conditions for integration into society, is increasing. In connection with these events, new approaches and features have emerged in conducting social and social expertise and collecting statistical information on disability and rehabilitation of this category of citizens.

The aim: To study the peculiarities of the distribution of participants of the counter-terrorism operation initially recognized as disabled by persons for the period 2014-2019 in the Poltava region. **Materials and methods:** The statistical reports of the Poltava region Transport and Radiological medical and social expert commission on the review of counter-terrorism operation participants during 2014-2019 and the analytical and information guide «Basic indicators of disability and activity of medical and social expert commissions of Ukraine for 2019» were analyzed.

Results: Among the first recognized persons with disabilities of participants of counter-terrorism operation in the Poltava region for the period 2014-2019, the most frequently established group III (55.4%, 505 persons) disability, group II - in 43.6% of cases (440 persons), group I installed 25 persons (1%). For the first time in 2014, 3 people were recognized as disabled, in 2015 - 94 people, in 2016 - 183 people, in 2017 - 158 people, which is 25 people less, and in 2018 this figure increased to 210 people, and in 2019 year - 295 people, reaching its highest level in all years of counter-terrorism operation. In the first place, among the causes of disability were injuries of different localization, but there is a tendency to gradually reduce the share of injuries each year from 51% in 2015 to 29% in 2019. Instead, there is an increase in somatic pathology in this contingent every year.

Conclusions: Thus, the presence of persons with group III disability of counter-terrorism operation participants is more than half (55.4%), implies high rehabilitation potential and a positive outlook for rehabilitation. Significant changes in the structure of disability among counter-terrorism operation participants are a consequence of military involvement and the impact of stress. Initially, it is the presence of combat traumas that gradually lead to the development of psychological and somatic disorders, which usually have a long prolonged nature and require as soon as possible to conduct various rehabilitation activities in order to adapt to society.

KEY WORDS: participants of counter-terrorism operation, participant in military operation, primary disability, rehabilitation, structure of disability

A HEALTHY LIFESTYLE AS A FACTOR IN THE GROWTH OF AN EFFECTIVE LABOR MARKET

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Introduction: In the psychological and pedagogical direction, a healthy lifestyle is considered in terms of consciousness, human psyche, motivation. ... A healthy lifestyle emerges as a specific form of appropriate human activity - an activity aimed at preserving, strengthening and improving one's health.

The aim: Improving the quality of human resources means increasing the efficiency of the labor market, improving education and training, overcoming poverty and creating a better health system. The state should play an important and comprehensive role in solving all these problems.

Materials and methods: Literature sources, regulatory framework were analyzed to achieve this goal. The method of system analysis was used.

Results: The definition of health was given by the World Health Organization in the preface to the Statute of the organization: "Health is a state of complete physical, mental and social well-being in the absence of illness or infirmity, including the ability to lead a socially and economically productive life."

In 1980, the World Health Organization (WHO) Global Strategy for the Development of Health for All was developed and adopted by all 189 WHO member countries. In 1998, a new version of the strategy, Health for All in the 21st Century, was adopted, the main goal of which is to achieve the highest possible level of health for all people in the world. The main and ongoing task of this strategy is to achieve the full realization by all people of their "health potential".

There are a number of obstacles to this:

- the importance of prevention is still largely declared;
- imperfection of legislative and regulatory frameworks;
- poor funding for prevention programs and specific measures;
- lack of knowledge about the economic consequences of conducting or not carrying out preventive measures;
- lack of financial incentives for doctors and nurses to engage in disease prevention and health promotion. The WHO formula (model) for health determinants has become widely known and has been adopted by the 1980s. According to this model, the environment contributes to 20% of the impact on the quality of health, about the same - the impact of genetic factors, the contribution to health of the health care system - 10-15%, the remaining 50% in the overall structure factors that shape public health due to people's lifestyle: work, nutrition, comfort, rest, home situation, family relationships, living conditions.

Conclusions: It follows that 50% of one's health can be gained by changing his or her life for the better.

KEY WORDS: healthy lifestyle, human activity, preserving, strengthening, improving of health.

ANALYSIS OF THE INCIDENCE OF ENDOCRINE PATHOLOGY AMONG THE ADULT POPULATION POLTAVA REGION

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Introduction: Statistics over recent years show an increase in morbidity and mortality among the population of Ukraine. Pathology of the endocrine system occupies one of the leading places in the structure of the general morbidity of the population.

The aim: to assess the state of the incidence of endocrine pathology among the adult population of Poltava region.

Materials and methods: the statistical method and the system approach method. The research materials were data from statistical reporting of the MHU and Poltava region.

Results: In Poltava region, the total spreading of endocrine diseases in 2019 compared with 2018 increased and amounts to 918 compared to 866.5 per 10,000 population. Low rates are noted in the city of Kremenchug - 580.0 (in 2018 - 586.5) per 10,000 population, in the city of Horishni Plavni - 521.0 (in 2018 - 533.1) per 10,000 population, in Grebenkovsky district - 512 (in 2018 - 536.3) in Orzhitsky district - 537.0 (in 2018 - 516.4) per 10,000 population. In the structure of diseases of endocrine pathology, the largest share is diabetes 432.00 per 10,000 population, then teriotoxicosis - 14.3, hypothyroidism - 32.5, autoimmune thyroiditis - 37.1, nodular goiter - 123.9 and diffuse non-toxic goiter - 99.3 per 10,000 population.

Conclusions: The main directions of optimizing the care for patients with endocrine pathology are strengthening the material and technical base of healthcare facilities for the diagnosis and treatment of diabetes mellitus, and to improve preventive measures.

KEY WORDS: endocrine diseases, prevalence, incidence

THE USE OF HARMFUL DRINKS AS A MEDICAL AND SOCIAL PROBLEM OF MODERN YOUTH

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Introduction: Today, one of the acute medical and social problems is the spread of the use of alcohol and low alcohol drinks by adolescents. Every year the number of teenagers who drink alcohol becomes more. Unaware of the harmful effects of alcoholic beverages, they destroy themselves.

The aim: study and analyze the prevalence of alcohol and low alcohol drinks among teenagers.

Materials and methods: used bibliosemantic, sociological and medico-statistical methods. The research materials were the annual report of the State Statistics Service of Ukraine.

Results: The study emphasizes the relevance of the problem of the spread of propaganda of alcoholic beverages and alcoholism itself among young boys and girls. The study revealed that more than 90% of 15-17-year-old students drank alcohol, almost 60% of adolescents were several times intoxicated. Most often, 15-17-year-old young people who, study use alcoholic drinks, such as beer (boys in 57,3% of cases) and factory low-alcohol drinks (girls in 43,7%). Recently, 40% of teenagers drank wine, and 22.4% drank champagne and spirits. The most common alcoholic drink used by young people aged 15-17 in an entertainment institution recently is beer, it was consumed by 45.4% of boys and 30.9% of girls. Low alcohol drinks of industrial production come second in popularity - they were consumed by 28.8% of boys and 35.9% of girls. 40.3% of adolescents replied that they had never consumed energy drinks, 32% had consumed them one to five times in their entire lives.

Conclusions: Thus, the general trend in the spread of alcohol and low alcohol drinks among adolescents is disappointing. The main factors that negatively affect the situation: the family's tolerant attitude to alcohol abuse of adolescents, the cultural traditions of communication in the company, the insufficiently formed worldview of the young man on understanding a healthy lifestyle; beer advertisement, lack of control over the implementation of Ukrainian legislation regarding the prohibition of the sale of alcohol to minors.

KEY WORDS: teenagers, schoolchildren, alcoholic drinks, energy drinks, beer.

DETERMINING THE CAUSES OF PROFESSIONAL VOICE DISORDERS IN PEOPLE OF LANGUAGE PROFESSIONS

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Introduction: The human voice, human language is the result of a complex mechanism of interaction of various organs and systems. Almost all major physiological systems of the body are involved in the implementation of phonation. They are combined to achieve a result by the central nervous system. Nowadays, an increasing number of professions are gaining a direct or indirect connection with the voice or speech function. The professional activity of teachers and lecturers of higher educational institutions requires significant energy expenditure and nervous and muscular tension. Voice load significantly affects the condition of the vocal apparatus. Diseases of the vocal apparatus reduce the ability to work in almost all healthy people.

The aim: Investigate the various causes of voice disorders in the voice professions. Materials and methods. The subjective attitude of the respondents was analyzed with the help of the questionnaire. Methods of application - statistical, system approach and system analysis.

Results: Observing the representatives of language professions, namely the teaching staff of higher education institutions, it was found that about 73% of respondents note that the cause of voice disorders is voice fatigue at the end of the school year. The impact of various infectious diseases of the upper respiratory tract in the autumn-winter period was noted by 22 % of respondents and 17 % of the causes of voice disorders indicated emotional overload. Uncertainty and fear of the audience during the speeches, as the cause of voice violations, identified 15 % of respondents.

Conclusions: Thus, timely detection and prevention of voice disorders in teachers, compliance with the regime and hygiene of the voice, prevention of respiratory infections, if possible to limit voice load in the cold and outdoors, allows to prevent voice disorders in people of the language profession. Even with minor voice disorders, you should consult a phoniatrician or otolaryngologist.

KEY WORDS: reasons, professional violation, voice.

PROFESSIONAL TRAINING OF MANAGEMENT MANAGER

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Introduction: Modern requirements for the professional training of the manager of management, we note the complexity of this process, associated with the vision of such a specialist as a highly educated personality, endowed with leadership qualities, with highly developed intellectual, creative and organizational skills, which takes into account the requirements for self-researcher, coordinator of creative search and constructive relationships in the team, project and innovation manager, initiator of progressive changes and more.

The aim: The purpose is to substantiate and analyze the professional training of the management manager.

Materials and methods: theoretical - study and analysis of scientific literature on the problem of research to determine the degree of development of the problem; comparison, systematization and generalization of the scientific provisions outlined in scientific works.

Results: Introducing a future teacher to the theory and practice of management in education will promote a deeper understanding of professional phenomena, an awareness of the patterns of activity as a manager under the structural section, a more objective attitude to the management problems involved, which he will find from time to time in any position. Such awareness can give an impetus to the professional self-development of a manager in this direction, to rethink his career intentions and to successfully realize them at a young age, when he has sufficient strength and energy for active management work.

Managerial competence is also able to extend its organizational capabilities in solving non-standard professional tasks, such as the development of various projects, the creation of a working team and management. The manager of the management, familiar with the basics of management management, is more susceptible to innovative processes that will not cause him a psychological barrier associated with the lack of skills and skills to evaluate and master innovation and incorporate them into the established system of activity.

Conclusion: Therefore, the manager of the management is one that includes the theoretical and practical foundations of management activity in the institution, we consider universal and necessary for training an employee of any profile. With the changes that are taking place in our country, there is a need to increase the demands on the personality - the manager, his professional and social competence, concerning the growing range of professional and non-professional issues, the tendency towards professional mobility, which is increasingly evident in Ukrainian society, and acmeology. considerations concerning both the expansion of the individual's career opportunities and the growth of skilled human resources in management.

KEY WORDS: manager, manager, activity, training.