Реферати

МАСШТАБИ СТАЦІОНАРНОЇ ЛЕТАЛЬНОСТІ ПАЦІЄНТІВ ЧЕРЕЗ ІНЦИДЕНТИ БЕЗПЕКИ У ВІТЧИЗНЯНИХ ЛІКАРНЯНИХ ЗАКЛАДАХ

Науменко О.М., Скалецький Ю.М., Риган М.М., Дідковський В.Л.

Проблема ненавмисної шкоди пацієнтам властива для всіх країн, і особливо для країн з низьким і середнім рівнем доходів населення. У статті проаналізовано методичні підходи до оцінки рівнів інцидентів безпеки пацієнтів у закладах охорони здоров'я. Установлено, що внаслідок несприятливих подій, які можна попередити, в Україні помирає більше 18 тис. пацієнтів, що значно більше, ніж кількість жертв унаслідок дорожньо-транспортних пригод і нещасних випадків на виробництві. Отримані дані свідчать про надзвичайну актуальність проблеми ненавмисної шкоди пацієнтам і потребу в невідкладних заходах з покращення безпеки пацієнтів у вітчизняних закладах охорони здоров'я. Метою роботи була оцінка масштабів летальності пацієнтів через інциденти безпеки у вітчизняних лікарняних закладах. Під час підготовки публікації аналізувалися тематичні наукові публікації, статистичні довідники Центру медичної статистики МОЗ України, національні доповіді та аналітичні огляди про стан техногенної та природної безпеки в Україні.

Ключові слова: інцидент, безпека пацієнтів, охорона здоров'я, стаціонарна летальність, ненавмисна шкода.

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МАСШТАБЫ СТАЦИОНАРНОЙ ЛЕТАЛЬНОСТИ ПАЦИЕНТОВ ИЗ-ЗА ИНЦИДЕНТОВ БЕЗОПАСНОСТИ В ОТЕЧЕСТВЕННЫХ ЛЕЧЕБНЫХ УЧРЕЖДЕНИЯХ

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Проблема непреднамеренной вреда пациентам свойственна для всех стран, и особенно для стран с низким и средним уровнем доходов населения. В статье проанализированы методические подходы к оценке уровней инцидентов безопасности пациентов в учреждениях здравоохранения. Установлено, что в результате неблагоприятных событий, которые можно предупредить, в Украине умирает более 18 тыс. пациентов, что значительно больше, чем количество жертв в результате дорожно-транспортных происшествий и несчастных случаев на производстве. Полученные данные свидетельствуют о чрезвычайной актуальности проблемы непреднамеренного вреда пациентам и потребность в неотложных мероприятиях по улучшению безопасности пациентов в отечественных учреждениях. Цель работы - оценка масштабов летальности пациентов из-за инцидентов безопасности в отечественных лечебных учреждениях. При подготовке публикации анализировались тематические научные публикации, статистические справочники Центра медицинской статистики Минздрава Украины, национальные доклады и аналитические обзоры о состоянии техногенной и природной безопасности в Украине.

Ключевые слова: инцидент, безопасность пациентов, здравоохранение, стационарная летальность, непреднамеренный вред.

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ASSESSMENT OF THE FUNCTIONAL TYPES OF BODY MOBILIZATION BASED ON A DYNAMIC ANALYSIS OF SPECTRAL INDICATORS OF HEART RATE VARIABILITY AND THEIR CLASSIFICATION

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The article is dedicated to the blessed memory of the hrv method and the cybernetic model of dual-circuit regulation of cardiac activity author Roman Markovich Baevsky (August 3, 1928 - May 31, 2020.)

The article is devoted to the study of electromagnetic phenomena of human cardiac activity and the possibilities of their clinical use in practical medicine to assess the level of health in order to prevent NCDs. The results of a dynamic analysis of the spectral parameters of cardiac activity during the performance of an orthostatic test by functionally healthy people are given in the article. The authors described four functional types of mobilization/adaptation, gave a characterization and interpretation to them, proposed a variant of their classification based on the cybernetic model of dual-circuit regulation of cardiac activity R.M. Baevsky.

Key words: heart rate variability, spectral analysis.

The work is a fragment of the 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.

Studying the processes of mobilization/adaptation, signaling continues to be one of the fundamental areas of systems biology and systems medicine. Adaptation provides daily adaptation to the action of the external environment and is of key etiological importance in the etiopathogenesis of non-communicable diseases (NCDs). Electromagnetic phenomena play a fundamental role in the functioning of the human body, and they should continue to be studied to further solve the global problem of NCDs.

The electromagnetic phenomena of cardiac activity can and should be considered as a sensitive indicator of the adaptive reactions of the whole organism because they have great prognostic and diagnostic

potential. The advent of the possibility of spectral analysis of cardiac activity frequencies has made the method of heart rate variability (HRV) the most accessible for studying the electromagnetic phenomena of the human body in clinical practice. However, the HRV method is not used for this purpose by doctors due to the lack of clear clinical recommendations and a systematic understanding of this issue. [2, 3, 7, 10, 11].

The purpose of the work was to help solve the problem of NCDs by improving diagnostics based on the study of electromagnetic phenomena in the body using modern high technology.

Materials and methods. The results of an open, non-randomized, controlled study of 82 functionally healthy people were taken to develop methods for the dynamic analysis of spectral parameters of cardiac activity in HRV. 60 athletes (n1 group, average age – 20,5±4,7 years, men – 100%;) and 23 anamnestically functionally healthy doctors studied at the faculty of postgraduate education and who did not engage in professional sports (n2 group, average age - 24,8±2,0 years, men – 78%; control) were examined [12]. Statistical analysis was performed on 72 HRV-short record results. 10 records were excluded from the analysis for technical reasons. The analyzed record consisted of two parts: 1) background (BG) recording (duration 5 minutes) and orthostatic test (OT) recording (duration 3 minutes). The analyzed records were obtained in compliance with all technical requirements, using certified equipment (model Poly-Spectr, Neurosoft Company, Ivanovo, Russia), in compliance with ethical standards [12]. Dynamic data analysis with the construction of graphical material, the classification of the results were performed in accordance with the hypothesis of the authors [1, 3]. Indicators Total power (TP, mc2), Very low frequency (VLF, mc2, %; 0,0033 – 0,04 Hz), Low Frequency power (LF, mc2, %; 0,04 – 0,15 Hz), High Frequency power (HF, mc2, %; 0.15 – 0.4 Hz), a ratio of Low Frequency to High Frequency LF/HF, the normalized (or normalized unit) spectral indices LFnu and HFnu (%) were presented in as average values with their average error (M±m) and were estimated with the construction of the diagram as well. Statistical analysis was performed using the Prism 5.0 software package. One-way analysis of variance) was used to test the null hypothesis in comparing multiple groups. Tukey's Multiple Comparison Test Tukey's honestly significant difference test (Tukey's HSD test) was used to refine the values of many groups.

Results of the study and their discussion. A different mobilization reaction to the orthostatic test among functionally healthy respondents and its regularities were established: a visual analysis of the graphic dynamics of the spectral indicators of cardiac activity revealed four repeatability options A, B, C, D. The presence of clear patterns of the dynamics of spectral indicators for each A-, B-, C-, D- options for mobilization during the orthostatic test were established and functionally healthy respondents were divided into groups according to types (table 1).

Table 1

Groups (options) of the heart rhythm spectral parameters dynamics after the orthostatic test in functionally healthy people

	Group 1 Type A n=18(25%) n1=11(61%) n2=7(39%)	Group 2 Type B n=20(28%) n1=14 (70%) n2=6 (30%)	Group 3 Type C n=25(35%) n1=20 (80%) n2=5 (20%)	Group 4 Type D n=9(12%) n1=6 (67%) n2=3 (33%)
Age, year	21.78±4.01	24.00±5.29	19.00±4.31	23.00±8.77
TP, mc^2	↓or ↑(33%)	↓ or ↑(70%)	↓(100%)	↑(100%)
VLF, mc^2	↓(100%)	↑(100%)	↓(100%)	↑(100%)
LF, mc^2	↑(100%)	↓(70%) or ↑	↓(100%)	↑(100%)
HF, mc^2	↓(100%)	↓(100%)	↓(100%)	↓or ↑(78%)
VLF, %	↓(89%) or ↑	↑(100%)	↓ or ↑(88%)	↓ or ↑(56%)
LF, %	↑(100%)	↓(90%) or ↑	↓(92%) or ↑	↓ or ↑(89%)
HF, %	↓(100%)	↓(100%)	↓(100%)	↓(100%)

The numerical indices values of HRV spectral analysis are presented in table 2.

Testing the null hypothesis confirmed the presence of a number of significant differences in a number of compared indicators of the spectrum of cardiac activity in the compared groups of types of mobilization of functionally healthy individuals. This was confirmed using the Tukey criterion as well.

It was established that a change in the numerical indicators of the frequency spectrum of cardiac activity logically corresponds to the graphic dynamics in the selected groups. The patterns of randomization depending on sports were not established: an approximately equal distribution of athletes and non-athletes was recorded for each type of response. The following specific characteristics of the types of mobilization were established (table 1, 2):

1) type A was characterized by a reaction of an increase in the absolute and relative values of LF with a decrease in the absolute and relative values of HF, VLF; The VLFBG value was greatest with this type A, and the VLFOT value was greatest with this type A as well;

2) type B was established by the type of mobilization due to the growth of VLF with a decrease in the absolute and relative contributions of other frequencies of the cardiac spectrum;

3) type C was characterized by a decrease in the entire frequency spectrum during mobilization; an increase in the relative VLF was characteristic of most respondents with type C; TCBG level was set the highest in the group of respondents with type C;

4) type D was characterized by an increase in all absolute values of spectral values with a change in the proportions of relative values: a decrease in the share of HF and an increase in the shares of VLF, LF were found in respondents with type D mobilization; these respondents had the lowest values of all indicators (TC, VLF, HLF, LF, HF) in the background before the OT.

Table 2

Comparative characteristics of the spectral analysis parameters of heart rhythm after an orthostatic test in functionally healthy people

	Group 1 Type A	Group 2 Type B	Group 3 Type C	Group 4 Type D
R-RBG, bpm	60.5±23.41	56.95±14.72	60.5±11.58	56.00±13.91
R-ROT, bpm	85.00±22.82	79.30±20.33	84.40±13.15	75.80±13.14
TPBG, mc2	3079±6947	3843±43.66	6640±12443***	1124±588***
TPOT, mc2	4183±7863	4830±10104**	1699±1563**	5886±4381
VLFBG, mc2	1401±3045*	1112±757.6*	1791±3326***	437.0±226.8***
VLFOT, mc2	829±2031	2178±2139**	732.0±733,11**, *	1966±2824*
LFBG, mc2	975.5±954.9	1138±2684	2063±3508*	337±313.5*
LFOT, mc2	2281±3846	1807±5304**	833±1018**	3025±1575
HFBG, mc2	951±3378	1506±1460	1869±7343	184.0±176.1
HFOT, mc2	2281±3846	513.5±3405	130±126.5	566.0±533.2
VLFBG, %	39.70±15.37*, ****	29.40±13.91*	30.10±16.60****	34.40±9.38
VLFOT, %	24.35±14.95	38.95±15.87	39.60±18.34	49.70±17.64
LFBG, %	26.10±11,88	33.50±14.37	33.80±14.52	30.10±14.45
LFOT, %	61.75±14.09	49.65±14.68	51.90±19.29	41.80±15.37
HFBG, %	28.80±15.62	34.00±12.75	35.80±16.52	29.20±13.46
HFOT, %	7.15 ±6,26	10.10±9.76	7.70±17.43	9.00±5.14
LFnuBG, %	46.75±22.03	46.80±15.88	48.20±19.20	55.40±20.27
LFnuOT, %	88.95±26.90	83.35±13.66	88.30±17.09	81.10±7.78
HFnuBG, %	47.35±19.90	53.20±15.88	51.80±20.61	44.60±20.27
HFnuOT, %	11.05±19.99	16.65±13.66	11.70±6.17	18.90±7.78
LF/HFBG	1.20±7.78	0.88±0.87	0.9±1.2	1.24±1.91
LF/HFOT	8.51±4.70	5.02±6.02	7.58±4.64	4.28±5.85

Note * - the difference Tukey's HSD test is reliable at $p<0.05$ between the characteristics Group1. Group2. ** - it's reliable at $p<0.05$ between Group2. Group3. *** - reliable at $p<0.05$ between Group3. Group4. **** - reliable at $p<0.05$ between Group1. Group4.

A physiological clinical explanation of the revealed patterns of the mobilization reaction can be given due to the representation of the human body as a bio-cybernetic model. The functional system of blood circulation regulation is a multi-circuit, hierarchical system with the dominant role of individual links according to the needs of the body in this model [1-3]. We share the opinion of a number of authors [4-6] that the two-circuit model of heart rate regulation R.M. Bayevsky (1978) [1, 2] is the simplest and most adequate model for clinical use. It is based on the idea of the existence of a central and autonomous levels (circuits) of regulation of cardiac activity with direct and feedback between them. The central circuit of the regulation of heart rhythm is a system of neurohumoral regulation of the physiological functions of the body by the central nervous system. The sinus node, vagus nerves and their nuclei in the medulla oblongata constitute an autonomous regulation loop (level of parasympathetic regulation). The frequency spectra of cardiac activity reflect the activity of regulation and can be recorded as electromagnetic phenomena by the HRV method. LF and HF represent the influence of the autonomous circuit. An increase in LF corresponds to activation and an increase in heart rate clinically. An increase in HF and a decrease in LF corresponds to inhibition and deceleration of the heart rate. VLF is the contribution of the central circuit to regulation and this indicator increases when central reserve mechanisms are included in the mobilization/adaptation process. Given this approach, we share the idea of [1, 3] and propose to classify the identified types of mobilization as follows:

1. Autonomous type – mobilization occurs due to the work of the autonomous circuit (this corresponded to type A and type C in our observation);

1.1. Mobilization occurs due to an increase in LF (it was type A in our observation): this is the most logical type of adaptation reaction based on the activation of the sympathoadrenal system;

1.2. mobilization occurs due to a decrease in all spectra (it was type C in our observation): this type is characteristic of well physically trained and overtrained individuals who have initially high energy spectral indicators of cardiac activity;

2. Reserve type – mobilization occurs using the central reserve mechanism: the transition to a vertical position is accompanied by an increase in VLF (this corresponded to type B and type D in our observation);

2.1. mobilization occurs due to an isolated increase in VLF (it was type B in our observation): this type can be considered as the initial variant of distress and impaired adaptation presumably;

2.2. mobilization with an increase in VLF and the entire spectrum: this type may turn out to be the most unfavorable since there is an initial decrease in all spectra, because it can be interpreted as an initially high level of randomness in the functioning of regulatory systems in the lying position and a decrease in randomness in the standing position. If an increase in all ranges occurs during rising, this indicates a simplification of the control mechanisms. That is, the body during mobilization is not able to maintain a high level of flexibility. This assumption is based on the idea that HRV is a reflection of the dynamic search for the optimal mode of work of the cardiovascular system of the body in the process of mobilization/adaptation.

The presented classification differs from the works [8, 9], which studied the type of the autonomic reaction to the orthostatic sample and distinguished only three types of reaction: autonomous, central, and autonomic-central variants.

Conclusions

1. Performing an orthostatic test in functionally healthy respondents causes a functional mobilization of the cardiovascular system in the form of one of four types A, B, C, D.

2. Types of mobilization/adaptation to an orthostatic test have clear mathematical laws of spectral dynamics of HRV and characteristic graphic visualization of dynamics.

3. The concept of a dual-circuit cybernetic model of regulation of cardiac activity R.M. Baevsky is most suitable for the clinical interpretation of the results.

4. The proposed classification is based on the cybernetic model of regulation of cardiac activity R.M. Baevsky also provides for dividing into two options, depending on the use of only the autonomous regulation circuit or, in addition, the inclusion of a central reserve circuit.

Prospects of further research are as follows. Using the proposed classification can give the doctor additional information about the functional state of the patient/respondent and become an additional criterion in assessing his valeological status, the efficacy of the treatment or training process. The use of a graphical diagnostic scheme as part of a dynamic analysis of spectral activity. It is planned to continue studies in this field and to study the functional types of mobilization in patients with NCDs.

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Реферати

ОЦІНКА ФУНКЦІОНАЛЬНИХ ТИПІВ МОБІЛІЗАЦІЇ ОРГАНИЗМУ НА ПІДСТАВІ ДИНАМІЧНОГО АНАЛІЗУ СПЕКТРАЛЬНИХ ПОКАЗНИКІВ ВАРІАБЕЛЬНОСТІ РИТМУ СЕРЦЯ ТА ЇХ КЛАСИФІКАЦІЯ

Невойт Г.В., Потяженко М.М., Мінцер О.П.

Стаття присвячена вивченню електромагнітних феноменів серцевої діяльності людини і можливостям клінічного їх використання в практичній медицині для оцінки рівня здоров'я з метою профілактики НІЗ. У статті наведені результати динамічного аналізу спектральних показників серцевої діяльності при виконанні функціонально здоровими людьми ортостатичної проби. Автори вперше описали чотири функціональних типи мобілізації/адаптації, дали характеристику і інтерпретацію їм, запропонували варіант їх класифікації на основі кібернетичної моделі двохконтурної регуляції серцевої діяльності Р.М. Баевского.

Ключові слова: варіабельність ритму серця, спектральний аналіз.

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ОЦЕНКА ФУНКЦИОНАЛЬНЫХ ТИПОВ МОБИЛИЗАЦИИ ОРГАНИЗМА НА ОСНОВАНИИ ДИНАМИЧЕСКОГО АНАЛИЗА СПЕКТРАЛЬНЫХ ПОКАЗАТЕЛЕЙ ВАРИАБЕЛЬНОСТИ РИТМА СЕРДЦА И ИХ КЛАССИФИКАЦИЯ

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Статья посвящена изучению электромагнитных феноменов сердечной деятельности человека и возможностям клинического их использования в практической медицине для оценки уровня здоровья с целью профилактики НИЗ. В статье приведены результаты динамического анализа спектральных показателей сердечной деятельности при выполнении функционально здоровыми людьми ортостатического пробы. Авторы впервые описали четыре функциональных типа мобилизации/адаптации, дали характеристику и интерпретацию им, предложили вариант их классификации на основе кибернетической модели двухконтурной регуляции сердечной деятельности Р.М. Баевского.

Ключевые слова: вариабельность ритма сердца, спектральный анализ.

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CLINICAL AND EPIDEMIOLOGICAL CHARACTERISTICS OF ACUTE BACTERIAL MENINGITIS IN ADULTS OF KHMELNYTSKYI REGION

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We analyzed 123 cases of acute bacterial meningitis, where 74 cases were in men and 49 cases - in women. 93.5% of cases began with fever, headache (86.2%), vomiting (69.9%), epileptic seizures (1.6%), altered level of consciousness (17.8%) and meningeal syndrome (80,2%). The etiological factor was established in 20.3% of patients. In 41.4% of patients neurological complications were observed. The terminal end was observed in 7.3% of patients**.** The main causative agent of acute bacterial meningitis was S. pneumoniae (56.0%), the second place was taken by N. meningitidis (36.0%), the third one was divided between S. aureus and L. monocytogenes (4.0%). Brain edema (90.2%), paresis of extremities (11.7%) and epileptic seizures (7.8%) were frequent complications. The prevalence of acute bacterial meningitis was 0.86 per 100 thousand population per year in the ratio between men and women of 1.5:1 and the total annual mortality of 0.06 per 100 thousand population.

Key words: bacterial meningitis, epidemiology, etiology, adults.

The study is a fragment of the research project "The course of infectious diseases depending on genetic, morphological and metabolic factors", state registration No. 0118U005454.

Acute bacterial meningitis (ABM) is one of the main causes of mortality from infectious diseases in the world [7]. Over the last few decades the incidence of ABM in children has decreased, but it leaves a significant burden of morbidity in adults with a mortality of about 30% [13].

The prevalence of ABM in average is 3 per 100 thousand population in the world and may vary depending on the age of patients, their sex and country [3].

In the United States in recent decades there have been some changes in the etiology and mortality of ABM with a tendency to decrease due to the introduction of combined vaccines from Neisseria meningitidis and Streptococcus pneumoniae and dexamethasone inclusion in the clinical protocols for the treatment [4].

The most common complication of the disease arises after meningitis caused by S. pneumoniae in comparison with other pathogens. Hearing disorder is one of the most common ABM complications. Other ABM complications include loss of limbs in the development of meningococcal sepsis, development of subdural empyema, hydrocephalus and epileptic seizures. The emergencies of neurocognitive impairment are frequent complications of ABM [13].

Three most common pathogens (Haemophilus influenza-b, N. meningitidis, and S. pneumoniae) are responsible for more than 80% of ABM cases worldwide [4]. However, the epidemiology of ABM