

## 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

DOI: 10.36740/WLek202006139

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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

Wiad Lek. 2020;73(6):1279-1283

## 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  $\pi$ -electrons, therefore  $\pi$ -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.

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*This research work 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).*

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#### Conflict of interest:

*The Authors declare no conflict of interest.*

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**Received:** 02.03.2020

**Accepted:** 07.05.2020