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АНАЛИЗ СОСТОЯНИЯ ДЫХАТЕЛЬНОЙ СИСТЕМЫ ПО ШУМАМ В ЛЕГКИХ – ВОЗМОЖНОСТИ И ПЕРСПЕКТИВЫ

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Анализ существующих методов и средств анализа акустических сигналов с целью определения состояний дыхательной системы человека показывает, что они однозначное не идентифицируют функционал, для приемлемо точно осуществлять диагностический процесс по акустическим шумам в основном из-за нестационарности биосигнала на коротких временных интервалах регистрации. В статье рассматриваются вопросы анализа дыхательных шумов в легких с целью изучения возможностей применения биосигнала для идентификации прямых и-или латентных показателей в автоматизированных системах поддержки диагностических решений состояний системы дыхания в процессе скрининговых медицинских массовых осмотров населения. Предложено развивать исследования в области синхронной регистрации и анализа дыхательных шумов и содержания во вдыхаемо-выдыхаемом воздухе концентраций кислорода и углекислого газа наряду с ионами различной поляризации и характеристик фотоплетизмограммы.

Ключевые слова: анализ биомедицинских сигналов, дыхательный шум, системы поддержки принятия решений.

THE ANALYSIS OF A CONDITION OF RESPIRATORY SYSTEM ON NOISE IN LUNGS – OPPORTUNITIES AND PROSPECTS

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The analysis of the existing methods and means of the analysis of acoustic signals for the purpose of definition of conditions of respiratory system of the person shows that they unambiguous do not identify functionality, for is acceptable to carry out precisely diagnostic process on acoustic noise generally because of not stationarity of a biosignal on short time intervals of registration. In article questions of the analysis of respiratory noise in lungs for the purpose of studying of opportunities of application of a biosignal for identification of direct and-or latent indicators in the automated systems of support of diagnostic solutions of conditions of system of breath in the course of screening medical mass examinations of the population are considered. It is offered to develop researches in the field of synchronous registration and the analysis of respiratory noise and contents in it is inhaled - the exhaled air of concentration of oxygen and carbon dioxide along with ions of various polarization and characteristics of the photoplethysmogram.

Keywords: analysis of biomedical signals, respiratory noise, systems of support of decision-making.

For permission of diagnostic problems in pulmonology (especially in the field of prenosological diagnostics) researches in the field of design and operation of various technical means and the measuring equipment accepted for clinical application on registration and a research

of pulmonary noise [3] will be organized and conducted as violations of functioning of lungs causes pathological changes in an organism – in general and separate physiological systems.

Acoustic noise in fact are the indicator of work of respiratory system as are caused not only the mechanical work of lungs aimed at providing necessary concentration of gases in organism cages but also depend on a number of external and internal factors.

Noise of lungs (respiratory noise) arise in the course of breath and are observed in the course of an auskultation. The classical description of ways of a traditional auskultation of small, pulmonary noises and types of breath is normal and is provided pathologies in work [6]. Standard signals of respiratory noise with the short characteristic are given in information medical banks [5] and differ with record registration parameters: quantization frequency on level and on time, duration, a processing technique, and also preservation formats. To each auskultativny phenomenon in a collection usually there corresponds one record that complicates assessment application of statistical methods of recognition and a clustering.

Work [8] is devoted to synthesis of experiences of studying of respiratory system of the person and development and technical means for its diagnostics:

- instruments of creation of the hardware and software and the analysis of trakhealny noise of the forced exhalation;
- ways of the analysis of parameters of the respiratory noise received on the basis of the spectral analysis;
- to results of experimental assessment of efficiency of diagnostics;
- to methods and algorithms of preliminary processing of non-stationary acoustic noise, parametrization (allocation of measurable informative signs) of "typical" realization of acoustic signals;
- to ways of assessment of informational content of the allocated signs and formation of optimum set of characteristics providing the acceptable representativeness (compactness of decisive rules at preservation of reliability of recognition);

Continuation of this work can be considered the opportunity of complex diagnostics of conditions of lungs of the patient offered in work [1] by installation of degree of belonging of an unknown state to a certain class of the diagnosed signs, known on the basis of indistinct representation.

Meanwhile, the analysis of the existing methods and software and hardware of the analysis of acoustic signals for the purpose of definition of conditions of difficult objects showed that they have no the functionality allowing to carry out rather exact identification of the majority of real objects for their acoustic noise because of not stationarity of these signals on short time intervals.

The shortcomings connected with reality of training of the distinguishing system in short temporary ranks can be in many respects leveled by means of a self-organizational harmonious algorithm of a method of the group accounting of arguments [9] and-or application of integrated indicators [11].

The hypothesis formulated in [7] Bocharovy M. E deserves attention. On the basis of methodological concepts of Chizhevsky A. G. [10] in the monograph the electric balance of an organism based on processes of internal and external electroexchange is considered by the author. Under external and internal electroexchange also the processes causing breath type are meant: "Transition to blood of neutral oxygen and release of positively charged oxygen raises a positive charge in alveoluses … that leads together with increase in partial pressure of carbon dioxide (Dalton's law) to increase to pressure in alveoluses and facilitate an exhalation". It is noted that the general regulation and transfer of negative "electricity" to compliance with this hypothesis it is carried out on the principles of "a pulse wave" by nervous system on the basis of characteristics of the rhythms of an organism set by heart and lungs.

If the specified hypothesis is right, then acoustic characteristics of respiratory noise of lungs correlate with characteristics of internal and external electroexchange.

Researches in this direction are represented perspective as allow to consider respiratory system as an element of higher degree of the organization, the organism providing interaction with the environment by means of changes of the internal environment and an organism with off-line control by autonomous artificial intelligence nervous systems of an organism for which information signals are characteristics of electric balance (imbalance) of system of breath, surrounding and internal environments of an organism.

Thus, the carried-out review of methods and ways of the analysis of acoustic noise shows that analog methods and means of the spectral analysis give the reliable and steady characteristic of a range only for the determined periodic signals and casual stationary signals with a small interval of stationarity (within time of the analysis of each frequency component).

For the analysis of the direct and latent information obtained on the basis of a range of respiratory noise, formations of a set of informative indicators it is recommended to use the achievements of artificial intelligence allowing to receive in the conditions of slabostrurirovanny and vague data diagnostic models with the set adequacy level (artificial neural and immune networks, logical networks, genetic algorithms and other algorithms of soft calculations, synthesis of indistinct decisive rules, self-organizational modeling, autonomous artificial intelligence) [2].

The modern levels of development of measuring elements (sensors and systems) and the microprocessor equipment and means of mobile communication allow to pass on qualitatively new

to a level of differential preventive diagnosis of pulmonary diseases, based on simultaneous registration and information transfers about pulmonary noise (an acoustic signal and data on the nature of ionization in the inhaled and exhaled vozdukh) and indications of the plethysmogram (reogramma).

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