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POSSIBILITIES OF USING MOLECULAR DIAGNOSTIC DEVICES IN THE CLINICAL LABORATORY

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Abstract. *Microchipping is of great importance in modern medical and technical diagnostics, it is also used to determine the sequence of DNA with fluorescent labels, but these probes must first be separated from patient samples and then compared with microchip samples. A DNA microchip is a base (glass, plastic, gel) on which up to several thousand microprobes with a length of 25 to 1000 nucleotides can be used. reaction of markers is observed. The results of the research should be ready 4-6 days after the collection of the material, any biomaterial can be used for the analysis of DNA and RNA samples, this method is used in oncology and cardiology (including the study of genetic predisposition*

Keywords: *DNA microarray, DNA and RNA sampling, molecular diagnostic analysis, genetic code, pharmacogenomics, protein expression patterns.*

I. SIGNIFICANCE AND COST OF MOLECULAR DIAGNOSTICS

A set of modern techniques used for molecular diagnostic analysis—genome and proteome within biological markers—consists of determining an individual's genetic code and how their cells express their genes. This technique is used to diagnose and monitor disease, determine risk, and decide which treatments work best for certain patients. The task of the techniques used in modern diagnostics is the genetic study of blood coagulation and its pharmacogenomics, which drugs have the best effect [1]. They are related to clinical sciences and theories, namely clinical chemistry (medical tests on body fluids), biophysics (the effect of medical tests on the human body).

Microchipping is of great importance in modern medical and technical diagnostics. It is also used in fluorescently labeled DNA sequence detection. However, these probes are first isolated from patient samples and then compared to microchip samples [3]. A DNA microchip is a base (glass, plastic, gel) on which up to several thousand microprobes with a length of 25 to 1000 nucleotides can be used [4,5]. The samples (probes) obtained after cleaning the biomaterial are combined with the microtests on the chip and the reaction of the markers is observed. The results of the research will be ready 4-6 days after the collection of the material. Any biomaterial from which DNA and RNA can be sampled is used for analysis. This method is used in oncology and cardiology (including genetic predisposition for learning) is used, it is a precise and sensitive method. Another important technique of molecular diagnostics and new technologies in modern medical and biological examinations is DNA Printing 3D. U printing technologies will create a unique new industry for printing and selling DNA. Millions of pieces of DNA are placed on tiny metal substrates and scanned by a computer, which eventually selects the strands that make up the entire sequence of the DNA chain.

The most common objects of DNA diagnostics in the clinic include the analysis of infectious pathogens and microflora, DNA and RNA viruses, slow-growing flora or slow-growing organisms (microorganisms, fungi). Molecular diagnostic methods are often used for

microorganisms that are studied according to the well-known Koch rules. Quantitative detection of cytomegalovirus in the blood allows to evaluate its dynamics after transplantation and the effect of antiviral treatment. The generally accepted assessment of viral load in viral hepatitis requires the use of quantitative PCR, which allows determination of viral levels in plasma before and during treatment. In addition to the tasks of identifying and quantifying infectious pathogens, an important problem of clinical molecular biology is the genotyping of individual pathogenic microorganisms [6,7]. It is used in the following cases:

1) in the study of clinical isolates of bacteria:
- identification of specific toxins genes;
- identification of genes determining resistance to therapy;
2) in the study of viruses:
- identification of prognostically unfavorable genotypes;
- identification of genes that determine resistance to therapy.

Diagnostic kits have been developed to address the challenges of genotyping to identify bacterial resistance genes in clinical isolates.

Currently, in clinical practice, there are a wide range of laboratory diagnostic methods that allow not only to diagnose diseases, monitor therapy, but also to monitor treatment. Until recently, laboratory diagnostic methods used in clinical practice had one common shortcoming - they did not take into account the patient's susceptibility to various diseases due to genetic factors. Questions about the patient's susceptibility to various diseases are the basis of a new direction of medicine - personalized medicine, which can be defined as a strategy for the prevention and treatment of diseases based on the results of molecular genetic research.

Thanks to scientific research, it became known that genetic polymorphisms play an important role in the development of various diseases - genome changes that occur in the human population in at least 2 variants (alleles) with a frequency of at least 1%. The most common type of genetic polymorphism is single nucleotide substitutions (SNPs), which are genetically unique to each individual. Under certain unfavorable conditions, some polymorphic variants of genes ("susceptibility genes") contribute to the development of multifactorial diseases. Unfavorable allelic variants of these genes can lead to common diseases such as atherosclerosis, cardiovascular disease (CVD), osteoporosis, diabetes, bronchial asthma, tumors, etc. Normal metabolic process combinations of allelic variants of different genes that ride or participate. the development of a certain pathology is called gene networks. Determining the components of the gene network of each multifactorial disease, developing a set of preventive measures for a specific patient on this basis is the basis of predictive (prognostic) medicine [13,14].

Currently, molecular diagnostic technologies are being developed, improved and introduced into clinical practice. Thus, even now, clinical laboratory diagnostics has a wide range of methods based on the detection and diagnosis of nucleic acid analysis methods - polymerase chain reaction (PCR), genotyping, biochips, sequencing, etc.

PSR is one of the few laboratory diagnostic methods currently used in clinical practice and is characterized by the highest specificity and sensitivity in the detection of diseases such as bacterial vaginosis, trichomoniasis, syphilis, viral hepatitis, HIV infection, tuberculosis, etc. [2, 3].

The PSR method is particularly effective in the detection of hard-to-cultivate and non-cultivable viruses and bacteria that are common in latent and chronic infections. It should be noted that, unlike bacteriological and virological diagnostic methods, the possibilities of PCR

diagnostics are not limited by the ability of microorganisms and viruses to grow in an artificial environment or in cell culture. The main advantage of PCR over bacteriological and virological diagnostic methods is the ability to identify, characterize and work with various microorganisms that cannot be reproduced in laboratory conditions for one reason or another.

The development of research tools and the development and industrialization of molecular biology analysis tools have made their use in clinics practical. A clinical laboratory requires high reliability standards, meaning diagnostics may require accreditation or compliance with medical device regulations. Laboratory data management systems help systematize these processes by tracking them. In laboratories, automation and sample barcoding through medical equipment maximizes efficiency and reduces the potential for error or morbidity during manual processing, reporting of results.

II. ANALYZES AND METHODS

"In vitro" biological analyzes used in molecular diagnostics, such as PCR-ELISA or Fluorescence "in situ" hybridization, are important. The assay determines the structure of the molecule, often at low concentrations, meaning that the marker can predict disease or risk in a sample taken from a patient. It is important to preserve the sample before analysis. It is useful to develop these techniques to reduce manual work. Because molecular diagnostic methods can detect sensitive markers, these tests take less time than conventional ones. For example, since cell-free nucleic acids are present in humans, plasma, a simple blood sample may be sufficient to obtain genetic information from a tumor, transplant, or unborn fetus. In most cases, molecular diagnostic methods use nucleic acid detection, i.e., polymerase chain reaction (PCR), greatly increasing the number of nucleic acid molecules and thereby increasing the number of clinical analyzes of target sequences in a patient's sample. Modern medical technology and molecules are introduced into the field of medicine.

III. CONCLUSION

In conclusion, it can be said that due to the increasing state support of molecular DNA diagnostics, in the future even the introduction of DNA diagnostics for the detection of cancer will be the basis for the development of medicine, the organization of reliable low-cost examinations for patients.

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