COMPARISON OF METHODS AND TOOLS FOR DIAGNOSTICS OF GASTROINTESTINAL TRACT DISEASES

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TUIT named after Muhammad al-Khwarizmi
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Abstract. *This article discusses a comparison of methods and means of diagnosing diseases of the gastrointestinal tract. Comparison of methods and means of diagnosing diseases of the gastrointestinal tract was carried out jointly with gastroenterologists at the clinic of Tashkent Medical Academy. With the help of comparative data, it is possible to modernize and improve previously developed methods and tools for diagnosing the gastrointestinal tract. In the last part of the article, a new technology and method for diagnosing diseases of the gastrointestinal tract is proposed.*

Keywords: *methods and means, diseases, gastrointestinal tract, technology, gastroenterology.*

INTRODUCTION

Interest in developing the latest technologies in the field of medicine is growing year after year. In all areas of medicine, new methods and hardware are developed every year for the diagnosis and treatment of patients. With the development of information technology and artificial intelligence in developed countries, there are already a number of projects to improve the methods and means of diagnosing diseases in various areas of medicine.

Many foreign countries around the world have adopted resolutions and decrees on the development of artificial intelligence technology in various industries, including medicine. In the Republic of Uzbekistan, also President Sh.M. Mirziyoyev adopted a number of decrees and resolutions:

- UP No. 6079 5.10.2020 - “On approval of the strategy “Digital Uzbekistan-2030” and measures for its effective implementation”;
- GD No. 4996 of February 17, 2021 - "On measures to create conditions for the accelerated implementation of artificial intelligence technologies";
- UP No. 6221 05.05.2021 - “On the consistent continuation of the ongoing reforms in the healthcare system and the creation of the necessary conditions for increasing the potential of medical workers.”

In our republic, M.M.Kamilov in the direction of recognition algorithms in the field of intelligent data processing, Sh.Kh.Fozilov in the direction of identification and feature extraction algorithms, M.M.Musaev in the direction of speech signals, N.A.Ignatiev in the direction of image processing , medical image processing Scientists such as Kh.N. Zaynidinov in the field of information processing, M.A. Rakhmatullaev in the field of expert systems, A.Kh. systems conducted research and contributed to the development of this area.

In particular, in the works of R. Esfandyarpour, A. Kashi, M. Nemat-Gorgani, R.V. Davis, P. State, Long Lin, An Sheng, Jia Zhu, Jian Li have developed devices, sensors and sensors for monitoring human saliva using neural networks and deep machine learning.

MAIN PART

In various countries of the world, research is being carried out aimed at developing hardware and software tools for the analysis of human saliva for the primary diagnosis of the gastrointestinal tract.

In 1995, a sensor was developed in Germany to detect narcotic substances in human saliva (Fig. 1). This equipment allows you to analyze the presence of drugs or their metabolites in the human body in a biological sample (urine, blood, saliva).

Figure 1. Sensor for detect narcotic substances

The test is carried out in order to detect the facts of the use of illegal drugs, such as marijuana, cocaine, heroin, etc. Similar tests are carried out to detect doping in athletes [4].

In 2014, US researchers developed a drop-shaped sensor for real-time monitoring of metabolites in human saliva (Fig. 2). This sensor is designed exclusively for monitoring the health of athletes [1].

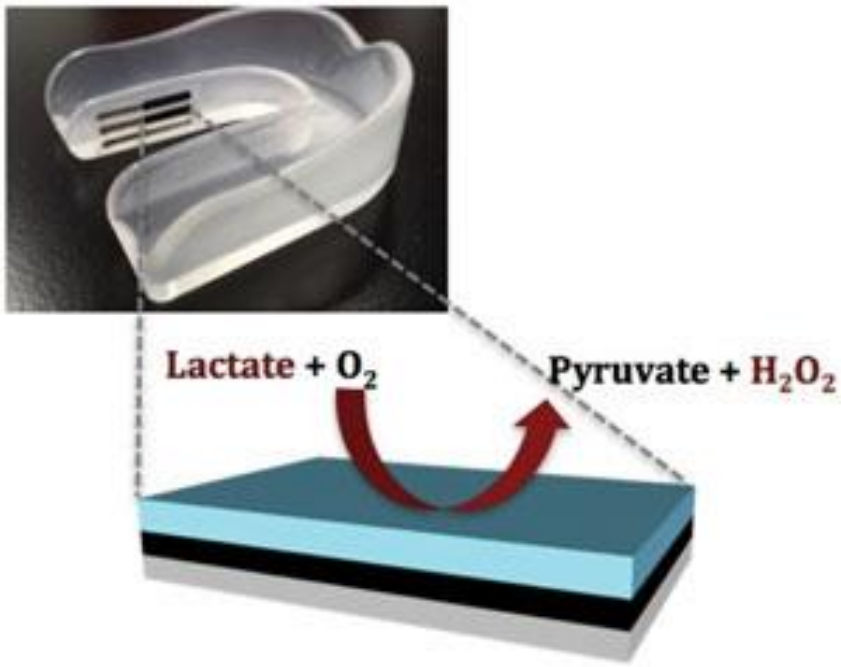

Figure 2. Biochemical saliva sensor for athletes.

In 2019, engineers from the Massachusetts Institute of Technology created a wearable sensor that allows you to determine the concentration of biological marker substances in human saliva (Fig. 3). As conceived by the developers, this device should eliminate the need for a blood test [3].

Figure 3. Wearable saliva sensor.

In 2022, scientists from Russia created a sensor to determine the pH level of human saliva (Fig. 4). The analysis is carried out using microdoses of the substance and a spectrofluorimeter, in which the substance is irradiated with a special lamp (its resource is tens of thousands of hours).

Figure 4. pH sensor

In the diagnosis of the gastrointestinal tract, various innovative equipment is currently used. Diagnosis of diseases of the gastrointestinal tract (GIT) is one of the most important areas of medicine, since many diseases of the gastrointestinal tract, such as ulcers, cancer of the stomach and intestines, chronic gastritis and duodenitis, can lead to serious complications and even death.

Innovative technologies in the field of gastrointestinal diagnostics can contribute to a more accurate and efficient diagnosis of diseases, as well as improving the quality of life of patients [5].

One of such innovative equipment for diagnosing diseases of the gastrointestinal tract is the fibrogastroscope, which is an improved version of the gastroscope. The fibrogastroscope allows medical personnel to examine the inner surface of the stomach and duodenum using an optical system and a light guide. Also, a fibrogastroscope allows the doctor to obtain a biopsy for further research (Fig. 5.6).

Figure 5. Fibrogastroscope.

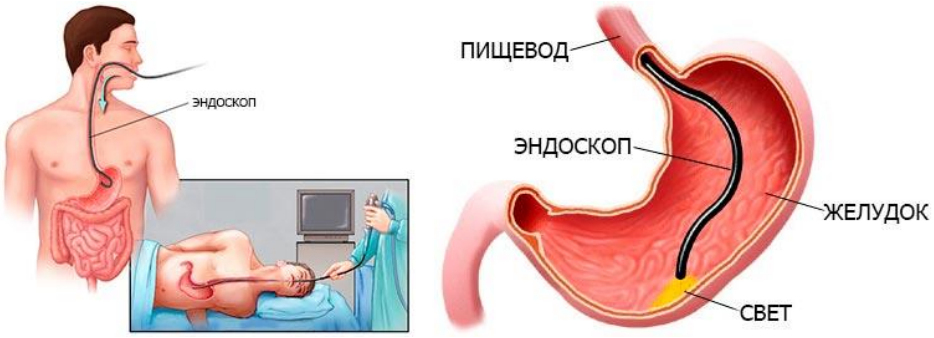

Figure 6. Endoscopy.

Another innovative device for diagnosing gastrointestinal diseases is capsule endoscopy, which allows medical personnel to view the inside of the gastrointestinal tract using a capsule with a camera that passes through the digestive system and is excreted from the body. Capsule endoscopy may be useful in cases where gastroscopy cannot be performed due to complications or inconvenience to the patient (Figure 7).

There are also innovative methods for diagnosing gastrointestinal diseases, such as cineendoscopy, which allows medical personnel to view the movement of food through the gastrointestinal tract in real time, and transabdominal ultrasound, which allows the doctor to image the gastrointestinal tract using ultrasound waves passing through the abdominal wall.

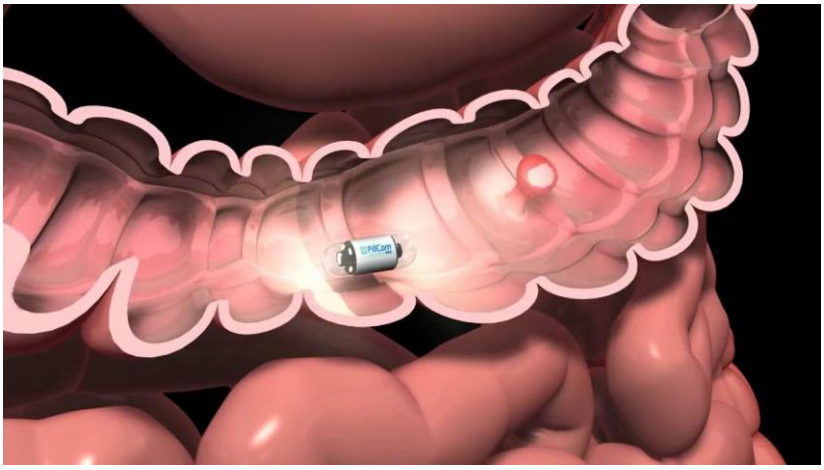

Figure 7. Capsule endoscopy

On the basis of [1-4] scientific papers, a hardware-software complex “Saliva” was developed for the primary diagnosis of diseases of the gastrointestinal tract based on the analysis of human saliva [5].

An intelligent method for the primary diagnosis of diseases of the gastrointestinal tract is proposed. The hardware-software complex "Saliva" is compact, portable and convenient for use during primary diagnostics. The “Saliva” hardware-software complex can be used in clinics, polyclinics and medical institutions for the purpose of primary diagnostics. In particular, the Saliva hardware and software complex partially replaces endoscopy (probing) and can be used in patients of the following categories: infants, pregnant women, children under 12 years old, and the elderly from 50–60 years old [9–11].

Saliva is an innovative hardware and software system for diagnosing diseases of the gastrointestinal tract using salivary gland analysis (Fig. 8). It is based on the technology of an

optical biosensor, which makes it possible to determine disease biomarkers in human saliva [13-15].

With the help of Saliva, you can detect various diseases of the gastrointestinal tract, such as stomach ulcers, gastritis, stomach cancer, intestinal infections, and others. The Saliva hardware and software system offers a non-invasive and fast diagnostic method that can be performed by a general practitioner in the office or at home.

The data obtained with Saliva is processed by software that analyzes biomarkers and determines the likelihood of having gastrointestinal diseases. Based on the results of the analysis, the patient can be sent for additional examination or may be subjected to additional treatment [6-8].

The advantage of Saliva is that it is a non-invasive diagnostic method that does not require a biopsy or other procedures that may be uncomfortable for the patient. It can also be done quickly by a general practitioner in the office or at home. Moreover, Saliva can be used to screen for GI disease in people who are at risk, such as the elderly or people with a family history of GI disease [13].

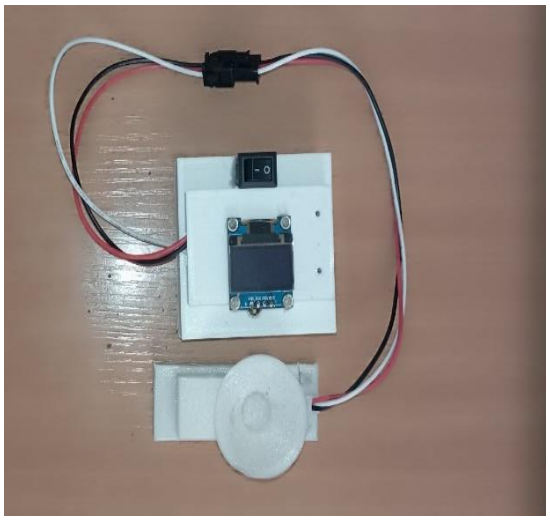

Figure 8. Hardware software complex "Saliva"

Also be aware that Saliva is a relatively new technology and may not be available in some regions or may be too expensive for some patients.

CONCLUSIONS

This article compared various methods and tools for diagnosing diseases of the gastrointestinal tract in order to determine their effectiveness and applicability in clinical practice.

As a result of the study, it was revealed that each of the considered methods has its own advantages and limitations. Gastroscopy and colonoscopy are important tools for visual evaluation of the gastrointestinal tract and tissue biopsy. Computed tomography and magnetic resonance imaging provide detailed images of organs and tissues, but may be limited by high cost and inaccessibility for some patients.

The final conclusion is that the choice of method and means of diagnosing diseases of the gastrointestinal tract should be individualized and determined by the doctor, depending on the specific situation and the requirements of the patient. Greater research and development of new technologies in the field of diagnostics will help improve the accuracy and efficiency of detection of diseases of the gastrointestinal tract and improve treatment outcomes.

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