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USE OF INFORMATION TECHNOLOGY (IT) TO STUDY, DIAGNOSE AND TREAT CANCER CELLS.

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Abstract: The use of information technologies (IT) for the study, diagnosis and treatment of cancer cells is becoming an important and promising area in modern medicine. These technologies help improve understanding of cancer, improve diagnostic accuracy, develop new treatments, and improve patient prognoses.

Keywords: IT tools, CT, MRI or ultrasound, DNA, Molecular diagnostics, Aristotle, microscope.

It is known that there is nothing more important than human life. Medicine, translated from Latin as “the art of healing,” is the guardian of our health.

In the current conditions of information growth, covering ever wider areas of human activity, it needs the help of decision support systems (DSS), which are aimed at increasing the accuracy, efficiency of treatment and minimizing medical errors. Timely detection and correct diagnosis of cancer plays a vital role in saving human life.

Most medical opinions are forced to be based on making emergency decisions based only on the doctor’s experience, since time limitations do not make it possible to resort to the help of competent experts, as well as a literature search and the necessary other extensive research.

In situations requiring complex analytical consideration, the role of the DSS is irreplaceable. The system processes the data provided by the doctor and produces the optimal result, while it does not replace the doctor, but acts as a prompt, competent expert and consultant in a specific area.

History of Cancer Cancer has a long and complex history. This disease is one of the most ancient diseases. Archaeological studies have shown that Neanderthals, even dinosaurs, suffered from cancer, and they were also found in the mummies of ancient Egypt. The earliest recorded case of cancer dates back to around 1600 BC. BC, in the Edwin Smith Papyrus, one of the oldest examples of ancient medical literature, which is part of an ancient Egyptian textbook on surgery and medicine. It describes eight breast tumors that were actually removed by cauterization.

The term “cancer” was first introduced by Hippocrates when discussing tumors (carcinoma, carcinosis, crab, cancer), due to the external resemblance of damaged cells to a crab. He developed the so-called humoral theory in medicine. She believes that the Universe is created from four basic elements: earth, air, fire and water.

As for the human body, in it these elements take the form of four “fluids”: blood, black bile, yellow bile and mucus (phlegm). The cause of this disease is an excess or deficiency in their ratio. The humoral theory is also mentioned in the works of Aristotle. The only way to treat cancer at that time was to surgically remove superficial tumors, if possible.

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It became possible to look deeper into the essence of the occurring phenomena only with the advent of the microscope, which brought about serious changes in the development of oncology. Today, all over the world, enormous work is being done to study tumors.

The classic triad of treatment for the disease: surgery, radiation and chemotherapy has been supplemented with more and more advanced techniques. Modern oncology has at its disposal a wide arsenal of means and methods for treating cancer, preventing its occurrence and development, saving human life, and in hopeless cases, maximizing prolongation and getting rid of painful symptoms.

Machine learning and artificial intelligence (AI) are being actively used to analyze data related to cancer cells:

Diagnosis of cancer. AI can analyze medical images (X-rays, MRIs, CT scans, biopsies) with high accuracy, helping doctors detect cancer cells at the earliest stages. AI algorithms can identify signs of tumors that might otherwise be missed by traditional analysis. Prediction of the course of the disease. AI is used to analyze large amounts of patient data (genetic information, medical history, treatment results) to predict the likelihood of disease spread and the effectiveness of various treatments.

Personalized treatment.

Based on big data analysis, including genomic research, IT helps develop personalized treatment plans tailored to the individual characteristics of the patient and his tumor.

Genome sequencing. Modern IT tools make it possible to analyze the genetic code of a tumor. Sequencing the DNA of cancer cells helps identify mutations that lead to the development of the disease and allows us to select optimal treatment methods.

Molecular diagnostics. Analyzing genetic changes in cancer cells using bioinformatics helps identify specific molecules that may be targets for treatment (targeted therapy). For example, the discovery of specific mutations in genes can indicate the effectiveness of certain drugs.

Medical Image Processing

IT technologies, in particular computer vision algorithms, are used to process medical images:

Image analysis. AI can analyze images obtained through X-ray, CT, MRI or ultrasound and automatically detect cancerous changes. This speeds up diagnosis and reduces the likelihood of errors.

Tumor segmentation. Computer algorithms can accurately segment tumors in images, helping doctors accurately determine its size, shape and location, and monitor changes during treatment.

Robotic systems for surgery

Robots using IT technologies are used to carry out precision operations to remove tumors:

Robotic surgeries allow surgeons to perform minimally invasive interventions with high precision, which reduces trauma, speeds up patient recovery and reduces the risk of complications.

Robots, such as the Da Vinci system, allow the use of miniature instruments to perform high-quality operations and also provide improved visualization.

Big Data in Oncology

Big data plays an important role in understanding cancer:

Big data processing and analysis makes it possible to collect and analyze information about thousands of patients, their medical histories, treatment results, as well as genetic and molecular characteristics of tumors.

This helps to identify new patterns and regularities that can be used to create effective treatments.

Search for new drugs. Through big data analysis, researchers can identify molecules that could be used as new drugs to treat cancer.

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Telemedicine and remote monitoring

Telemedicine and IT-enabled remote monitoring help improve care for patients with cancer: Telemedicine allows patients to consult with doctors remotely, which is especially important for people who are in remote regions or cannot often visit medical facilities.

Health monitoring

Health monitoring. Wearable devices and mobile applications can monitor a patient's condition in real time, including parameters such as body temperature, blood pressure, pulse and blood oxygen levels. This data can be transmitted to the doctor, which allows for a timely response to changes in the patient's condition.

Immunotherapy and targeted drugs

IT helps in the development of new cancer treatments, such as immunotherapy and targeted therapy:

Development of targeted drugs. Using data on the molecular characteristics of cancer cells, IT helps develop drugs that directly target the molecules responsible for tumor growth and spread.

Immunotherapy. Data analysis allows us to develop methods to activate the immune system to fight cancer cells, for example, by creating new vaccines or drugs to treat cancer.

3D printing and creation of tumor models

3D printing also finds application in oncology:

Tumor models. Using medical images, 3D printers create precise models of tumors, allowing doctors to better plan surgeries and predict treatment outcomes.

Personalized implants. In the case of surgery, 3D printing allows the creation of customized implants or prostheses for patients with cancer.

CONCLUSION

The use of information technology in the study and treatment of cancer cells significantly improves diagnosis, allows the development of more accurate and personalized treatment methods, and also contributes to the early detection of the disease. IT technologies are being actively introduced into oncology, which offers great prospects for increasing the effectiveness of treatment and improving prognoses for patients Telemedicine allows patients to consult with doctors remotely, which is especially important for people who are in remote regions or cannot often visit medical facilities.

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