THE INFLUENCE OF ARTIFICIAL INTELLIGENCE IN EYE MICROSURGERY

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https://doi.org/10.5281/zenodo.20498209

Abstract. This article examines the impact of artificial intelligence technologies on the development of modern ophthalmic microsurgery. It analyzes the main areas of artificial intelligence application in ophthalmology, including retinal disease diagnosis, surgical planning, robotic microsurgery, and postoperative patient monitoring. Particular attention is paid to the use of machine learning algorithms and neural networks to improve surgical accuracy, reduce the risk of complications, and optimize clinical decisions. The article also discusses the advantages and limitations of implementing artificial intelligence in ophthalmological practice, as well as prospects for the further development of this technology.

Keywords: artificial intelligence, eye microsurgery, ophthalmology, machine learning, robotic surgery, diagnostics, neural networks, laser surgery, medical technologies.

Introduction. Modern medicine is actively implementing digital technologies, among which artificial intelligence (AI) holds a special place. In recent years, AI has become an important tool in various areas of healthcare, particularly in ophthalmology and eye microsurgery. Highly accurate image analysis, the ability to process large volumes of data, and the automation of complex processes make AI an effective assistant for ophthalmologists.

Eye microsurgery requires the utmost precision, as even the slightest error can lead to serious complications or vision loss. This is why the introduction of intelligent technologies into this field is particularly important. Artificial intelligence improves diagnostics, increases surgical precision, and reduces patient recovery time.

Main areas of application of artificial intelligence in eye microsurgery

1. Diagnosis of ophthalmological diseases

One of the most common applications of AI is the diagnosis of eye diseases. Deep learning algorithms can analyze retinal images and detect pathological changes at early stages.

AI is successfully used to diagnose the following diseases:

- diabetic retinopathy ;
- glaucoma;
- age-related macular degeneration;
- cataract;
- corneal diseases.

Modern neural networks can compare thousands of images and identify pathologies with an accuracy comparable to that of a qualified ophthalmologist. This is especially important in regions with limited access to specialists.

The use of automated diagnostic systems allows us to reduce the time required for patient examination and improve the effectiveness of early disease detection.

2. Artificial intelligence in surgical planning

Surgical planning is a crucial step in ocular microsurgery. AI helps analyze the patient's anatomical features and select the optimal surgical strategy.

Based on data from computed tomography, optical coherence tomography and other visualization methods, intelligent systems are capable of:

- simulate the course of an operation;
- calculate the parameters of laser exposure;
- predict possible complications;
- choose the optimal surgical method.

AI is particularly active and is used in laser vision correction and cataract surgery. Artificial intelligence systems help calculate the parameters of intraocular lenses, significantly improving vision after surgery.

Robotic microsurgery of the eye

One of the most promising areas is robotic ophthalmic surgery. Robotic systems enable highly precise movements beyond the capabilities of the human hand.

Advantages of robotic surgery:

- minimizing hand tremors in the surgeon;
- high precision micro-cuts;
- reducing the risk of tissue damage;
- increasing the safety of the operation.

AI coordinates the movements of surgical equipment and helps the physician monitor the surgical process in real time.

The use of robotic systems in retinal surgeries, where the precision of movements is measured in microns, is considered particularly promising.

Postoperative monitoring of patients

After surgery, artificial intelligence helps monitor the patient's recovery process. Special programs analyze examination results and identify signs of complications at early stages.

Telemedicine platforms with AI elements allow:

- conduct remote monitoring;
- automatically analyze the patient's condition;
- remind you to take your medications;
- evaluate the effectiveness of treatment.

This significantly reduces the workload on medical staff and improves the quality of postoperative care.

Benefits of using artificial intelligence

The implementation of AI in ocular microsurgery has a number of significant advantages:

- Improving diagnostic accuracy.
- Reducing the likelihood of medical errors.
- Improving surgical outcomes.
- Accelerating the processing of medical data.
- Individual approach to patient treatment.
- Reduction of rehabilitation time.

Furthermore, artificial intelligence facilitates the development of personalized medicine, where treatment is tailored to the individual characteristics of the patient's body.

Challenges and Limitations : Despite numerous advantages, the use of AI in ophthalmology is associated with certain challenges.

Main problems:

- high cost of equipment;
- the need to protect medical data;
- dependence on the quality of training samples;
- limited availability of technology;
- the need for supervision by a physician.
- The issue of ethical responsibility when using automated decision-making systems in medicine also remains important.

Development Prospects . In the future, artificial intelligence will become an integral part of ophthalmological practice. The development of fully automated diagnostic systems and intelligent surgical systems is expected.

Promising areas are:

- integration of AI with augmented reality;
- development of autonomous surgical robots;
- use of big medical data;
- creation of intelligent disease prediction systems.

Advances in technology will increase access to high-quality eye care and significantly reduce the rate of blindness worldwide.

Conclusion . Artificial intelligence is having a significant impact on the development of ocular microsurgery. Modern intelligent technologies allow for increased diagnostic accuracy, improved surgical quality, and optimized postoperative patient care.

Despite existing limitations, AI opens up new opportunities for the advancement of ophthalmology and improved efficiency of medical care. In the coming years, we can expect further active implementation of intelligent technologies in clinical practice, marking a significant milestone in the development of modern medicine.

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