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MATHEMATICAL MODEL OF CATARACT DEVELOPMENT AFTER EYE VITRECTOMY

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In the paper methods and results of analysis for predicting patient's cataract condition after eye vitrectomy based on their pre-surgery condition and surgery process were presented. The state of the patients' cataract were examined before surgery and one month, three months and six months after vitrectomy. For this purpose, the LOCS III scale (Lens Opacities Classification System, version III) was introduced. The influence of many variables on the postoperative condition of patients was examined. For this purpose, the basic information collected from patient cards and information on the course of treatment was divided into three groups: preoperative, intraoperative and postoperative. In the first group, apart from general information on the patient's age, sex and state of health, there is information on, among others, previous eye injuries, subretinal hemorrhages or previous operations. The second and third group included parameters describing the course of surgery and the patient's condition after surgery.

In the first step of the analysis, it was checked, whether exists linear correlation, between the parameters reflecting the degree of cataract before surgery and the parameters describing condition after surgery. Next, mathematical models were introduced to describe relations between chosen pre- and post-surgery parameters. For the adopted predictive models in the form of exponential, logarithmic, semi-logarithmic and hyperbolic functions, the parameters of the models were determined and the best fit was selected based on the collected data.

The conducted analysis proves that the state of patients' cataract before vitrectomy has an impact on their condition after the surgery. The less serious the patient's condition before surgery was, the more its condition will worsen after surgery compared to the original condition. Taking into account the similarity of the generated models for different groups of patients, it can be assumed that the dependence of the postoperative cataract state from its initial state is the same, regardless of the patient's sex and general condition. One can also conclude the possibility of a negative impact of the number of retinal quadrants affected by the disease on the increase of the cataract state after surgery, especially in the group of patients with hypertension.

The presented results indicate the need for further analysis of the cataract state in patients undergoing vitrectomy. A larger research group would allow to clearly define the nature of changes in the eye after the surgery. The proposed predictive models may be helpful in assessing the condition of cataracts after surgery and in making decisions about further treatment of patients.