Abstract - Different techniques are used today in neurosurgery for intraoperative navigation, including metabolic guidance using 5-aminolevulinic acid (5-ALA). The article focuses on history of intraoperative photodynamic diagnosis (PDD), mechanisms of 5-ALA action, possibilities of its application in different areas of neurosurgery. In addition to visual assessment of fluorescence, laser biospectroscopy significantly increases the diagnostic value of PDD. Laser biospectroanalysis is described in details, wide perspectives of its application in neurosurgery are demonstrated.

Keywords - 5-ALA, photodynamic diagnosis, laser biospectroscopy

Different techniques are used today in neurosurgery for intraoperative navigation, including metabolic guidance using 5-aminolevulinic acid (5-ALA). The article focuses on history of intraoperative photodynamic diagnosis (PDD), mechanisms of 5-ALA action, possibilities of its application in different areas of neurosurgery. In addition to visual assessment of fluorescence, laser biospectroscopy significantly increases the diagnostic value of PDD. Laser biospectroscopic analysis is described in details, wide perspectives of its application in neurosurgery are demonstrated.

Clinical studies have revealed high selectivity of 5-ALA-induced protoporphyrin IX accumulation in different brain tumors. Modern methods of evaluation of tissues visible fluorescence are based on the qualitative analysis of the images. Up-to-date methods of combined spectral analysis allow fulfilling the intraoperative quantitative evaluation of the protoporphyrin IX content, as well as the scattering and absorption properties of a tissue. This paper presents a new method of the simultaneous analysis of hemoglobin concentration in oxygenated and reduced forms, tumor marker concentration (5-ALA-induced PP IX) and a new way to analyze the changes in the scattering properties of the tissues. The method is implemented by splitting the visible spectrum into intervals where hemoglobin and protoporphyrin IX have the characteristic peaks of absorption and fluorescence. The present method shows the dependence of the fluorescence index from the tumor grade. Combined spectroscopy (optical biopsy) can detect the differences between the subtypes of gliomas that are similar in the protoporphyrin IX fluorescence index. This method complements and enhances the diagnostic capabilities of spectroscopy, which is particularly important in the non-fluorescent glioma surgery.