

LASER ABLATION IN THE SURGERY OF PARASAGITTAL MENINGIOMAS: MONITORING OF TEMPERATURE WITH SEMICONDUCTOR VISION INFRARED THERMOGRAPH (SVIT)

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Meningovascular tumors – meningiomas – are observed in 13-27% of all adult intracranial neoplasms, ranking second among all brain tumors. They rank second among other brain meningiomas in localization and make a significant portion of neurooncologic patients.

Nd-YAG laser is used in the Clinic of Neurosurgery of Novosibirsk RITO since 1995. This is a solid, yttrium aluminum garnet neodymium laser with wave length 1.06 mkm designed in Siberian Laser Centre (SB RAS Laser Physics Institute). Surgical laser operates in pulse-periodic regime with impulse duration 200 mks, irradiation frequency 100 Hz, and power 45-60 W. This type of laser irradiation penetrates into meningioma tissues up to 0.5 cm and, being fully absorbed by blood, exert high-degree coagulating effect. Surgical laser application is based on the effect of laser coagulation and laser vaporization of biological tissues.

From 1998 till present 216 patients with meningiomas of different localization were operated on using original laser technologies. All patients were divided into 3 groups: 9 patients (4,16%) with convexity meningiomas, 90 patients (41,66%) – with parasagittal and 117 (54,16%) - with skull base meningiomas. Nd-YAG laser was used at the stage of microsurgical removal of the tumor (coagulation and ablation of the stroma), in treating tumor matrix, hyperostosis and bone flap if it is involved in neoplastic process.

Temperature parameters in the region of laser action were controlled with the help of “SVIT” (Semiconductor Vision Infrared Thermograph), developed in the Institute of semiconductors of Novosibirsk Scientific Center. Thermograph works in the range of infrared spectrum 2.6-3.1 mkm and is characterized by high sensitivity (0.025oC), high registration speed (0.001 sequence per sec), and thermal filming function. This allows for its real time application.

In the course of tumor parenchyma coagulation the temperature in laser impingement point reached 71.45oC while the temperature of adjacent brain tissue in close proximity to laser operation point was 33.2oC. In treating the tumor original site of growth (matrix), namely sinus wall or falx, the temperature in laser impingement point varied from 70.14 to 102.33oC. The temperature in laser point at the bone flap reached 80.66oC.

Thus, the use of infrared laser (wavelength 1.06 mkm, power 45-60 W) is effective and safe technique for removal of meningovascular brain tumors of multiform localization. As intraoperative monitoring of temperature parameters has shown, ND-YAG laser coagulation of meningioma, its matrix, and bone flap creates strictly local high temperatures in the laser impingement point. The temperature of adjacent intact brain tissue remains within the physiological norm.