E-9. Effects of Laser Radiation upon the Transplanted Brain Tumors

Kiyoo KAMIKAWA, Toru HAYAKAWA, Takuya IKEDA,
Ryotaro KURODA, Yukitaka USHIO and Hiromasa MURUI

Department of Neurosurgery Osaka University Medical School,

Since laser is monochromatic light, absorption of laser is expected to be increased by physiologic pigments and dyes in the irradiated tissues. Various dyes have been used as exogenous photosensitizer in laser research. Dyes increase the biomedical effects of laser energy. It is well-known that the absorption of dye injected intravenously takes place in tumor tissue of brain, while the blood-brain barrier limits the entrance of dye from blood to brain and consequently the normal brain tissue remains unstained. Those evidences indicate that there is a possibility of selective destruction of brain tumor with less damages of normal brain tissues by laser radiation. Experiments were designed to apply the laser for treatment of brain tumor. Acridine orange was used as a photosensitizer to argon gas laser because of the match in absorption of light.

VX₂ tumor was transplanted in the cortex of rabbits and 4 days after the transplantation, 2 ml of 1% acridine orange solution was given intravenously. On the next day additional 2 ml of solution was given several hours prior to radiation. Laser was 200 mW exit energy at 4880Å of wave length. Laser irradiated on the dural surface in the tumor-implanted area through a burr hole for 10 sec to 15 min. Animals were sacrificed one week after the radiation. Histological examination revealed that well-delineated necrotic lesion had been made in the irradiated tumor tissue. The lesion made by radiation for 25 sec was 2.2 mm in width and 1.9 mm in depth, while radiation for 10 sec produced small lesion. However prolonged radiation for 15 min could not increase the bulk of lesion so much.

Less damaged lesions were found in tumor tissues irradiated by laser without dye. Photosensitizing effects of dye was proved in brain tumor by laser radiation, although laser with exit energy of 10 joule/cm²/sec has thermal effect on irradiated tissues. One of the characteristic histological findings was pleomorphic changes of tumor cells in surrounding area of necrotic lesion. It must be clarified in further investigation that those pleomorphic changes indicate either malignant or degenerative.