ONCOLOGY

Stimulation of the Growth of Human Tumor by Low-Power Laser Irradiation

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We studied the effect of low-power laser on the growth of human gastric adenocarcinoma transplanted to athymic mice. Irradiation shortened the latency of tumor growth in recipients from 4-6 months to 21-24 days. After 17 serial passages on athymic mice, the size of tumor node in irradiated recipients on day 33 after transplantation was 161.1 mm^3 (vs. 10.2 mm^3 in nonirradiated mice). These findings suggest that low-power laser irradiation can stimulate the growth of metastases in patients with a history of malignancy.

Key Words: *low-power laser; transplanted tumors; angiogenesis; metastases*

The growth of human tumor tissue isolated during surgery and transplanted to immunodeficient nude mice starts sometimes several days, sometimes several month after transplantation. This latency depends on the angiogenic potential of the transplanted tumor, *i.e.* on its ability to stimulate the growth of blood vessels into the transplant [1]. The formation of new vessels starts from local lysis of the basement membrane of a recipient microvessel by endothelial proteases [6,7]. This induces proliferation and migration endothelial cells toward the angiogenic stimulus and culminates in the formation of new capillaries [3].

During the last three decades low-power laser radiation was successfully used in the treatment of trophic ulcers and indolent wounds of diverse etiology, when traditional drug therapy was ineffective [2,4,5].

The aim of the present study was to evaluate the effect of low-power laser on the growth of slow growing human gastric adenocarcinoma transplanted to athymic nude mice.

MATERIALS AND METHODS

Experiments were carried out on 6-week old nude mice derived from BALB/c mice. In series I, tumor tissue was taken from a patient with stomach cancer SC-1. In series II, the recipient mice received SC-1 tumor cells after 17 serial passages on nude mice.

Tumor tissue was promptly and thoroughly minced with scissors under aseptic conditions, suspended 1:1 in MEM, and injected subcutaneously to nude mice in a dose of 0.5 ml/mouse.

Injection sites were irradiated with an ODER He/Ne laser (633 nm, 3.5 J/cm^2) on days 1, 3, 5, 8, 10, 12 after transplantation.

RESULTS

Tumor material obtained from a patient with adenocarcinoma SC-1 was injected to 8 nude mice; four of them were irradiated with low-power laser. The latency (time between injection and tumor growth) was 4-

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6 months in nonirradiated mice and 21-24 days in irradiated mice.

In series II, SC-1 after 17 serial passages in nude mice was injected to 11 mice; five of these mice were irradiated and six were not irradiated. In irradiated mice the mean tumor size on day 33 after transplantation was 161.1 mm^3, whereas in nonirradiated mice this parameter was 10.2 mm^3 (Fig. 1).

Normally, the time between transplantation and the start of growth in the recipient for human tumors decreases during serial passages in nude mice to a certain limit characteristic of the given tumor, and further serial transplantation does not change this latency [1]. Shortening of this latency during the first few passages can be explained by the fact that the percentage of transplanted tumor cells capable of stimulating angiogenesis increases during this period to a level characteristic of the given tumor.

In our experiments low-power laser irradiation clearly stimulated the growth of transplanted human tumor in nude mice. It can be hypothesized that irradiation affects endothelial cells in recipient vessels either directly, or by stimulating production of angiogenic factors by transplanted cells and recipient fibroblasts. Previous studies showed that low-power laser irradiation stimulated the release of angiogenic factors such as basic fibroblasts growth factor (bFGF), transforming growth factor (TGF), and platelet-derived growth factor (PDGF) from fibroblasts [8].

Our findings suggest that low-power laser irradiation, an effective method of treating trophic ulcers and indolent wound, should not be used for patients with a history of malignancy, because of potential stimulation of metastasis growth.

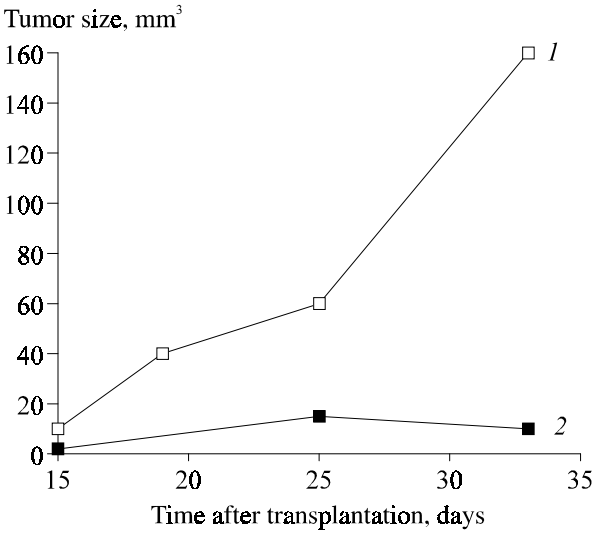

Fig. 1. Effect of low-power laser irradiation on growth of human gastric adenocarcinoma SC-1 (17th passage) in nude mice.

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