

EXPERIENCE OF USING MALAKHIT LASER DEVICE IN CLINICAL PRACTICE

V.A. Evtushenko, B.N. Zyryanov, and A.N. Soldatov

*Scientific-Research Institute of Oncology,
Tomsk Scientific Center,
Siberian Branch of the Russian Academy of Medical Sciences, Tomsk
Tomsk State University
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The paper presents some results of 10-year treating of cancer patients as well as patients with gastric ulcer by the low-energy copper-vapor laser. The experience of using a "Malakhit" laser in oncological dispensaries of Siberia and Far East is summarized.

The methods of treating tumor diseases remain traditional during the last half century. They are operation, irradiation, and chemotherapy. In spite of permanent development of these methods, the results of five-year survivivity and patients' life quality do not satisfy oncology physicians. Operative interventions, radio- and chemotherapy lead to serious disturbances of various functions of an organism. The disturbances are aggravated in oncology patients due to initial decrease of reserve and adaptive capabilities.

At present there is observed an avalanche-like extension of using low-intensity lasers in medicine. All the branches of clinical medicine are embraced, and only oncologists keep restrained relation to laser therapy. Literature data about the application of lasers in medicine elucidate mainly the influence of He-Ne lasers to purulent processes, dystrophical disorders, vessel disturbances. Unique properties of laser radiation in accelerating reparative processes with stimulating cell proliferation are described. But the probability of simultaneous tumor growth stimulation induces care and higher caution in applying low-energy laser radiation in cancer patients.

The possibility of applying low-energy lasers in oncology clinics is studied at the Scientific Research Institute of Oncology, Tomsk Scientific Center, Siberian Branch of the Russian Academy of Medical Sciences, during more than 10 years. The experimental copper-vapor laser device "Milan" with which the experimental and clinical tests have begun was designed at the Institute of Atmospheric Optics, Siberian Branch of the Russian Academy of Sciences. It was found that a copper-vapor laser operating in a pulse mode at a power of 20–300 mW hinders the growth and metastasizing of a tumor and possesses a pronounced anti-inflammatory action and the ability to enhance the tissue regeneration. The physiotherapeutic device "Malakhit" based on a small-sized copper-vapor laser was designed at the laboratory of laser physics of the Tomsk State University for clinical tests. The "Malakhit" device possesses such positive advantages as low energy consumption, small size, single phase line, absence of water cooling what makes it possible to

remove it to a dressing ward or an operating room. The device consists of a power source generating high-voltage pulses (up to 10 kHz repetition rate) which are applied to electrodes of the gas-discharge tube. The "Malakhit" device has a two-channel laser radiation output with separation of generation wavelengths (510.6 and 578.2 nm) in different optical channels and mixed radiation in one of the channels. There is an exit of a laser beam to a waveguide what enables one to drive the radiation to stomach, bronchi, intestine by endoscopes. The output power can be regulated from 50 to 300 mW. Simplicity in control, automatic transition to operating regime make the device accessible for many users.

597 patients have been treated in the clinic of the Scientific Research Institute of Oncology (Table I). They underwent 6354 laser radiation seances including the treatment of pre-cancer and chronic stomach diseases in 260 patients, prophylaxis and treatment of post-operative complications in 87 lung cancer patients, correction of post-operative disturbances in 81 stomach cancer patients, prevention and treatment of radiation complications in the skin and mucous membrane in 143 patients with head and neck tumors, 15 breast cancer patients, 11 patients with tumors of ossa and soft tissues.

TA" LE I. Groups of patients two underwent laser therapy.

Disease	Amount	Effect
Stomach and duodenum ulcer	260	Treatment of the prior disease
Lung cancer	87	Prophylaxis and treatment of postoperative complications
Stomach cancer	81	Correction of post-resection disturbances
Slead and neck tumors	143	Prophylaxis and treatment of radiolesions of the skin and mucous membranes
Breast cancer, tumors of ossa and soft tussues	15 11	

Laser therapy of stomach ulcer was performed in patients for whom medicamental treatment during more than 3 months was inefficient. Some patients were unsuccessfully treated for 2–3 years. In more than 80% morphological examination of gastrobiopsates in the edge of the ulcer exposed epithelium dysplasia of II–III stage what is related to pre-cancer state of mucous membrane. Before the treatment, large ulcers with necrotic bottom and dense uneven edge were described at fibergastroscopy. After 1–2 procedures the patients noted a decrease or a complete disappearance of pain and sickness, recovery of appetite. Observing the laser action to ulcer defect during the treatment seance one can separate the following healing stages: cleaning of the ulcer bottom, massive vascularization of the ulcer bottom and edges, crawling of epithelium from the edges and appearance of epithelium islets on the bottom of the ulcer up to full epithelization with a slight scar deformation of the wall of the stomach and the duodenum. Microscopy examination of gastrobiopsates from the zone of the healed ulcer demonstrates that the recovered cells and glands are functionally active. A good clinical effect was obtained in 93% patients; as to other patients, we succeeded in decreasing the ulcer defect; the inflammation of the surrounding mucous membrane was liquidated, and so the patients were made ready for operation.

Anastomositis, reflux gastritis, reflux esophagitis arise in patients after the operation for stomach cancer in 15–35% of cases. These disturbances cause terrible sufferings to patients and create unfavorable background for the processes of post-operative adaptation, shorten the life time, sometimes they are the direct cause of death. Such patients got the laser therapy both in the early postoperative period and in postponed dates. The anastomositis zone and the mucous membrane of the stomach stump were radiated under the endoscope monitoring. After 5–7 seances, the exhausting pain disappeared, the patients felt better. The gastroscopy demonstrated the recovery of the closure function of the anastomosis what prevented pathological refluxes and promoted the liquidation of the inflammation in the rest part of the stomach.

Analyzing the treatment results in this group of patients one can say that we have improved the life quality by laser radiation without tumor recurrences and metastasizing stimulation. Only one woman with the third stage of stomach ulcer died of metastases 2 years later after the operation; other patients outlived a five year term. According to literature data, the five-year survivivity with II–III stage of stomach cancer is no more than 40%.

Surgical treatment still remains the main method of treatment of non-small-cellular lung cancer. The results of a treatment depend to a large extent on the course of the post-operative period. For instance, complications dangerous to life appeared in 16–20% of patients operated for lung cancer.

Attendant non-specific diseases of lungs with disturbances of the drainage function of bronchi leading to post-operative pneumonies, atelectases, bronchial fistulas, and pleura empyemae cause essential influence to the frequency and character of post-operative complications. The complications are developed much more frequently on the background of chronic bronchitis at which one has metaplasia of the bronchial epithelium leading to the disturbance of the clearance function because of the decrease of the ciliary motions of the respiratory epithelium and mucous glands' work. The aggression of pathogen flora in the aperture of the bronchial tree is gaining ground. The oedema of the mucous membrane deteriorates the trophism and valuable blood supply of tissues what influences the healing of bronchi stump after the operation. So it is important to make the patients ready for the operation carefully trying to normalize the main functions of bronchi.

We performed 275 seances of endoscopic laser therapy in 87 patients operated for lung cancer afterwards. Check analyses revealed disappearance of pathogen microflora in bronchus secretion, the oedema and hyperemia of the mucous membrane of bronchi visually decreased what is confirmed by morphological examination of biopsates. The drainage function of bronchi assessed by determination of mucociliary clearance was improved. As a result, we have observed a 2.5 times decrease in complications in comparison with the group where the patients got only medicamental treatment (reference group). Moreover, the complications were liquidated considerably faster in patients with laser sanitation as compared with the patients from the reference group.

The patients of head and neck tumors, breast cancer, locomotor apparatus tumors are subjected to combined treatment (photon-neutron therapy + operation), or they undergo only definitive radiotherapy. At photon-neutron therapy one frequently observes early and late radiolesions of normal tissues in the irradiated zone. The development of acute radioreactions in the skin and mucous membranes obliges the radiologists to interrupt the course of radiotherapy what unfavorably influences the state of tumor process and promotes repopulation of tumor cells and radioresistance. Radiolesions of normal tissues lay obstacles to the performance of the operation.

Prophylactic treatment by low-energy copper vapor laser irradiation was performed in 169 patients who underwent radiotherapy. Radiotherapy was performed on the basis of a U-120 cyclotron with the energy of 6.3 MeV. A single dose was equal to 2–2.2 Gy. Photon therapy was performed by a "Rokus-M" device with a single dose of 60–65 Gy. The laser irradiation was performed during the whole course of neutron-photon therapy within the next 2–3 hours after it. We obtained the decrease of radio complications and their heaviness (Table II).

TA" LE II. Frequency of radio complications in the skin (%).

Complications	Radiotherapy	Radio+laser therapy
Erythema	44	16
Dry epidermitis	39	9
Moist epidermitis	17	6
Total	100	31

Radioreactions were absent in 69% patients who got laser protection, and the complications appeared in

a group of patients with laser therapy took place only at full irradiation dose at the end of treatment what enabled us to complete the course of radiotherapy without any interruption.

The treatment of oncology patients is being performed by our methods with Malakhit device in Barnaul, Tyumen', Omsk, Noril'sk, Kemerovo, Blagoveshchensk, Ulan-Ude during 5 years. More than thousand patients have been treated with positive results.