EXPOSURE TO COPPER-VAPOR LASER AS PROPHYLAXIS OF RADIATIVE AGGRAVATIONS IN PATIENTS TREATED FOR HEAD OR NECK TUMOURS

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Possibilities are studied of using radiation of a copper vapor laser for prophylaxis of radiative aggravations in patients suffering from head and/or neck tumours. 114 such patients were treated. A Malakhit laser was used for this study. It was shown that treating patients with laser radiation significantly reduces radiation reactions of skin and mucous membranes, so that a full course of radiation therapy may be performed without any forced breaks and treatment of maladies of epidermis and epithelium caused by radiation may be shortened.

Tumours of head or neck represent up to 10% of the total radiopathologies, about 50-60% of such patients starting treatment at the third or fourth stage of the disease.[3] That is why radiotherapy is the leading technique in treating tumours of such localization. Early or delayed radiolesion of normal tissues around the tumour exposed to radiation is often observed when using the neutron–photon therapy methods. Development of early acute radiation responses of skin and mucous membranes forces radiologists to interrupt radiotherapeutic course, which adversely affects the tumour process, provokes repopulation and develops radioresistance of tumour cells.

Radiolesions of normal tissues prevent combining neutron radiation treatment with surgical intervention.

We studied possibilities of using low intensity laser radiation (LILR) for prophylaxis and treatment of the acute radiolesions of skin and mucous membranes in patients with head and/or neck tumours.

The LILR stimulates activity of such enzyme systems as dehydrogenates of the Krebs cycle "old yellow" enzyme, adenosinetriphosphatre, acetylcholinesterase, and cytochromoxidate, as well as oxydoreduction and oxygenation of tissues, so that the process of tissue respiration improves. Laser radiation is favourable for intensification of synthesis of the nuclei acid and of structural and controlling proteins.[1,2] Stimulating bioenergy processes in the human body is one of the principal pre–conditions for mobilization of its intrinsic restoring forces necessary to recover after radiolesions.

The group of patients under study with local and metastasing tumours of head and neck consisted of 114 persons. These were subjected to fast neutron radiotherapy at the medical–biological complex at the Oncology Research Institute, based on the U–20 cyclotron at the Nuclear Physics Institute of the Tomsk Polytechnical University (TPU). Beam energy was 6.3 MeV. Targets for irradiation varied from 6×8 to 10×12 cm in size. A single dose of skin irradiation was 2–2.2 Gr.

The Rokus-M gamma–ray radiation apparatus was used for photon therapy at a single dose of 2 Gr. Cumulative exposure over a full course of radiotherapy reached 60–65 Gr.

A Malakhit laser physiotherapeutic unit built around a compact copper-vapor laser at the Laser Physical Laboratory at the Tomsk Polytechnical Institute was used for laser therapy. It operated in pulse-periodic mode at repetition frequency from 15 to 22 kHz (pulse duration 20–30 ns) at wavelengths of 510.6 and 576.6 nm and the output energy of 300 mW. Laser treatment went on throughout the whole course of neutron-photon therapy, its single dose reaching 2.8–3.2 J/cm^2. The efficiency of laser therapy was estimated from clinical indications, from data on skin electroresistance, from results of morphological treatment of skin bioptates, of subcutaneous fat, and of mucous membranes, as well as from thermograms taken by the TVTS–1 Raduga thermal mapper.

Results of these investigations are presented in Figs. 1 and 2. The main criterion used to assess the laser and radiologic effect on tissues was histologic data. Since the dose of ionizing radiation was the same for patients treated by radiotherapy only and for those under radiotherapy parallelled by laser irradiation we associated observable differences between the histological pictures (Figs. 3 and 4) with the effect of laser irradiation.

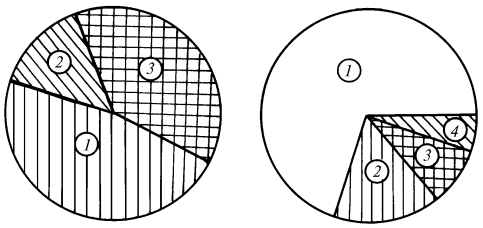

FIG. 1. Frequency of acute radioreactions of skin during radical neutron–photon therapy. 1) erythema 44%, *2) wet epidermitis* 17%, *and 3) dry epidermitis* 39%.

FIG. 2. Frequency of acute radioactions of skin during neutron–proton therapy accompanied by LILR. 1) no reaction 69%, *2) erythema* 16%, *3) dry epidermitis* 9%, *and 4) wet epidermitis 6%.*

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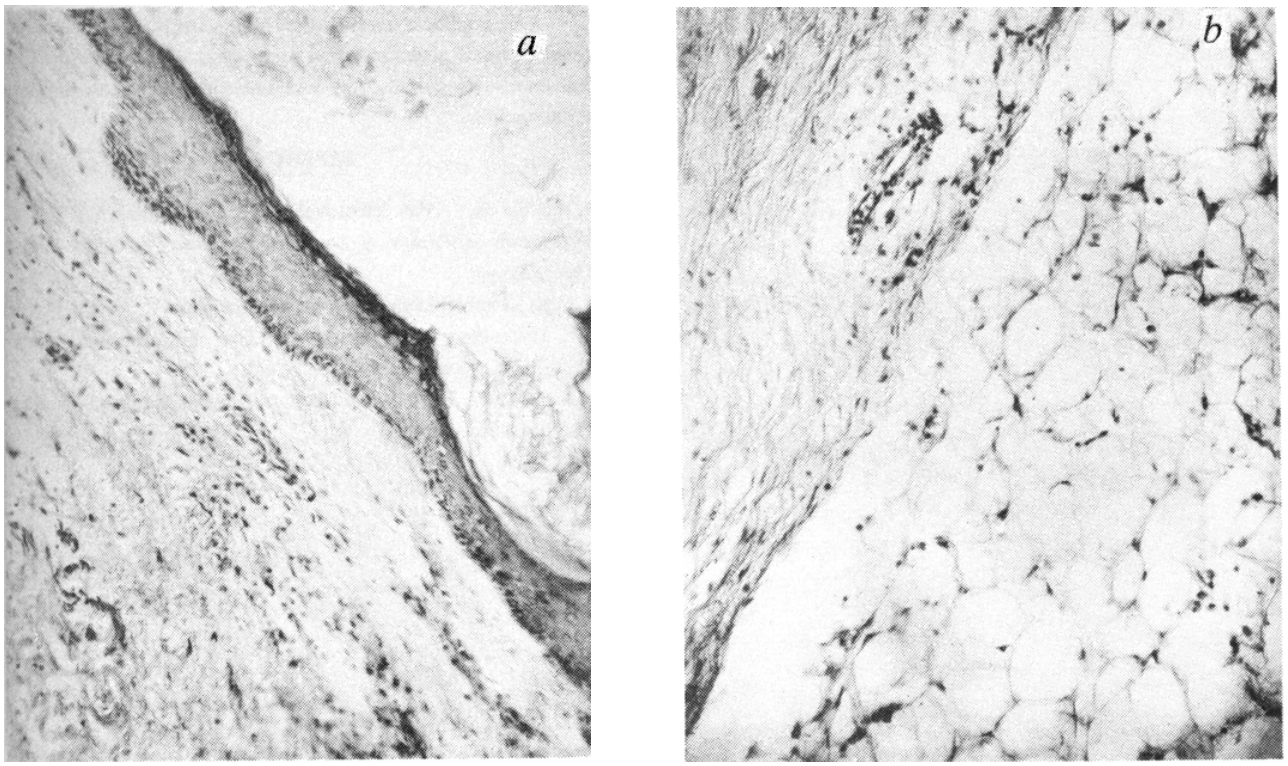

FIG. 3. Microspecimen. Changes in skin (a) and in subcutaneous fat (b), after a proton–neutron therapy course (in 3 days). Hematoxiline–eosine dve. 100 fold magnification.*

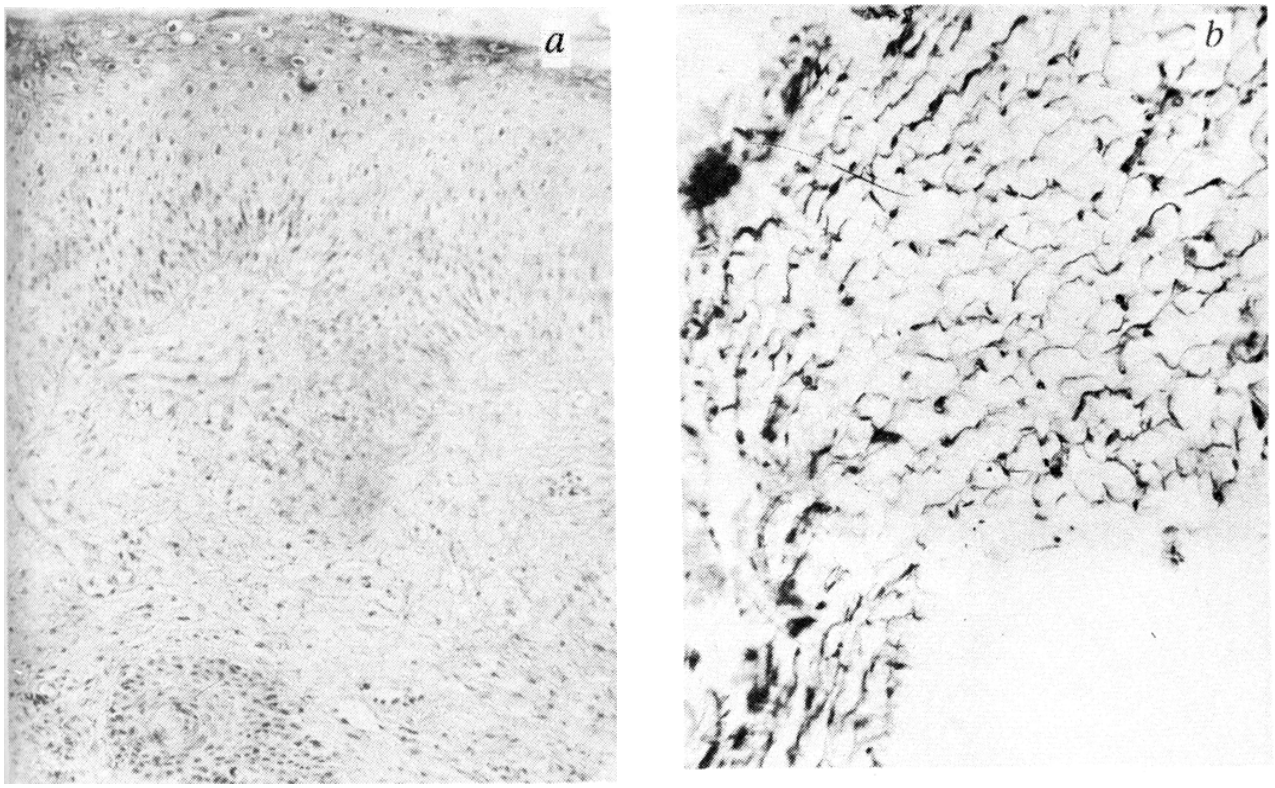

FIG. 4. Microspecimen. Changes in skin (a) and in subcutaneous fat (b) after combined course of photon–neutron and LILR therapy. Hematoxiline–eosine dye, 100 fold magnification.*

Changes seen in Fig. 3, may be characterized by pronounced edema, mucoid swelling, formation of extensive acantholitic cysts filled with unstructured masses. Significant lymphoid infiltrate with follicle formations is seen around the cysts. Vascular walls necrotize in places. Pronounced rough fibrosis is observable in every layer of skin and subcutaneous fat.

Following a course of laser therapy characteristic manifestations appear of reparative process. Numerous newly formed vessels may be observed through the moderately expressed edema and lymphoid tissues infiltrate, these vessels extending as slits. A phenomenon is noted of vessel budding together with extensive anastomosing of small vessels. Fibrosis is only slight and predominantly such fibrous tissues are fresh and of tender fibers.

Thus, clinical investigation shows LILR to be useable for prophylaxis of acute radiative aggravations. In some cases the full course of radiotherapy was not accompanied by any local radioreactions.

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