and a disturbance of the primary phase of enzyme synthesis at the nucleus–RER level, accompanied by a marked decrease in trypsin and amylase activity in the animals' blood serum (Table 1).

On morphological investigation 24 h after the operation focal disruption of the complex structure of the acini was still present, with basal orientation of the granules, and foci of necrosis were present in the cytoplasm of AC, but with reduced accumulation of ZG. Slight polymorphocellular infiltration was discovered in the interlobular connective-tissue stroma.

5-FU thus inhibits secretory activity, reduces the degree of destruction of AC, and inhibits inflammatory changes in the gland and the rise in the blood enzyme levels. It can be concluded from the results of these biochemical and morphological investigations that 5-FU can be used as an additional aid in the combined pathogenetic treatment of patients with pancreatic necrosis.

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EFFECT OF THE HELIUM–NEON LASER ON ULTRASTRUCTURE AND PROLIFERATION OF THE EPITHELIUM OF THE GASTRIC MUCOSA

I. M. Baibekov and É. Sh. Musaev

UDC 615.849.19:616.33-008.1-091

KEY WORDS: laser irradiation; stomach; ultrastructure; cell proliferation.

Year by year lasers are increasingly being employed in medicine. They are used in surgery to divide tissues [7] and also to coagulate them to arrest bleeding [4]. These uses have made it necessary to study morphological changes in the tissues under the influence of laser irradiation [2, 5]. Comparatively powerful sources of laser radiation with high energy density are as a rule used for these purposes. There is information that radiation of low-power helium–neon lasers has a stimulating action on wound repair processes [1, 3].

The object of this investigation was to study the effect of the helium-neon laser on proliferation and ultrastructure of cells of the gastric mucosa.

EXPERIMENTAL METHOD

Experiments were carried out on 20 male albino rats weighing 120-130 g. For autoradiographic investigation the animals were given an intraperitoneal injection of ^{3}H-thymidine at 10 a.m. in a dose of 0.5 μCi/g body weight. The peritoneal cavity was opened under ether anesthesia and the anterior wall of the stomach was irradiated with the LG-51-1 helium–neon

Department of Pathological Anatomy, Tashkent Branch of the All-Union Scientific Center for Surgery, Academy of Medical Sciences of the USSR.

(Presented by Academician of the Academy of Medical Sciences of the USSR A. P. Avtsyn.) Translated from Byulleten' Éksperimental'noi Biologii i Meditsiny, Vol. 92, No. 10, pp. 501-504, October, 1981. Original article submitted April 7, 1981.

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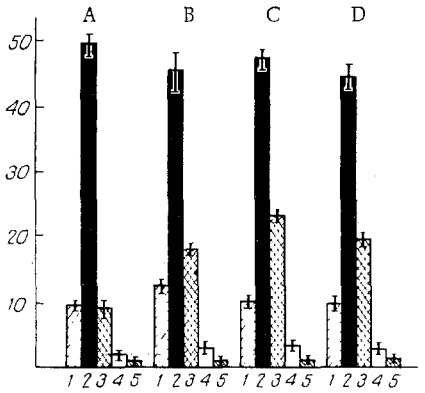

Fig. 1. Incorporation of ^{3}H-thymidine into cells of gastric mucosa during irradiation with helium–neon laser: 1) epithelial cells of gastric pits, 2) cells of cervical epithelium; 3) accessory cells, 4) parietal cells, 5) chief cells. A) Control, B) irradiation for 1 min, C) for 3 min, D) for 5 min. Ordinate, incorporation of ^{3}H-thymidine (in % of control).

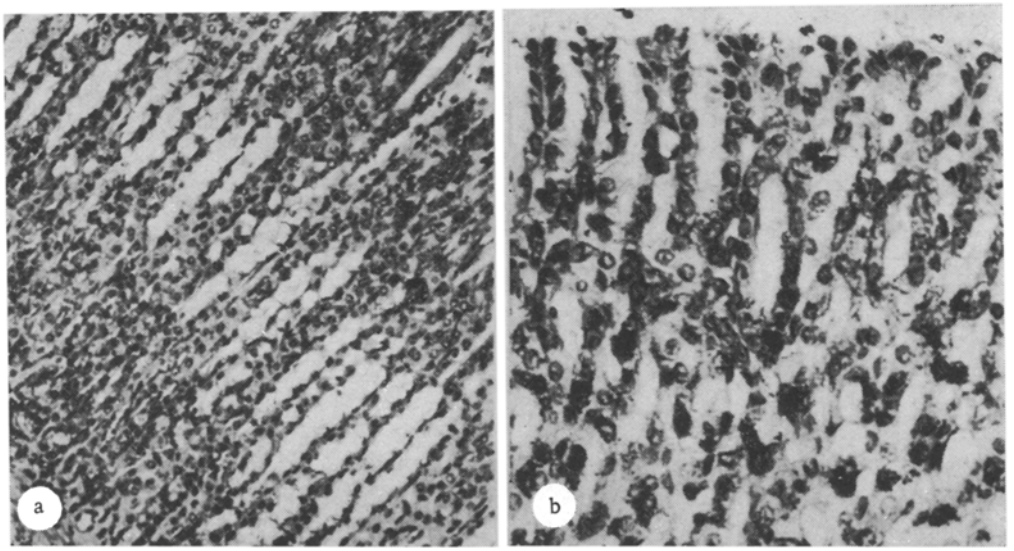

Fig. 2. Accumulation of mucoid in accessory cells (a) and incorporation of ^{3}H-thymidine into cervical and accessory cells (b) after irradiation for 5 min. Magnification: a) 63×, b) 200×. Stained with hematoxylin and eosin.

laser in a certain area of the fundal portion of its glandular part. Irradiation began 10 min after injection of ^{3}H-thymidine and continued for 1, 3, and 5 min. The wavelength of the radiation was 0.63 μ, its power 8 MW, and the diameter of the beam 0.6 mm and of the zone of irradiation 3 mm. The energy density of irradiation was 0.76 J/cm^2 for an exposure of 1 min, 20.34 J/cm^2 for 3 min, and 33.9 J/cm^2 for 5 min. The stomach of control animals was irradiated with white light under similar conditions and for similar exposures. The animals were killed instantly by decapitation 1 h after injection of 3 h-thymidine. Pieces of the fundal portion of the stomach from the zone of irradiation were fixed with 10% formalin by Lillie's method and paraffin sections were coated with type M emulsion. The index of labeled nuclei (ILN) of cells of each type in the fundal gland and epithelium of the gastric pits was determined by counting 1000 cells in longitudinal sections through the glands. Statistical analysis was carried out by the Fisher–Student method. Stomach tissue for electron-microscopic investigation was taken from animals receiving and not receiving ^{3}H-thymidine.

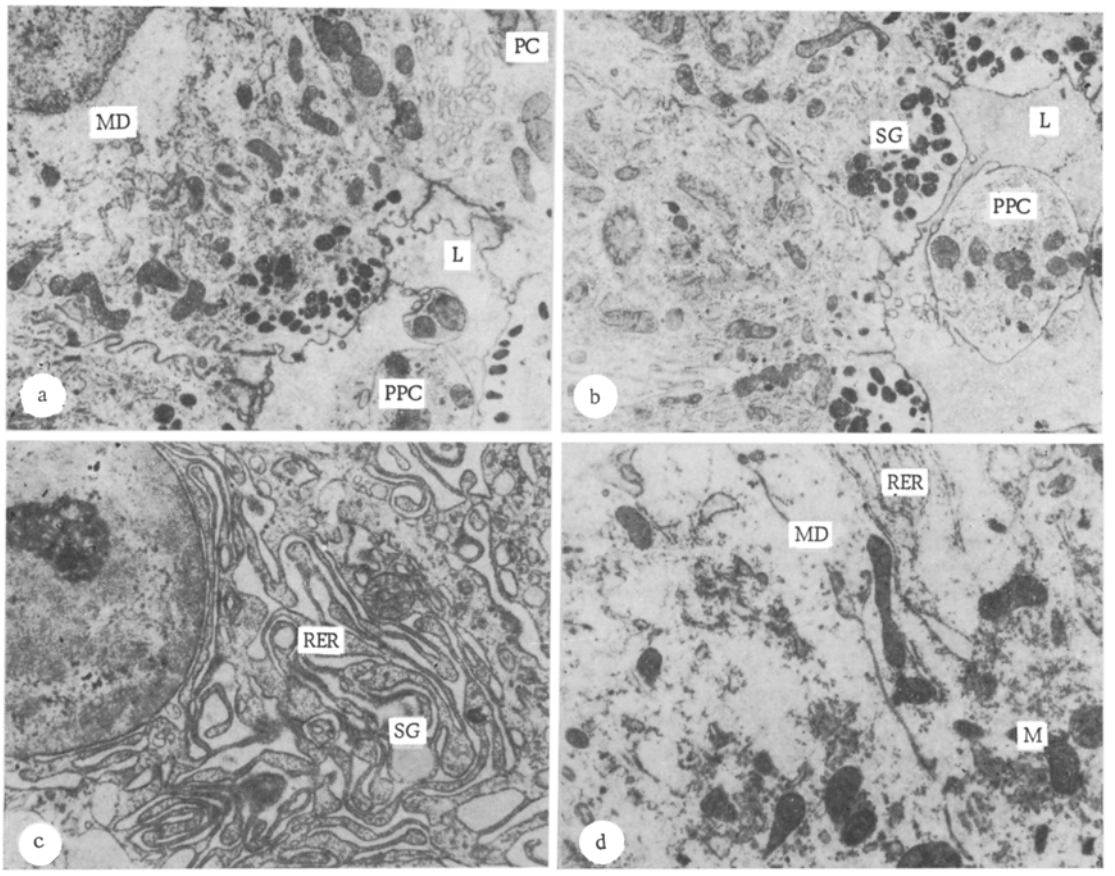

Fig. 3. Parietal and superficial cells of gastric mucosa. a, b) Parietal and superficial cells of gastric mucosa after irradiation for 3 min, c) chief cell of gastric mucosa after irradiation for 5 min, d) accessory cell of gastric mucosa after irradiation for 3 min. PC) Parietal cell, IST) intracellular secretory tubule, L) lumen of gland, PPC) part of parietal cell, SG) secretory granules, MD) mucoid, RER) rough endoplasmic reticulum, M) mitochondria. Magnification: a, b) 12,000, c, d) 15,000 ×.

Material was fixed in osmium tetroxide after prefixation with glutaraldehyde and embedded in Epon-Araldite mixture; sections were examined in the EMV-100L electron microscope.

EXPERIMENTAL RESULTS

After exposure to the laser for 1 min congestion of the blood vessels occurred in the gastric mucosa, reflected macroscopically as hyperemia of the stomach wall. The quantity of mucoid material in the accessory cells was increased. Autoradiographic investigations showed that even a short exposure (1 min) of the stomach wall to the laser led to a significant increase in ILN of the accessory cells (Fig. 1) from 9.3 ± 1.6% in the control animals to 17.7 ± 1.1% in the irradiated animals. ILN of other types of cells showed no significant change. The greatest changes were observed in the fundal glands of the stomach after exposure to laser radiation for 3 and 5 min. Accumulation of mucoid secretion was observed in the accessory cells. This was particularly marked in cells located in the middle third of the glands. Translucency of the cytoplasm of the accessory cells on account of accumulation of mucoid distinguished the zone of concentration of these cells clearly (Fig. 2a).

Electron microscopy showed that the cytoplasm of the accessory cells 1-3 min after irradiation was filled with finely granular electron-permeable contents, numerous cross-sections through the rough endoplasmic reticulum, part of which was distended with contents, and mitochondria with a fairly dense matrix (Fig. 3d). The Golgi complex occupied a considerable area in these cells. Laser irradiation for 3-5 min caused a significant increase in the number of accessory cells incorporating circulating ^{3}H-thymidine. For instance, after 3 min ILN of the accessory cells was 23.4 ± 0.9%, i.e., increased by almost 2.5 times compared with the control. No marked differences were found between ILN of the other types of cells (Fig. 1).

Laser irradiation for 3-5 min caused some increase in the size of the vesicles in the parietal cells and a change in the shape of the microvilli of the intracellular secretory tubules. The appearance of fragments of parietal cells was observed in the lumen of the glands and of the pits (Fig. 2a, b), attributable to so-called clasmatosis [6]. Laser irradiation caused marked dilatation of the cross-sections of the rough endoplasmic reticulum in the chief cells with electron-permeable contents. An increase also was observed in the number of secretory polymorphic granules in the cytoplasm (Fig. 3c). In cells of the pit and surface epithelium of both control and irradiated animals, secretory granules of fairly high electron density were located in the translucent apical parts of the cytoplasm. In the same cells of irradiated animals electron-translucent contents similar to that in the accessory cells of the fundal glands accumulated in the basal parts. In some cells in the region of the neck of the glands this secretory material accumulated in the supranuclear region, by which they resemble the accessory cells of fundal glands (Fig. 3a, d). The lumen of the pits also was filled with this secretion. It can be tentatively suggested that laser irradiation causes an increase in mucoid formation by accessory and covering cells.

Irradiation of the stomach wall with a helium-neon laser thus causes an increase in ^{3}H-thymidine incorporation into the accessory cells and also changes in the intracellular structures of the epitheliocytes, evidence of stimulation of secretion formation in them.

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