Effect of Electromagnetic Radiation Modulated by Biostructures on the Course of Alloxan-Induced Diabetes Mellitus in Rats

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Exposure of rats with experimental diabetes mellitus to wide-band electromagnetic radiation generated by He-Ne laser and modulated by the pancreas and spleen is informing and phenomenological method prolonging animal life span, normalizing blood glucose level, and promoting regeneration of the pancreas.

Key Words: *alloxan-induced diabetes mellitus; laser exposure; wide-band electromagnetic radiation*

The mechanisms of storage and transfer of regulatory genetic information during embryonic and fetal development are a fundamental problem. We evaluated principal possibility of stimulating regeneration of the pancreas in rats *in situ* using wide-band electromagnetic radiation (WER) modulated (through photons) with a preparation of the pancreas from rats of the same strain. To this end, we studied the effect of WER modulated by biological structures on the course of experimental diabetes mellitus (DM) in Wistar rats.

MATERIALS AND METHODS

Wide-band electromagnetic radiation was generated by He-Ne laser and modulated by biological structures by our technology. He-Ne laser (2 MW power, of 632.8 nm wavelength) has two superposed orthogonally linearly polarized single-frequency radiation modes. Fresh preparations of the pancreas or spleen from a newborn Wistar rat were applied onto a slide and placed on the optical axis of laser beam. The slide with the preparation was adjusted to provide partial reflection of the beam into the laser resonator. Due to this multipassage mode, the preparation acts as an optical correlator and regulates the distribution of secondary modes of the laser. Two spatially separated modes with perpendicular polarization were used for registration of the correlation signal. Optical signals were recorded and transferred into electric circuit regulating laser generation regime, in which mode intensities were compensated best of all. In this regimen, the laser generates WER depending on the exposed biopreparation. The distance between the preparation and laser active element was 11 cm. Laser beam photons at counter-current beams were modulated by the preparation, including modulation by two orthogonally polarized components of radiation.

Experiments were carried out on adult male Wistar rats (5-6 months, 180-220 g). Experimental DM was induced in animals with normal blood glucose levels by intraperitoneal injection of 1.0± 0.2 ml alloxan (200-300 mg/kg) after 24-h fasting. The animals were divided into 3 groups (10 animals per group): 1) control without WER; alloxan 200 mg/kg; 2) WER; alloxan, 200 mg/kg; 3) WER; alloxan, 300 mg/kg. Group 2 animals were placed

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at a distance of 70 cm from WER source (laser), group 3 ones at a distance of 20 m from laser in a partially shielded room (basement floor).

The course of irradiation in group 2 started on day 3 after alloxan injection, in group 3 on the day of alloxan injection. The animals were exposed to 30-min WER sessions daily for 4 days according to the following protocol: 10 min WER after laser beam passage through pancreatic tissue preparation; 10 min WER after laser beam passage through splenic tissue preparation; 10 min WER after laser beam passage through pancreatic tissue preparation.

General state of the experimental animals was evaluated; the day of death after alloxan injection was recorded in all groups. Experimental animals were observed for 1.5 months after alloxan injection. The reproductive function was evaluated in 5 rats with maximum elevation of blood glucose levels after alloxan injection (3 rats from group 2 and 2 from group 3).

Blood glucose level was measured by Ascensia Entrust glucometer (Bayer) in the 2.0-30.6 mmol/liter range.

Heart, lung, liver, kidney, spleen, and pancreas tissues were collected for macroscopic examination and histological study: on day 3 after alloxan injection in controls, which corresponded to the day of maximum mortality; 1 day after the last WER exposure in groups 2 and 3, which corresponded to day 7 after alloxan injection in group 2 and to day 4 postinjection in group 3; and on day 42 of experiment in survivors. Tissues for histological study were fixed in 10% neutral formalin, dehydrated in ascending alcohols, and embedded in paraffin. Paraffin sections (5-7 μ) were made on a Leica SM 2000R microtome, stained with hematoxylin and eosin, and analyzed under a Leica DMLS microscope. Videoimages were obtained on a videosystem with CCD camera.

RESULTS

The use of subtoxic doses of alloxan in the control group promoted the development of DM complicated by toxic involvement of many vital organs and systems, which determined high mortality (70%) as early as on day 3 (Fig. 1). Blood glucose level did not spontaneously reduce during the period of observation.

The exposure to WER clearly modified the course of experimental alloxan DM in group 2. The peak of glucose level was recorded on day 3 (25.21±1.03 mmol/liter), differing significantly ($p<0.05$) from the initial level (5.70±0.30 mmol/liter). On day 7, glucose level significantly decreased to 6.75±0.60 mmol/liter in comparison with the level before WER exposure ($p<0.05$). After WER exposure, blood glucose level decreased significantly in 80% animals; 20% animals died with pronounced hyperglycemia on days 6-7 after alloxan injection, which differed from the control group (Fig. 1). One day after the last WER exposure (on day 7 of experiment) blood glucose level was normal (5.56±0.12 mmol/liter) in 3 rats.

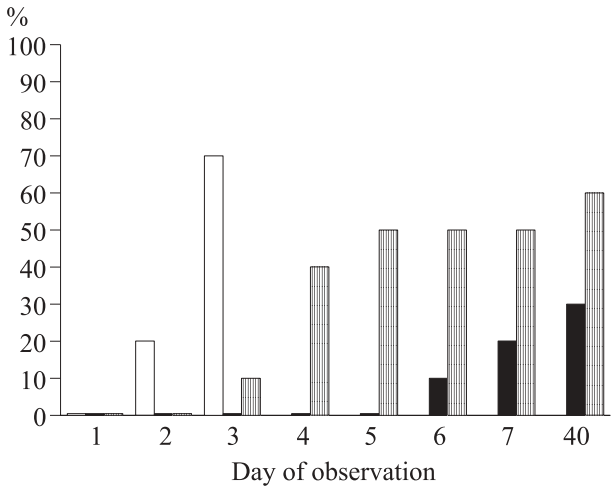

Fig. 1. Effect of WER exposure on the mortality of animals (%) with alloxan DM. Light bars: group 1; dark bars: group 2; cross-hatched bars: group 3.

Five survivors were observed for 1.5 months. The reproductive function was evaluated in 3 rats. One rat had no progeny and died on day 40 after alloxan injection, this differing significantly from the control group (Fig. 1). Two other rats had normal progeny: 14 and 11 pups. Tissues for pathomorphological study were collected from 4 survivors 1.5 months after alloxan injection. Blood glucose level in these animals was <10 mmol/liter.

Exposure to WER modulated the course of alloxan DM in group 3 rats. The mortality differed from group 2 and control (Fig. 1). Despite higher dose of alloxan, the life span in this group was longer than in the control. The mortality in group 3 on day 4 after alloxan injection was 50% of the control. Fluctuations in blood glucose levels from normal to maximum values (>30.6 mmol/liter) were observed in 2 rats of group 3 during a long (1.5 months) period of observation. A similar picture was observed in 1 rat from group 2. Despite obvious hyperglycemia during the entire period of observation, the status of these animals was satisfactory, they remained active and survived for 40 days after alloxan injection. One day after the last exposure to WER (on day 4) two animals were sacrificed and tissues were collected for pathomor-

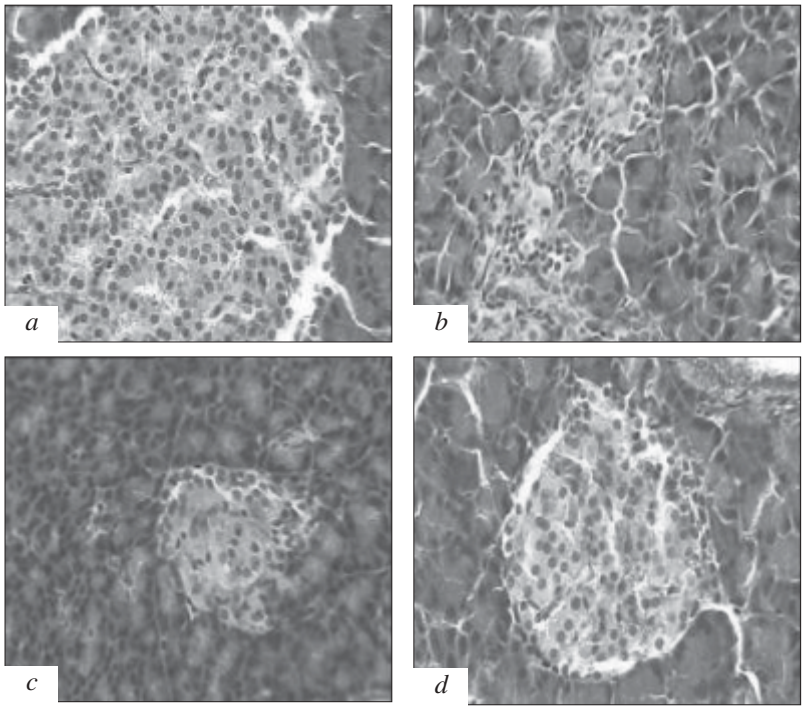

Fig. 2. Pancreatic tissue structure, Langerhans islets. *a*) intact rats; *b*) control, after alloxan injection in a dose of 200 mg/kg; *c*) group 2 rats on day 7 after alloxan injection in a dose of 200 mg/kg and 1 day after WER exposure; *d*) group 2 rats 1.5 months after alloxan injection and WER exposure. Hematoxylin and eosin staining, ×400.

phological study. The remaining 3 rats were observed for 1.5 months. The reproductive function of 2 animals was evaluated; it was reduced.

Histological study of the pancreas revealed some specific features (Fig. 2). Pronounced degenerative changes in Langerhans islets were detected in animals with alloxan DM (Fig. 2, *b*). The number and size of the islets were reduced, their shape was irregular. The number of β-cells in the islets was sharply reduced; vacuolation of the cytoplasm, decreased nuclei, chromatin condensation were observed in the majority of them; karyopyknosis was seen in some cells. Lymphocytic infiltration was seen around and inside some islets. Histological picture of the pancreas in group 2 on day 7 after alloxan injection was characterized by signs of functional strain, in contrast to preparations from the control group. The nuclei were mainly intact (Fig. 2, *c*). The presence of numerous small islets of regular shape and normal histological structure near the blood sinuses and ducts 1.5 months after alloxan injection presumably indicate activation of the regenerative processes in the pancreas (Fig. 2, *d*).

The quantum nonlocality principles (confusion) of morphogenetic information, linked with the polarization (spin) modulation of laser beam photons and subsequent transformation of photons in WER, are presumably realized in this act [1,2]. To a certain measure this is confirmed by recent results of effective "information input" (rendering new properties) of different substances directly into the brain of volunteers by means of confused spin states [3]. Pulsed magnetic field, photoflash, UHF radiation, and red laser were used for creating "confused states" between the nuclear spins of active substances (morphine, chloroform, deuterochloroform, diethyl alcohol, nicotine, caffeine, *etc.*) atoms and brain matter nucleus spins [3].

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