SCANNING ELECTRON MICROSCOPY OF THE RAT ADRENAL GLAND AFTER SURGICAL LASER EXPOSURE

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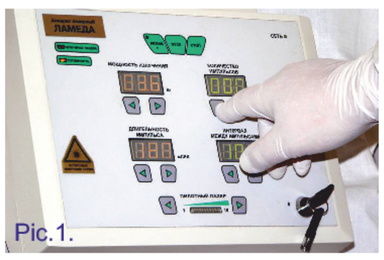
INTRODUCTION

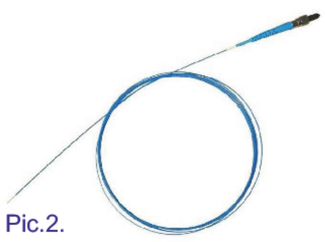
The increasingly widespread use of lasers in surgery explains significant interest in studying this method. Meanwhile, reaction of the tissues and organs to the laser damage remains still insufficiently studied (Welch & van Gemert 2011). Adrenal gland in this regard is no exception: its laser surgery has more than a quarter-century history (Gambarin et al. 1988), but the detailed fundamental studies of the reaction of the adrenal gland to laser damage have appeared only recently (Kemoklidze & Tiumina 2013a, 2013b, 2014; Kemoklidze et al. 2013). Information in the scientific literature on the assessment of the effects of laser effects on adrenal glands with a scanning electron microscope (SEM) is missing. That is the purpose of the present work.

PURPOSE

The study evaluated the effects of laser ablation of adrenal glands and results of regeneration using low-vacuum scanning electron microscopy for modeling the effects of laser ablation on pathological focus in the adrenal glands.



Pic.1.


Pic.2.

Pic.1. A diode surgical laser device "Lamy"

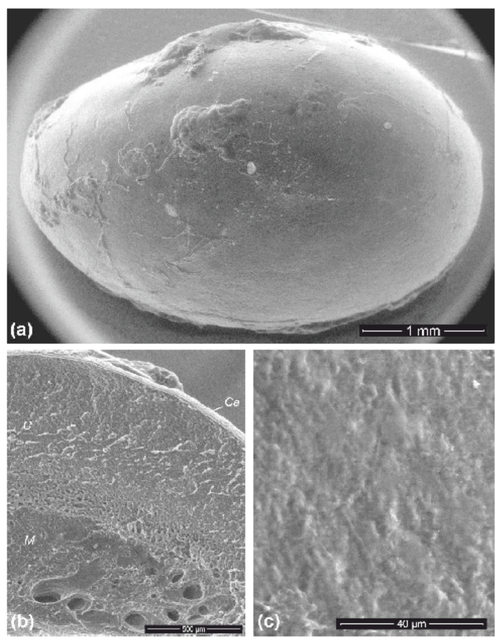
Pic.2. A optical fiber - 400 μm in diameter

MATERIALS and METHODS

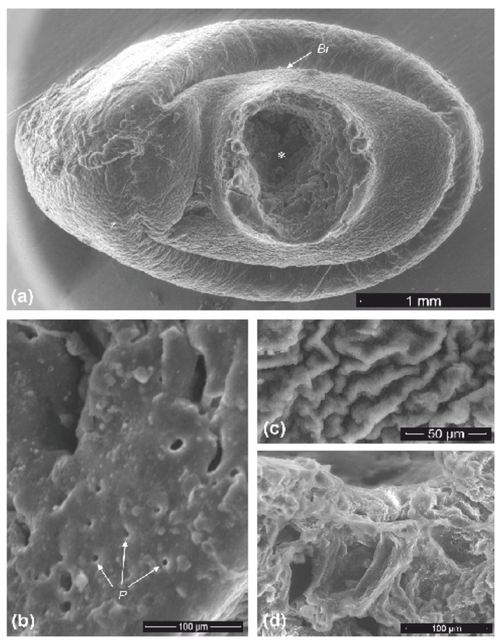
A study performed on the rats (n=19, male, Wistar line) with weighing 335.3 ± 24.9 g. At 14 of them (control 5 intact rat) under general anaesthetic was performed local laser ablation part of left adrenal gland. For damages used surgical Laser apparatus "Lami" (pic.1) with standard options for parenchymatous organs: point action quartz with polyamide-coated optics (pic.2) with a diameter of 400 μm (wavelength-1020 nm radiation power-2.5 watts). Energy exposure amounted to 70 DJ. The adrenal glands were researched without the laser exposure, immediately after it and 1 month later.

RESULTS

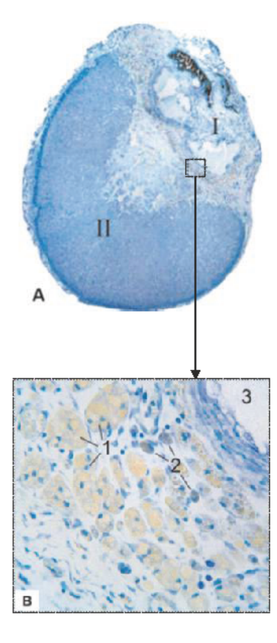
The shape of the intact rat adrenal glands is a prolate spheroid of 10.3 ± 2.5 mm3 in volume and with uniformly convex matte surface (pic.3).
Immediately after exposure occurs laser ablation crater with rough edges and melted surface (pic.4). It is penetrated by equidistant pores which are footprints of blood vessels. Beneath of the surface are numerous vaporization bubbles. Around the crater the surface wrinkles and sags due to decreased ability to retain water. Through 1 month after the laser damages in the affected area is determined by a scar (pic.5). Among the big bundles of collagen fibers determined by amorphous chunks of coal and caverns. Tissues with normal structure are detected near to the scar, both inside of the adrenal gland and the tissues around her. The wrinkling and the sagging are absent. The undamaged part of organ has retained the previous shape and structure without hypertrophy, the damaged part the adrenal gland reduced (pic.6).



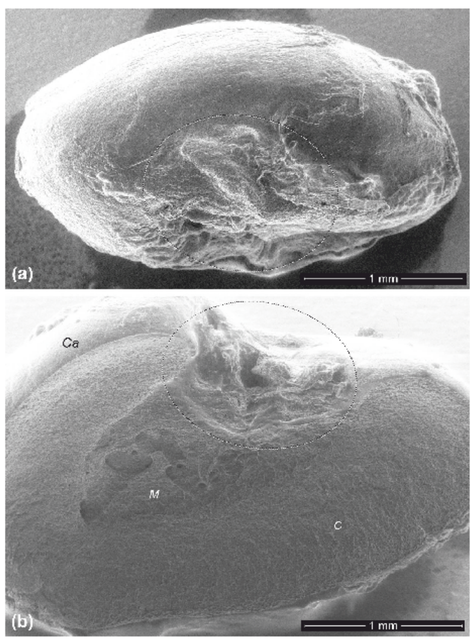
Pic.3.



Pic.4.



Pic.5.



Pic.6.

Pic.3. The intact rat adrenal gland. General view (a), a fragment of longitudinal section (b) and the capsule surface (c). M - medulla; C - cortex; Ca – capsule.
Pic.4. The rat adrenal gland immediately after the surgery laser exposure. General view (a), the surface of the ablation crater (b), the capsule surface around the ablation crater (c) and the spongy area under the ablation crater surface (d). * - point of the impact; Br - border of the damage area; P - equidistant pores.
Pic.5. Adrenal gland by 28 days after laser impact: I –area necrosis; II – survival area; 1 – giant polynuclear cells; 2– mononuclear macrophages ; 3 – cavity cyst. Fix. Glut. aldehyde, Honore coloring . A – Ob. 4×, B – Ob. 40×, photo attachment 27×.
Pic.6. The rat adrenal gland 1 month after the surgery laser exposure. General view (a) and longitudinal section (b). Dotted ellipse - lesion area substituted by scar tissue; M - medulla; C - cortex; Ca – capsule.

CONCLUSION

The nature of the regeneration processes indicates a low probability of a relapse after the destruction of a pathological focus in the adrenal after the surgical laser ablation.