

---

## METHODS

---

# Ultrasonic Model of Acute Pancreatitis

S. V. Morozov, V. L. Poluektov\*, V. T. Dolgikh, and B. A. Reis\*\*

Translated from *Byulleten' Eksperimental'noi Biologii i Meditsiny*, Vol. 140, No. 12, pp. 705-706, December, 2005  
Original article submitted February 7, 2005

---

Acute pancreatitis was modeled in outbred albino rats by contact exposure of the pancreatic lobes to low-frequency ultrasound. This method induces focal destruction of the pancreas not accompanied by damage to the adjacent intact tissues. Morphological study showed microcirculatory disorders, parenchymatous edema, plethoric vessels with diapedetic and focal hemorrhages, and small foci of hemorrhagic impregnation and steatonecrosis in zones locally exposed to low-frequency ultrasound.

---

**Key Words:** *acute pancreatitis; simulation; rats, ultrasound*

---

Treatment of patients with acute necrotic pancreatitis remains a pressing problem of urgent surgery [2]. Patients with acute pancreatitis constitute 5-10% of all surgical inpatients, and this patient population is still increasing [3,5]. Acute pancreatitis is a necrotic condition with the development of severe toxic and septic complications [1] requiring timely treatment [4]. Several experimental models of acute pancreatitis are known, which do not fully correspond to clinically observed structural and functional metabolic manifestations of pancreonecrosis. In the present study an attempt was undertaken to creation of a model of pancreonecrosis maximally similar to this condition in humans.

## MATERIALS AND METHODS

Experimental acute pancreatitis was modeled. Outbred male albino rats ( $n=7$ ) were subjected to laparotomy under ether narcosis; the duodenum and pancreatic lobes located between the mesenteric leaflets were exposed. The working piece of a

waveguide was delivered to the zone of planned destruction and contact between the headpiece and pancreatic lobe was attained, after which ultrasonic (US) medical device URSK-7H-22 was switched on and US destruction of the lobe was carried out at 26.5 kHz frequency, 25-40  $\mu$  amplitude for 2-5 sec, with waveguide instrument pressure 5-10 g, at intermittent sonication mode. Due to local quenching of US oscillations the zone of US application is exposed to a local thermal shock associated with coagulation of the pancreatic lobe directly under the radiating tip of the waveguide instrument and with high-frequency vibroshock mechanical destruction at the site of US exposure.

## RESULTS

For histological examination the animals were decapitated under ether narcosis 12 h after US exposure. Moderate volume of serous hemorrhagic exudate was detected in the abdominal cavity. Acute hemorrhagic pancreatitis eventuating in focal necrosis developed in zones exposed to US.

Morphological study of the pancreas showed microcirculatory disorders, plethoric vessels with diapedetic and focal hemorrhages, and parenchymatous edema. Small foci of hemorrhagic impreg-

---

Department of Pathophysiology with a Course of Clinical Pathophysiology, \*Department of Surgical Diseases No. 1, \*\*Central Research Laboratory, Omsk State Medical Academy. **Address for correspondence:** prof\_dolgikh@mail.ru. T. I. Dolgikh

nation and steatonecrosis were seen. These changes were detected mainly at the site of local exposure to low-frequency US. In other compartments of the pancreas minor or moderate circulatory disorders were seen. Edema and hemorrhages in the focus of injury were more pronounced and located around the zone of focal necrosis with signs of purulent melting in the center.

Polymorphonuclear leukocytes and macrophages predominated in the infiltrate. Swelling of endotheliocytes was seen in the adjacent capillaries. Pancreatic islets looked edematous. Solitary acinar cells with blurred contour and pale swollen nuclei and homogenous cytoplasm were discernible. The lumen of these acinuses was sharply stenosed and filled with protein mass. In other visual fields the insular epithelium was desquamated and the excretory duct wall adjacent to the necrotic zone was loosened with blurred contours, with focal destruction, which was paralleled by purulent infiltration.

Hence, the proposed method induces local injury to the pancreatic tissue without involving appreciable volumes of tissues, the injury being reproducible due to local US exposure. Moreover, the method provides the development of focal destructive process with minimum injuries to the adjacent intact pancreatic tissues and can be recommended for wide use in experimental studies.

## REFERENCES

1. N. A. Kuznetsov, G. V. Rodoman, A. T. Brontvein, *et al.*, *Khirurgiya*, No. 12, 22-27 (2004).
2. N. A. Kuznetsov, G. V. Rodoman, T. I. Shalaeva, *et al.*, *Nov. Med. Tekhnol.*, No. 7, 45-50 (2004).
3. V. S. Savel'ev, M. I. Filimonov, B. R. Gel'fand, and S. Z. Burnevich, *Consilium Medicum*, **3**, No. 6, 1-15 (2000).
4. A. D. Tolstoi, V. B. Krasnogorov, V. R. Gol'tsov, and V. G. Dvoinov, *Vestn. Khir.*, **160**, No. 6, 26-30 (2001).
5. J. P. Neoptolemos, E. A. Kemppainen, J. M. Mayer, *et al.*, *Lancet*, **335**, No. 9219, 1955-1960 (2000).