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LATE COMPLICATIONS OF BLUNT ABDOMINAL TRAUMA

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https://doi.org/10.5281/zenodo.22895582

Introduction. Blunt abdominal trauma remains a challenging problem in emergency surgery, particularly when the intestine and mesentery are involved. Although hollow viscus and mesenteric injuries occur in approximately 1% of blunt trauma cases, delayed recognition may lead to severe complications. Early clinical manifestations are often nonspecific, and the absence of intestinal perforation does not exclude significant mesenteric vascular injury or subsequent intestinal ischemia [7].

Materials and methods. The experimental study was conducted in laboratory rats using a model of closed abdominal trauma designed to produce predominantly intestinal and mesenteric injuries. Two levels of injury severity were reproduced by varying the number of impacts. Animals were allocated to four groups according to trauma severity and the treatment administered.

Experimental trauma model. Blunt abdominal injury was induced using a gravity-driven impact device. A 200-g weight was dropped from a height of 90 cm onto the middle and lower abdominal regions. Displacement of the anterior abdominal wall was limited to 2 cm to reduce the risk of spinal injury.

In the moderate-trauma model, a single impact produced intestinal wall contusions and mesenteric hematomas without bowel perforation or free intraperitoneal bleeding. In the severe-trauma model, two consecutive impacts caused mesenteric tears, vascular injury, and hemoperitoneum. The intestinal wall remained intact immediately after injury in both models.

Experimental groups and treatment. Four groups were established:

Group I: Moderate trauma; observation and analgesia.

Group II: Moderate trauma; observation, analgesia, and additional laser therapy.

Group III: Severe trauma; early laparotomy, surgical hemostasis, and standard postoperative treatment.

Group IV: Severe trauma; early laparotomy and hemostasis supplemented with platelet-rich plasma (PRP), laser irradiation, and a topical hemostatic agent.

In Group II, external laser therapy was initiated on the second day after injury using the Milta device and continued daily for five days.

Animals with severe trauma underwent immediate midline laparotomy under inhalational anesthesia with isoflurane. Following evacuation of intraperitoneal blood, the abdominal organs were examined and bleeding was controlled using gauze compression and electrocautery. Intestinal viability was assessed visually according to bowel wall color and mesenteric vascular pulsation, with reassessment after warm-water irrigation when necessary.

In Group IV, 1.0–1.5 mL of PRP was administered into the mesenteric root after surgical hemostasis. The mesentery was subsequently exposed to laser irradiation at a power density of 50 mW/cm², and Hemoben powder was applied to the mesenteric tears. External abdominal laser therapy was started on postoperative day 2 and continued for seven days, with each session lasting two minutes.

Outcome assessment. Animals were monitored for activity, food and water intake, abdominal tenderness, defecation, wound condition, and mortality. Body weight was measured before injury and on days 3, 7, 14, and 21.

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Intestinal motor-evacuatory function was assessed on days 3, 7, and 14 using a charcoal transit test. Following fasting, 1 mL of activated charcoal suspension in a 1% sodium carboxymethylcellulose solution was administered intragastrically under light inhalational anesthesia. The distance traveled by the marker was evaluated after one hour. Animals with enterostomies were excluded from this assessment.

Macroscopic examination of the abdominal cavity was performed after scheduled euthanasia. Residual hematomas, inflammatory exudate, adhesions, intestinal and mesenteric deformation, luminal narrowing, and prestenotic dilatation were recorded. Tissue samples were collected for subsequent morphological examination; detailed histological findings were outside the scope of the present article.

Results and discussion. The experimental findings demonstrated distinct patterns of intestinal and mesenteric injury depending on the intensity of blunt abdominal trauma. The principal difference between the two models was the presence of mesenteric vascular damage and intraperitoneal hemorrhage. These initial anatomical differences determined the treatment approach and were associated with different patterns of subsequent functional recovery.