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Clinical Rationale for Minimally Invasive Interventions in the Surgical Treatment of Acute Pancreatitis

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Abstract

Introduction. Acute pancreatitis ranks third among emergency surgical diseases, in which mortality in severe form can reach 30%, and in case of purulent-septic complications development – up to 70%. Because of this, the problem of increasing the diagnosis and treatment of this condition is acute.

Purpose. To improve the results of treatment of patients with severe acute pancreatitis by increasing the strategies of surgical interventions using miniinvasive technologies.

Materials and methods. The research was carried out about 182 patients with severe acute pancreatitis in Samarkand branch of the Republican Scientific Center for Emergency Medical Care from 2018 to 2023. The treatment method was conservative therapy, minimally invasive and open surgery. The studies were carried out in the form of prospective, retrospective and parallel.

Results. Minimally invasive interventions are more effective than open surgery operation in the treatment of aseptic severe acute pancreatitis. This was shown by analysing data obtained from the treatment of 182 sick with severe acute pancreatitis. The reduction in the incidence of mortality was 6.2% and 17.2%, respectively. Since the mortality rate was 19.8% in infected pancreonecrosis, the use of miniinvasive procedures was preferred over open surgery.

Conclusion. Minimally invasive interventions are widely spent in the treatment of severe acute pancreatitis in the fermentative phase, in addition to conservative therapy. Open surgery operation should be considered only in the case of serious complications that cannot be controlled by minor invasive procedures in the primary stage of severe acute pancreatitis. In the treatment of sick with aseptic severe acute pancreatitis, the use of miniinvasive procedures is accompanied by a lower mortality rate of 6.2% compared to open surgery, which reaches 17.2%.

Keywords: severe acute pancreatitis, surgical approach, minimally invasive interventions, open surgery, purulent-septic complication

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Клиническое обоснование мини-инвазивных вмешательств в хирургическом лечении острого панкреатита

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Резюме

Введение. Острый панкреатит занимает третье место среди неотложных хирургических заболеваний, при котором летальность при тяжелой форме может достигать 30%, а при развитии гнойно-септических осложнений – до 70%. Из-за этого остро стоит проблема улучшения диагностики и лечения этого состояния.

Цель. Улучшение результатов лечения пациентов с тяжелым острым панкреатитом за счет улучшения стратегий оперативных вмешательств с использованием мини-инвазивных технологий.

Материалы и методы. Исследовали 182 пациента с тяжелым острым панкреатитом в Самаркандском филиале РНЦЭМП с 2018 по 2023 г. Методы лечения – консервативная терапия, малоинвазивные и открытые операции. Исследования были проспективными, ретроспективными и параллельными.

Результаты. При лечении асептического тяжелого острого панкреатита мини-инвазивные вмешательства эффективнее, чем открытые операции, что подтверждается анализом данных, полученных при лечении 182 пациентов с тяжелым острым панкреатитом (снижение частоты смертности составило 6,2% и 17,2% соответственно). Поскольку при инфицированном панкреонекрозе частота смертности составила 19,8%, использование мини-инвазивных процедур было предпочтительнее, чем открытых операций.

Заключение. Мини-инвазивные вмешательства широко используются в лечении тяжелого острого панкреатита в ферментативной фазе, помимо консервативной терапии. Открытые операции следует рассматривать только в случае возникновения серьезных осложнений, которые невозможно контролировать с помощью небольших инвазивных процедур на начальной стадии тяжелого острого панкреатита. При лечении пациентов с асептическим тяжелым острым панкреатитом использование мини-инвазивных процедур сопровождается более низкой частотой смертности, составляющей 6,2%, по сравнению с открытыми операциями, которые достигают 17,2%.

Ключевые слова: тяжелый острый панкреатит, хирургическая тактика, мини-инвазивные вмешательства, открытая операция, гнойно-септические осложнения



■ INTRODUCTION

Acute pancreatitis ranks third among emergency surgical diseases, in which mortality in severe form can reach 30%, and in case of purulent-septic complications development – up to 70% [1, 2]. Because of this, the problem of increasing the diagnosis and treatment of this condition is acute. Nevertheless, there is disagreement about which surgical operations are better to perform at different stages of the disease. Aseptic fermentative phase of the pancreas and the development of severe acute pancreatitis leave an ambiguous question about the choice between open and miniinvasive approaches [3–5].

In the late stage of acute pancreatitis, purulent-septic complications develop in 30–50% of cases and are accompanied by a high mortality rate of up to 80%. This shows the importance of developing an ideal surgical strategy [6, 7]. Nevertheless, there is still no clear decision which surgeries are preferable for patients with such complications. The choice between minimally invasive and open techniques is an important issue because each method has its own advantages and disadvantages. Although open surgery may provide more effective sanitation of the puruloseptic focus, minimally invasive procedures are less invasive. Thus, the question of a reasonable choice of treatment method at different stages of acute pancreatitis remains unresolved. This emphasises the need for additional research in this area [8–10].

■ PURPOSE OF THE STUDY

To improve the results of treatment of patients with severe acute pancreatitis by increasing the strategies of surgical interventions using miniinvasive technologies.

■ MATERIALS AND METHODS

The study showed interesting things about 182 patients with severe acute pancreatitis in Samarkand branch of the Republican Scientific Center for Emergency Medical Care from 2018 to 2023. The study included both men and women aged 57.1% and 42.9%, respectively, and the mean age of the patients was 51.6 years. In 51.1% of cases of severe acute pancreatitis, the cause was alimentary factor and alcohol abuse, and in 42.9% of cases, the cause was impaired outflow of pancreatic secretion and intraductal hypertension caused by cholelithiasis, extrahepatic bile duct lesions. In 6% of patients the cause of acute pancreatitis remains unknown.

After analysing clinical and laboratory data, ultrasound findings, computed tomography (CT) and diagnostic laparoscopy, the diagnosis of severe acute pancreatitis was established in 182 patients. The 2012 Atlanta Classification was used to classify the disease according to severity. The Balthazar-Ranso pancreatitis severity index was used on computed tomography to assess the amount of primary pancreatic necrosis.

About two-thirds of patients (65.9%) had small-focal pancreonecrosis. Thirty-four 1% had large-focal and subtotal necrosis. According to the study, 48.9% of patients had lesions in one region of retroperitoneal tissue, while 51.1% of patients had lesions in two or three regions [10].

The majority of patients with severe acute pancreatitis (40.7%) underwent miniinvasive surgery, while 37.4% underwent open surgery.

Aseptic necrosis of the pancreas was recorded in 107 patients, or 58.2% of all patients. Severe acute pancreatitis was found in 75 patients (41.2%). Clinical, instrumental and

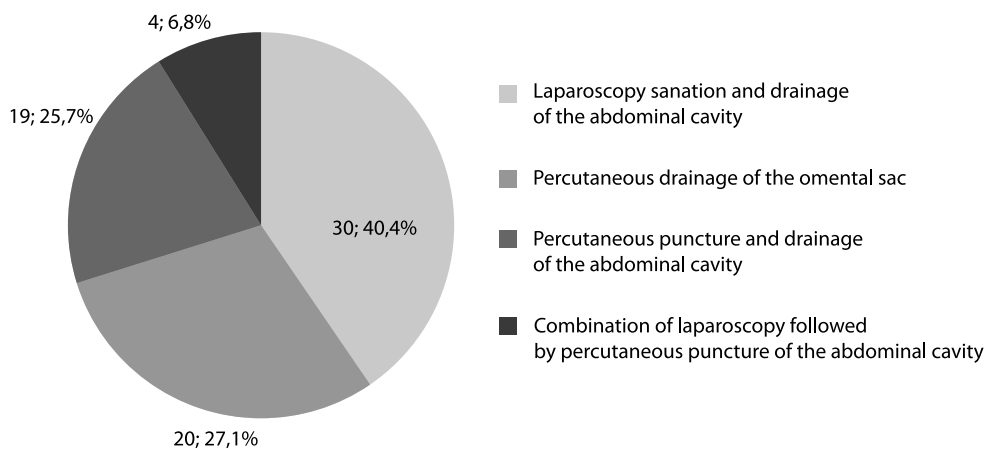


Fig. 1. Structure of minimally invasive interventions in patients with severe acute pancreatitis, n=73

laboratory signs, such as persistent hyperthermia and leukocytosis, detection of gas bubbles on ultrasound and CT, and positive culture results of abdominal drainage or percutaneous puncture aspirate, served as criteria for determining infection.

Patients with severe acute pancreatitis were divided into two groups: group A consisted of 107 patients with aseptic pancreatic necrosis and group B consisted of 75 patients with infected pancreatic necrosis. Group A was further divided into three groups: A1 used only conservative treatment, A2 performed open surgery and A3 used mini-invasives. In addition, Group B was divided into two subgroups. Subgroup B1 included mini-invasive surgeries and subgroup B2 included open surgeries.

17.7% of patients with aseptic pancreatic necrosis (Group A) had enzymatic peritonitis, and 8.4% of patients had serous-fibrotic peritonitis. In the group of sick with infected pancreatic necrosis (Group B), there were erosive bleeding (13.3%), intestinal fistula formation (14.6%), and a combination of erosive bleeding and intestinal fistula formation (9.3%). In addition, 32% of patients had retroperitoneal phlegmon and 17.3% had serous fibrous peritonitis. Instrumental diagnostic methods included ultrasound, computed tomography, FEGDS, diagnostic laparoscopy, diagnostic puncture and drainage of the abdominal cavity and/or retroperitoneal space.

Complex conservative therapy performed in 182 patients with severe acute pancreatitis (SAP) included the following components:

- infusion therapy, carried out for the purpose of rehydration and detoxification, at the rate of 40 ml per 1 kg of the patient's weight with forced diuresis;
- analgesia, non-narcotic analgesics (NSAIDs, antispasmodics)
- epidural blockade with 6–10 ml of 2% lidocaine was performed in 140 (76,9%) patients, pain syndrome was relieved in 15–20 min after injection, if necessary epidural blockade was repeated in 24–48 hours;
- antisecretory drugs were administered to all sick included in the study (proton pump blockers Omeprazole were administered to 106 (58.2%) patients, H2-histamine blockers Cimetidine were administered to 76 (41.8%) patients;



- antibacterial therapy was used in all sick included in the study, Cefoperazone and Amoxicillin were used for treatment and prevention of infection in sick with aseptic pancreatic necrosis (group A) and with infected pancreatic necrosis (group B).

Of 142 sick with severe acute pancreatitis (SAP), 51.4% underwent minimally invasive surgery and 48.6% underwent open surgery. Abdominal drainage and videolaparoscopic sanitation were used to treat aseptic PPC in 16.4% of patients.

The pancreas was opened through one or both lateral accesses in case of extensive aseptic necrosis of the pancreas with signs of peritoneal protrusion. In case of fluid accumulation in the omental sac it was drained through the gastric-obstetric ligament. As the volume of fluid secreted from the abdominal cavity decreased, the drains were removed alternately during three days. In 7–10 days after the operation the drainage from the omental sac was usually removed.

In three cases (4.8%) sick with severe acute pancreatitis (SAP) were found to have fluid accumulation in the retroperitoneal region or omental sac. In these cases, percutaneous punctures with ultrasound navigation were performed. These procedures were not only useful for treatment but were also used to diagnose suspected pancreatic necrosis.

Various types of open surgery were performed to treat 35 patients (19.2%) with aseptic necrosis of the pancreas. This included wide midline laparotomy with abdominal drainage for 19 patients who had signs of decompensated duodenal obstruction or pseudocyst rupture. Minilaparotomy with drainage of the abdominal cavity and omental sac was used for enzymatic peritonitis in 21 patients. In two patients suffering from decompensated duodenal obstruction due to paraduodenal infiltrate formation, formation of an anteroduodenal gastroenteroanastomosis with interintestinal Braun's access was performed. After opening of the omental pouch, abdominisation of the pancreas was performed in twelve patients. After that, drainage of the abdominal cavity and omental sac was performed, with special emphasis on rupture of the forming pseudocyst.

After open surgery to treat aseptic pancreatic necrosis (APN), the surgical wound was closed. Treatment of infected pancreonecrosis (group B) included minimally invasive interventions such as percutaneous ultrasound-guided omental pouch drainage to treat pancreatic abscess or acute infected fluid accumulation. 22.5% of patients presenting with infected pancreonecrosis (group B). Methods such as fistulography, computed tomography and ultrasound were used to determine the effectiveness of drainage and to detect residual cavities.

For the treatment of purulent-septic forms of TCP in 18.7% of patients, the main method of treatment was open surgery using minilaparotomy, lumbotomy and wide midline laparotomy.

Lumbotomy was performed with small incisions of 4–5 cm in cases where focal pancreatic necrosis was limited to two anatomical areas of retroperitoneal fibre. Two types of drainage were used during wide midline laparotomy or lumbotomy. The first was called "open" and involved the use of gauze swabs and 11 mm diameter double-lumen drains to drain the unclosed surgical wound. The second one was called "closed" and included drainage of retroperitoneal fibres and abdominal cavity under conditions of omental sac integrity. The "closed" method of drainage was used for the operation only in three weeks and more after the onset of the disease, on condition of completion of sequestrations formation in the pancreas necrosis centre and exhaustive necrosectomy. After installation of double-lumen drains in the area of necrosis focus, the surgical wound was closed completely.

In the early stages of the disease (7–14 days beyond the onset of acute pancreatitis), when destructive areas of the pancreas are not yet fully sequestered, the method of "open" drainage was used to avoid purulent-septic complications of severe acute pancreatitis (SAP). This usually required performing small laparotomies to open the omental pouch and remove necrotic tissue. An omentobursostomy or retroperitoneostomy was then followed. Necrosesquestrectomy was performed using double-lumen drains and latex gauze swabs.

Thus, when planning subsequent operations and in cases of serious damage to the pancreas and retroperitoneal region, the use of "open" type drainage was justified. Repeated sanation operations included replacement of gauze swabs, cavity lavage, removal of necrotic tissues, management and correction of drains and evaluation of drainage efficiency. On average, there are two to three sanation operations per patient with focal infected pancreatic necrosis, and three to five operations if the necrosis spreads. After complete necrosectomy and granulation formation in the wound, complete closure of the surgical wound was performed, switching to the closed type of drainage.

■ RESULTS

Sicks with infected pancreatic necrosis (group B) had the highest mortality rate, accounting for 14.8% of all groups studied. Subgroup B2, which underwent open surgery, showed the highest mortality rate (26.5%) in this group. Group A patients with aseptic necrosis of the PG had a mortality rate of 9.3%, and group A2 patients with open surgery had a mortality rate of 17.1%.

Based on the above data, the highest number of deaths occurred in subgroup B2, where open interventions were performed, due to complications of TCP, such as arterial bleeding and retroperitoneal phlegmon. However, the mortality rate was statistically significantly lower in subgroup B1 (19.5%) where minimally invasive interventions were used. In groups A and B, there were statistically significant differences in operating centre treatment times and hospital stay times.

Comparison of subgroup A2 patients with aseptic pancreatic necrosis and subgroup B2 sick with infected pancreatic necrosis showed no statistically significant differences in operating theatre treatment time and duration of hospital stay ($p>0.05$). In addition, no statistically significant differences were found between subgroup A3 for aseptic pancreatic necrosis and subgroup B1 for infected pancreatic necrosis ($p<0.05$). However, in subgroup A3, where minimally invasive interventions were used, the treatment time in the operating theatre and hospital stay were statistically significantly shorter than in subgroup B2.

Treatment time in ICU and in hospital (median and interquartile range)

Subgroup	In the ICU per day	In hospital per day
A1 (conservative therapy only)	12 (8–14)	24 (17–24)
A2 (open interventions)	8 (6–11)	17 (14–21)
A3 (minimally invasive interventions)	6 (4–9)#	17 (14–21)#
B1 (minimally invasive interventions)	5 (4–7)	15 (13–19)
B2 (open interventions)	9 (6–11)#	21 (17–24)#

Note: # statistically significant differences (Mann – Whitney test, $p<0.05$).

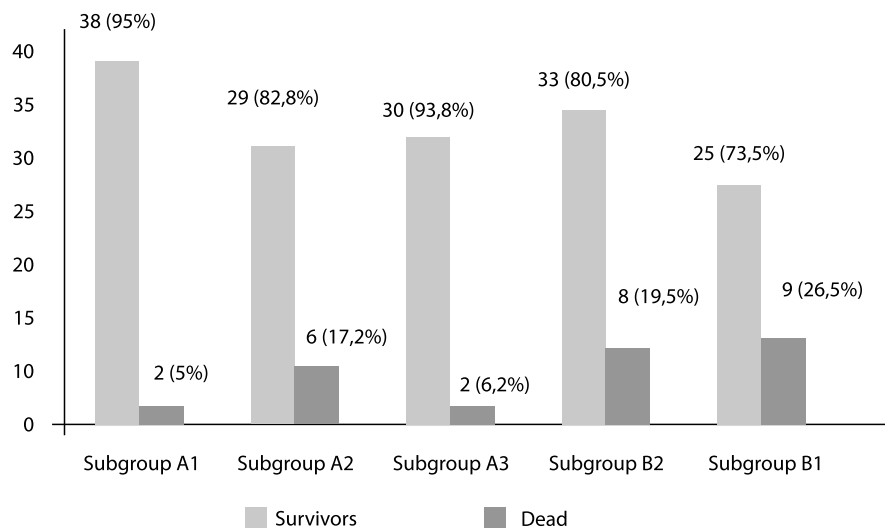


Fig. 2. The ratio of survived and died patients in the studied subgroups

Comparison of mortality showed statistically significant differences between subgroup A2, in which open surgery was performed for aseptic pancreatic necrosis (16.3%) and subgroup B2, in which open surgery was also performed for infected pancreatic necrosis ($p < 0.05$). The mortality rate in subgroup B2 was 25.8%, significantly higher than that in subgroup A2, where it was 17.2%. In subgroup B1, infected pancreatic necrosis was treated with miniinvasive procedures and the mortality rate was 26.5%. This was significantly higher than in subgroup A3, where the same treatment modalities for aseptic pancreatic necrosis were used, and the mortality was 6.2%.

■ CONCLUSIONS

1. Minimally invasive interventions are widely spent in the treatment of severe acute pancreatitis in the fermentative phase, in addition to conservative therapy. The choice of surgical approach depends on the type and severity of the underlying pathological process. Minimally invasive operations are preferable for drainage of the abdominal cavity at the early stage of fermentative peritonitis.
2. Open surgery operation should be considered only in the case of serious complications that cannot be controlled by minor invasive procedures in the primary stage of severe acute pancreatitis. In case of purulent-septic complications, open surgery operation is preferred to completely clear the focus of inflammation.
3. In the treatment of sick with aseptic severe acute pancreatitis, the use of miniinvasive procedures is accompanied by a lower mortality rate of 6.2% compared to open surgery, which reaches 17.2%. Minimally invasive interventions are also preferred in cases of infected pancreonecrosis, as the mortality rate is 19.8%, which is lower than in open operations, where the rate was 26.5%.

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