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TREATMENT OF INFECTED PANCREATIC NECROSIS BY MINIMALLY INVASIVE INTERVENTIONS

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Abstract A simple comparative multicenter study included 270 patients with infected pancreatic necrosis who were treated for the period from 2016 to 2023. Paients were divided into three groups:

1 group – 90 patients who underwent only remedial laparotomy.

2 group – 90 patients who had minimally invasive drainage as the first stage followed by subsequent remedial laparotomy.

3 group – 90 patients with only minimally invasive drainage.

Patients distribution by age, comorbidities, severity of purulent necrotic parapancreatitis and therapeutic medical complex was homogeneous. There were maximal incidence of complications (digestive fistula, bleeding, RDS, severe sepsis) and mortality rate in group 1. In group 2 there was a tendency to decrease of morbidity and mortality in infected pancreatic necrosis patients although their level remained high. Minimally invasive interventions (3 group) for infected pancreatic necrosis resulted significant reduction of morbidity and mortality. Minimally invasive techniques should be preferred for primary drainage of infected pancreatic necrosis (purulent necrotic parapancreatitis). Laparotomy with necrosectomy is necessary in case of ineffectiveness of minimally invasive drainage or appearance of complications that can not be treated using minimally invasive interventions.

Key words: pancreas, pancreatic necrosis, parapancreatitis, minimally invasive interventions.

Introduction. Acute destructive pancreatitis has a phase course, which corresponds to two peaks of mortality: in the first week of the disease – from organ failure with sterile pancreatic necrosis and later – from purulent complications, which usually develop by the beginning of the third week of the disease. According to the Atlanta classification, the morphological manifestations of purulent complications are pancreatic abscess and infected pancreatic necrosis. Infected necrosis refers to a purulent-necrotic lesion of the pancreas and retroperitoneal tissue, which, unlike an abscess, has no separation from healthy tissues. The mortality rate in infected pancreatic necrosis is several times higher than in pancreatic abscess and reaches 60-65%. The choice of the type of surgical treatment of infected necrosis, and especially the indications for the use of minimally invasive interventions in PNP, remains one of the most difficult problems in emergency pancreatology.

Aim. To examine the effectiveness of minimally invasive interventions for infected pancreatic necrosis (purulent necrotic parapancreatitis).

Material and methods. A simple comparative multicenter study was conducted. The study included 270 patients diagnosed with infected pancreatic necrosis from 2016 to 2023, 90 in each research center. The patients were divided into 3 groups. In group 1, there were 90 patients (30 in each research center) who underwent only rehabilitation laparotomy. The 2nd group included 90 patients (30 in each research center) who underwent minimally invasive drainage and later laparotomy as the first stage of rehabilitation for the development of infected pancreatic necrosis. In group 3, there were also 90 patients (30 in each research center) who were treated with infected pancreatic necrosis only with minimally invasive interventions. In group 1, there were patients who were treated in research

centers from 2016 to 2020. This is due to the fact that during this period, sanitization laparotomy was a common method of surgical treatment of infected pancreatic necrosis. As minimally invasive interventions have developed, this method has become less common. The 2nd and 3rd groups included patients who were treated in research centers from 2020 to 2023.

Criteria for the inclusion of patients in the study:

– age from 18 to 60 years;

– established diagnosis of “infected pancreatic necrosis": the volume of pancreatic necrosis is more than 3 cm according to CT angiography (or intraoperative data) with signs of infection (positive bacterial culture of the material obtained by fine needle puncture or drainage);

– the established degree of prevalence according to CT angiography or intraoperative data of “infected pancreatic necrosis” (PNP): limitation of the omentum (C), spread beyond the omentum along the paracolic tissue on the left or right (D), spread beyond the omentum along the paracolic tissue on the left and right (E);

– the same type of treatment complex for sterile pancreatic necrosis: the use of complex infusion and transfusion therapy with antisecretory and enzyme support in the early stages; antibiotic prophylaxis (cephalosporins of the third generation or fluoroquinolones of the second generation in combination with metronidazole) and therapeutic nutrition with nutritional support for peripancreatic infiltration;

– absence of chronic diseases or pathological conditions that could affect the clinical outcome (chronic heart failure, bronchial asthma, chronic renal failure, etc.);

– absence of organ failure (0 points on the SOFA scale) at the time of the patient's inclusion in the clinical trial.

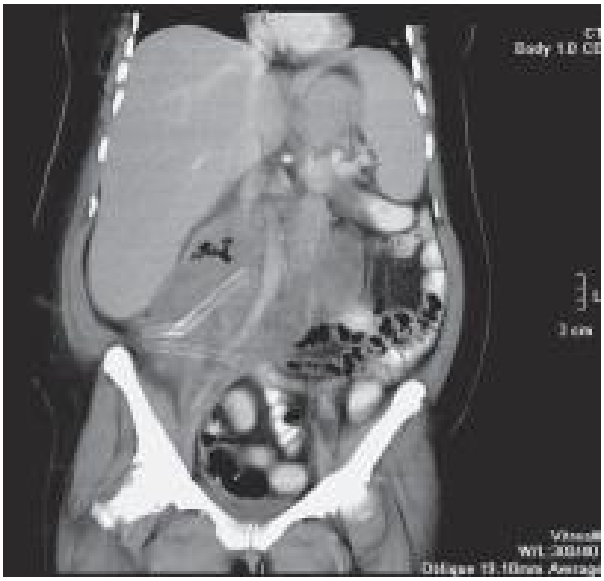


Fig. 1. Infected pancreatic necrosis, purulent-necrotic parapancreatitis: computed tomography after minimally invasive drainage

In all patients of the 2nd and 3rd groups, when infected pancreatic necrosis was detected, primary drainage was carried out using the V.G. Ivshin method with 2-4 drains of 12 Fr. Subsequently, the diameter of the drains was increased to 1.0–2.0 cm (Fig. 1), which made it possible to perform

sequestrectomy, aspiration or instrumental, under radiation or endoscopic control (Fig. 2). In the absence of the effect of minimally invasive interventions and the increase in signs of intoxication, patients underwent sanitation laparotomy. Such patients were included in the 2nd group.

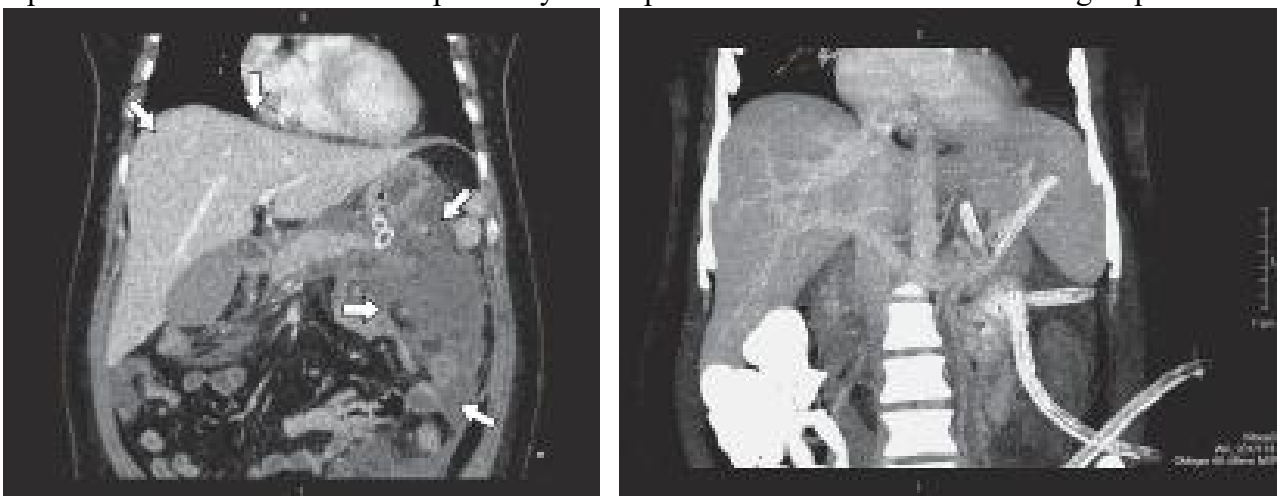


Fig. 2. Minimally invasive drainage of GNPP (arrows) spreading through the paracolon tissue from the left to the pelvis: computed tomograms.

Criteria for evaluating the effectiveness of the methods: mortality, frequency of complications of infected pancreatic necrosis (erosive bleeding, gastrointestinal bleeding, gastric fistula, duodenal fistula, large intestinal fistula, small intestinal fistula, peritonitis, pneumonia, pleurisy, adult respiratory distress syndrome (ARDS), severe sepsis – 2 symptoms of SIRS and multiple organ failure).

The MS Excel program is used to create the database. Each of the 270 observations contained 20 features, of which 15 were discrete, qualitative, and 5 were continuous, quantitative. The percentage of missing values was less than 1%. Linear and rank correlation analysis were used. The critical value of the significance level was assumed to be 5%. The data was analyzed using the Statistica for Windows 5.0 application software package.

Results and discussion. The incidence of complications and, consequently, mortality, as a rule, depend on the degree of prevalence of GNPP. To exclude the influence of this factor on the outcome of the disease, the structure of the prevalence of GNPP in the groups was analyzed.

Group of patients	Number of observations, abs. (%)			
	total	PNP C	PNP D	PNP E
1st	90	42 (46,7)	29 (32,2)	19 (21,1)
2nd	90	39 (43,33)	30 (33,33)	21 (23,33)
3rd	90	47 (52,2)	28 (31,1)	15 (16,7)
total	270	128 (47,4)	87 (32,2)	55 (20,4)

Table 1. The structure of PNP in the studied groups

It was revealed that the studied groups were formed uniformly, and there were no statistically significant differences in the prevalence of PNP. In all groups, approximately half of the observations developed GNPP limited by the limits of the omentum sac (C), one in three had PNP D, and one in five had PNP E (Table 1).

One of the most common postoperative complications of infected pancreatic necrosis is an internal fistula. When performing minimally invasive intervention under ultrasound control, all researchers adhered to the principle of gentle drainage, i.e. they tried not to "pass" through hollow organs when installing drainage into the purulent cavity. However, in 15 (16.7%) cases, the drainage path passed through the stomach, and it was not possible to install drainage along a different trajectory. In these patients, PNP drainage occurred trans gastrally, but the drainage diameter did not exceed 0.7 cm. The gastric fistulas formed after this closed independently within 2-3 days, this did not affect the severity of the patients' condition. Therefore, gastric fistulas after minimally invasive manipulations were not regarded as fistulas that developed as a result of complications of infected pancreatic necrosis, which coincides with the generally accepted opinion. Internal fistulas meant such violations of the integrity of hollow organs, which resulted in either ischemia of the organ wall or bedsore from drainage. No iatrogenic organ damage was observed during laparotomy. To identify the relationship between the type of surgical intervention in infected pancreatic necrosis and the development of fistulas, a correlation analysis was performed (Table 2).

Group of patients	Number of observations, abs. (%)				
	total	Duodenum fistula	Gastric fistula	Colonic fistula	Small intestinal fistula
1st	90	15 (16,7)	9 (10)	18 (20)	8 (8,9)
2nd	90	8 (8,9)	2 (2,2)	11 (12,2)	2 (2,2)
3rd	90	2 (2,2)	3 (3,3)	2 (2,2)	-
total	270	25 (9,3)	14 (5,2)	31 (11,5)	10 (3,7)

Table 2. Frequency of internal fistula development in the studied groups

As a result of the study, it was found that there is a weak direct statistically significant relationship between the type of surgical treatment of infected pancreatic necrosis and the development of fistulas. The maximum frequency of fistulas of the duodenum (duodenum), stomach, colon and small intestine was noted in group 1, the minimum in group 3. Thus, when performing minimally invasive interventions in patients with infected pancreatic necrosis, the risk of developing fistulas is the lowest.

Another fairly common complication of infected pancreatic necrosis is bleeding: gastrointestinal from acute and chronic gastroduodenal ulcers and erosive, usually venous, from the PNP cavity.

Correlation analysis revealed that there is a moderate direct statistically significant relationship between the type of surgical treatment of infected pancreatitis and the development of gastrointestinal and erosive bleeding. In group 1, the incidence of gastrointestinal and erosive bleeding was extremely high (43.3 and 35.6%, respectively), in group 2, these values were twice as low, in group 3, compared with group 1, they were 5 and 8 times lower, respectively. Thus, the use of minimally invasive interventions helps to reduce the incidence of gastrointestinal and erosive bleeding in infected pancreatic necrosis.

One of the causes of death in acute pancreatitis is respiratory failure. Complications of the respiratory system that can lead to respiratory failure were included in the study.

Correlation analysis revealed that there was no statistically significant relationship between the type of surgical treatment of infected pancreatic necrosis and the development of pneumonia and pleurisy. Their frequency of development is quite high and approximately the same in all the studied

groups, however, there is a tendency to decrease them in the 3rd group. The incidence of ARDS has a moderate direct statistically significant relationship with the type of surgical treatment of infected pancreatic necrosis. The highest incidence of ARDS was observed in groups 1 and 2 (42.2 and 34.4%, respectively), and the lowest in group 3 (3.3%). Thus, the use of minimally invasive interventions helps to reduce the incidence of ARDS and does not affect the incidence of pneumonia and pleurisy in infected pancreatic necrosis.

Group of patients	Number of observations, abs. (%)		
	total	severe sepsis	severe sepsis
1st	90	39 (43,3)	32 (35,6)
2nd	90	19 (21,1)	16 (17,8)
3rd	90	8 (8,9)	4 (4,4)
Total	270	66 (24,4)	52 (19,3)

Table 3. Incidence of severe sepsis and deaths

A correlation analysis of the relationship between the type of surgical intervention in infected pancreatic necrosis and the development of severe sepsis and mortality was carried out (Table 3). It was found that there is a moderate direct statistically significant relationship between the type of surgical treatment of infected pancreatic necrosis and the development of severe sepsis and mortality. In group 1, almost all patients (91.1%) developed severe sepsis, and more than half of the patients (57.8%) were fatal. In group 2, the vast majority of patients develop severe sepsis (73.3%), and mortality, although significantly lower than in group 1, remains quite high (36.7%). In group 3, the studied indicators are almost an order of magnitude lower than in group 1: 10 and 6.7%, respectively. Thus, the use of minimally invasive interventions helps to reduce the incidence of severe sepsis and mortality in infected pancreatic necrosis.

Conclusion. With infected pancreatic necrosis, most patients develop complications such as pneumonia and pleurisy. The type of surgery does not affect the incidence of these complications. The use of sanitization laparotomy with necrosequestrectomy is accompanied by the maximum frequency of complications (internal fistula, bleeding, RDSV, severe sepsis) and, accordingly, mortality in patients with infected pancreatic necrosis. The use of two–stage drainage tactics (first, minimally invasive interventions, then sanitation laparotomy with necrosequestrectomy) leads to a slight decrease in the incidence of complications and mortality in infected pancreatic necrosis, although their level remains quite high.

The use of minimally invasive interventions in infected pancreatic necrosis significantly reduces the incidence of complications and mortality. When clarifying indications for primary drainage of infected pancreatic necrosis (GNPP), preference should be given to minimally invasive interventions. If minimally invasive drainage is ineffective or complications develop that cannot be eliminated with minimally invasive interventions, laparotomy with necrosequestrectomy should be performed.

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