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Surgical Treatment of Acute Biliary Pancreatitis

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Annotation: In the review article the modern classification of acute pancreatitis, indications for surgical treatment of severe, primarily infected pancreonecrosis, development trends and controversial issues of this problem are covered. Two different methods of operations - “closed” and “open” - for drainage of retroperitoneal space depending on the scale of necrotic accumulation were analyzed. The prospect of using transluminal endoscopic surgery through natural orifices (ENOTES) in the treatment of severe acute pancreatitis complicated by abdominal compartment syndrome is shown. Frequency of intraoperative and early complications of “closed” and “open” interventions in severe acute pancreatitis, their recognition, prevention of their occurrence and choice of surgical or conservative treatment method are considered.

Keywords: acute pancreatitis, surgical treatment, complications of acute pancreatitis, pancreonecrosis, pancreatic fistulas, intra-abdominal bleeding.

Introduction. In recent years, there have been a number of important developments that have defined the ideology of surgical treatment of acute pancreatitis, primarily in determining the indications, timing of surgical intervention, and type of surgical aid. Much less attention in the discussion is paid to the treatment of surgical complications, although there are indications about their occurrence in the specialized literature [1].

The starting point in the development of acute pancreatitis treatment strategy was Atlanta (1992), where leading pancreatologists developed a working classification that satisfies the majority of surgeons to date, as well as its revision in 2012, which introduced a number of additions and proposals detailing the features of the course of acute pancreatitis.

According to modern ideas about the course of acute pancreatitis, mild pancreatitis is accompanied by minimal organ dysfunction, and the pathologic phenomenon in this case is represented by interstitial edema of the pancreas. Severe pancreatitis is associated with multiorgan failure lasting more than 48 h and/or local complications such as necrosis, abscess, or postnecrotic suppurative pseudocyst. Most often, severe pancreatitis is a manifestation of the development of pancreatic necrosis, although patients with edematous acute pancreatitis may also present with a severe course [2].

Mild acute pancreatitis is seen in 80% of cases of the disease, severe forms of acute pancreatitis occur in 20%.

The incidence of acute pancreatitis, according to world data, varies from 200 to 800 patients per 1 million population per year, in our country the disease accounts for 9-12% among surgical emergencies.

Without surgical intervention lethality in patients with severe course of acute pancreatitis approaches 100%, with surgery this value decreases to 24-39% [3].

Most patients with sterile necrosis respond positively to drug therapy. However, the condition of some patients does not improve despite intensive conservative treatment, and the role of surgery increases for those patients who develop multiorgan failure associated with sterile pancreonecrosis [4].

All operations for pancreonecrosis can be divided into two groups: resection and organ-preserving. Proponents of radical methods of pancreonecrosis treatment report postoperative mortality rates from 30.7 to 70.0% [5].

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At present surgeons resort to pancreas resection in acute pancreatitis less and less frequently, which was reported by domestic specialists even earlier. The majority of modern publications on the treatment of pancreonecrosis report the use of organ-preserving operations, the lethality of which reaches 30% [6].

The main principle in surgical treatment of destructive pancreatitis is timely removal of dead tissues of the pancreas and retroperitoneum, because a significant break in the course of the disease can occur only when sequestrations, especially large ones, are removed from the areas of suppuration.

In the literature, there are reports of two methods of surgery that provide different conditions for drainage of the retroperitoneal space depending on the extent of necrotic lesion - “closed” and “open”.

“Closed” method of draining operations provides active drainage of purulent-necrotic focus in the conditions of anatomical integrity of the omental sac cavity and abdominal cavity. In this technique in the cavity of the omental sac and retroperitoneal space for the purpose of sanitation (washing with antiseptics) are introduced under the control of ultrasound, CT or laparoscope multi-channel silicone drains. Some authors recognize the “closed” method of drainage as effective in the treatment of severe pancreatitis due to low traumatism and ensuring permanent removal of devitalized tissues, microorganisms [7].

“Closed” method of drainage involves performing repeated interventions only ‘on demand’, so the frequency of relaparotomies is 33-50%. Control over the focus of destruction and drainage function is carried out according to the results of ultrasound, CT, video-optical technique, fistulography.

The main disadvantages of the “closed” method are inadequate drainage, drainage obturation by sequestrations, detritus, formation of small and large intestinal fistulas, lack of visual control of pancreonecrosis dynamics, recurrence and appearance of new foci of necrosis [8].

“Open” method of drainage is used in widespread infected forms of pancreonecrosis, provides adequate access by forming a drainage channel for staged sanations and sequestrectomies [15].

The following methods of surgical treatment of severe pancreatitis are referred to “open” drainage:

“open” sequestrectomy and relaparotomy

“on demand” (Zipper technology);

“open” sequestrectomy with closed permanent lavage and programmed relaparotomy (Ulm procedure);

“open” sequestrectomy with tamponade -

“open” abdomen (Open parcing);

“Open sequestrectomy and closed abdomen (Warshaw procedure).

When applying the “open” method, the biciliac access is becoming increasingly popular, providing mobilization of the pancreas and the possibility of low-traumatic multiple repeated interventions [7].

After the stage of surgery aimed at opening of all purulent foci, tamponade of a single cavity of the omental sac and retroperitoneal tissue with tampons is performed, closing the abdominal cavity with provisor sutures. After 48-72 h under general anesthesia in the operating room change of tampons and stage sequestrectomy. “Open” method of drainage allows to control the state of the pancreas and retroperitoneal tissue and provides timely drainage of ‘satellite’ abscesses [8]. Despite all the advantages, the method has disadvantages - significant operative trauma, development of postoperative ventral hernias, prolonged hospitalization and multiple anesthesia. Although in a study by S. Connor et al. (2005) showed that the number of complications in the application of “closed” and “open” methods of drainage is approximately the same, but minimally invasive techniques are not always effective. It is also important to note that, according to available data, the lethality in the management of “open” and “closed” methods is not fundamentally different [1].

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At the same time, H. M. Zhu et al. (2015) conducted a study to evaluate the efficacy of transluminal endoscopic surgery through natural orifices (ENOTES) in the treatment of severe acute pancreatitis complicated by abdominal compartment syndrome. The patients' APACHE II score in the ENOTES group was lower than the operative group on the 1st, 3rd, and 5th postoperative days ($p < 0.05$). The treatment efficacy rate was 96.87% in the ENOTES group, which was statistically different from 78.12% in the comparison group ($p < 0.05$). There were also significant differences in complications and mortality between the two groups ($p < 0.01$) in favor of ENOTES. The authors showed that, compared to surgical decompression, ENOTES treatment using a flexible endoscope is an effective and minimally invasive procedure with fewer complications [9].

The prognosis and outcomes of surgical treatment of patients with pancreonecrosis depend on a multitude of interrelated local changes in the pancreas and retroperitoneal tissue and the body's overall response to them, which is expressed by organ dysfunction, the incidence of which varies from 8 to 50% [1, 4]. Increased incidence of postoperative organ failure significantly increases in-hospital mortality and is its independent prognostic factor. There is also an opinion that optimization of the type of surgical intervention can reduce the incidence of postoperative organ failure [10].

We believe, as well as other researchers, that it is not quite correct to focus on organ failure as a complication of pancreatic surgeries in pancreonecrosis, since the vast majority of patients had signs of organ dysfunction before the operation and required hospitalization in the intensive care unit.

Complications observed after various types of surgical interventions are of the greatest practical importance, which has not found significant coverage in the specialized literature. The incidence of the latter is almost the same after both “open” and minimally invasive sequestrectomy and, according to some researchers, reaches 95% and 92%, respectively [1].

In most cases, complications cause increasing difficulties in the treatment of patients and jeopardize their survival, even after initially successful treatment of pancreatic necrosis. Small intestinal fistulas [11], colonic necrosis, intra-abdominal bleeding [3], localized focus of infection , and pancreatic fistulas are the most significant complications that may result from the disease itself or from aggressive treatment tactics.

Analysis of long-term studies has shown that the average number of patients operated annually for pancreonecrosis has doubled [11]. In the distant terms, according to S. Connor et al. (2005), 62% of patients who survived after sequestrectomy have various complications, and 16% of patients required repeated surgical intervention.

According to A. L. Wei et al. (2016), a retrospective analysis of 334 patients was conducted to identify possible predictors of early complications after primary surgery for acute necrotizing pancreatitis. The analysis showed that the Marshall scale score on admission, multiorgan failure, preoperative respiratory infections, and sepsis were predictors of postoperative progressive infection. The presence of single organ failure, systemic inflammatory response syndrome on admission, and elevated C-reactive protein levels are risk factors for postoperative intestinal fistula. In addition, preoperative Marschall score, multiorgan failure, sepsis, and preoperative systemic inflammatory response syndrome are risk factors for postoperative intra-abdominal bleeding [7].

Bleeding after necrectomy is a life-threatening complication and occurs in 1% to 23% of cases [3]. It is also reported that after laparostomy and when programmed relaparotomy is used in the treatment of infected pancreonecrosis, the incidence of bleeding reaches 18-22%, while closed management with lavage is comparatively less likely to result in arterial bleeding [8]. At the same time, the above-mentioned authors note that the combination of “open” and minimally invasive procedures in the treatment of pancreonecrosis, although associated with only 11% of postoperative bleeding, the lethality increases to a critical 70%.

The development of massive arrosive bleeding in the retroperitoneum is the most characteristic complication of widespread pancreonecrosis. According to V. S. Saveliev et al. (2001), the frequency of occurrence is 6%. The maximum frequency of intra-abdominal bleeding was observed at the time of

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the 1st or during 3-4-stage sanation. In the first case it is caused by wide mobilization of the pancreas, in the second case it is a consequence of tissue delineation along the demarcation line, skeletonization of visceral vessels with damage of their wall in the projection zones of sequestrectomies [5].

Most often the source of profuse arterial bleeding is large arteries and venous trunks: primal and superior mesenteric artery, portal vein and its main tributaries, less often inferior vena cava.

Among the peculiarities of pathomorphogenesis of widespread pancreonecrosis, responsible for the massive character of intraoperative bleeding, it should be noted the absence of clear delineation of tissues, the presence of extensive area of retroperitoneal tissue lesion, violation of hemostasis factors.

Close location of the main pancreatic duct and blood vessels in pancreonecrosis is the main cause of massive bleeding. The most dangerous and difficult to treat are bleeding, which develop when melting foci of purulent-necrotic lesions in the pancreas and retroperitoneal tissue, with the communication of pancreatic cysts with pancreatic ducts, with the stomach and duodenum, that is, in the presence of internal fistulas of the pancreas.

Another mechanism of bleeding is the stretching of the cyst, on the shell of which is located a large vessel (more often the splenic artery). Bleeding from such vessels can be fatal, especially when the cyst opens into the free abdominal cavity [9].

M. V. Danilov et al. (2000) report that the experience of using repeated operations in patients who underwent acute necrotizing pancreatitis showed a lower incidence of early complications when using the “open” abdomen technique for purulent pancreatitis. The authors recorded a clear correlation between the incidence of its late complications requiring repeat surgical treatment and the adequacy of the primary surgical intervention. In the study of these authors 137 repeated operations on the pancreas and adjacent organs were performed in patients who had previously undergone various surgical interventions for pancreonecrosis [10].

In the study by B. N. Ivanov (2000) of 52 patients operated for destructive pancreatitis, 18 patients (34.6%) had postoperative period complicated by external arterial bleeding that developed mainly in the phase of purulent-necrotic sequestration. The source of bleeding was: in 5 cases - splenic vessels, in 2 - superior mesenteric vein, in 3 - pancreaticoduodenal artery, in other cases the source was not determined. Surgical hemostasis was performed by tamponization when the source of bleeding could not be identified, by suturing and/or stitching the verified source of arrosion. Postoperative mortality in this group amounted to 11 (61.6%) patients [11].

According to A.C. Butkevich et al. (2007), arterial bleeding occurred due to prolonged purulent process and melting of the vessel wall by proteolytic enzymes and occurred in 4.2% of patients in whom the “open abdomen” method was used. According to the authors, this rather low level indicates a more favorable course of the wound process and adequacy of drainage of the purulent focus [8].

A group of authors headed by D.M. Krasilnikov (2000) presented the results of surgical treatment of 287 patients with pancreonecrosis, 72.1% of whom developed complications: retroperitoneal abscesses, paracolic phlegmons (53.6%), arterial bleeding (20.8%), large intestinal (3.6%) and high small intestinal fistulas (2.1%). At relaparotomy in patients with large intestinal fistulas an ileostomy was formed, in patients with high small intestinal fistulas the loop of intestine carrying the fistula was resected, abscesses were opened, necrotized retroperitoneal tissue was removed, thorough hemostasis, wide drainage of retroperitoneal space was performed. Postoperative lethality amounted to 25.4% [12].

The prevention of arterial bleeding is the complete rejection of forced necrectomy, removal of only free-lying sequestrations, placement of silicone and “active” drainage structures outside the projection zones of visceral vascular trunks [23].

A number of surgeons pay considerable attention to secondary fungal infection of pancreonecrosis foci in their studies and consider it as a complication of surgical intervention, occurring in 12-35% and increasing mortality. In particular, S. Connor et al. (2005) revealed the frequency of secondary fungal infection in 32% of cases, with a mortality rate of 46% [1].

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Another difficult to recognize and poorly treatable complication of necrectomy, observed by some authors in 13% of patients undergoing “open” or “closed” necrectomy, is portal vein thrombosis. However, it is fair to note that portal vein thrombosis is not always the result of necrectomy. Portal vein thrombosis may develop during the progression of inflammatory changes in the pancreas and surrounding tissues. Performing thrombectomy in such patients does not always demonstrate a positive result of treatment, as the mortality rate reaches 8%. Consequently, prevention of thromboembolic complications in the pre- and postoperative period is extremely important, despite the possible risk of bleeding. Gastrointestinal fistulas after “open” or “closed” necrectomy occur, according to various researchers, in a wide range - from 1 to 43%. However, it should be emphasized that still most often such fistulas occur with a frequency of 1-5% [13].

According to A. C. Butkevich et al. (2007), the technique of “open” draining operations is inevitably associated with a high risk of intestinal fistula formation, so further studies are needed to reduce the rate of such complications [8].

A common condition for pancreatic fistula formation is trauma to the pancreas or damage to the gland during surgery. However, the greatest destruction of the gland parenchyma is observed in cases of acute destructive pancreatitis. In all cases, the outlet ducts are damaged with subsequent proteolytic action of pancreatic juice on the pancreas and surrounding tissues with the formation of a pancreatic fistula.

Another significant factor of fistula formation, often complementing the above-mentioned cause, is the presence of an obstacle to the outflow of pancreatic juice into the duodenal lumen - persistent spasm of the sphincter of Oddi, its stenosis, obstruction by a concrement, etc. [9]. There is a wide variation in the incidence of pancreatic fistula after necrectomy (from 3 - to 72%), indicating differences in the detection of pancreatic fistula [1].

It has been proven in experimental work that even after opening the lumen of the main pancreatic duct, the wall therein rapidly epithelializes, especially if the secretion flows freely into the intestine. Thus, in the absence of obstruction in the pancreatic ducts, the fistula may obliterate rather quickly, which is confirmed by the data on 95% conservative cure of external pancreatic fistulas.

Colonic necrosis is observed in 1-17% of patients with pancreonecrosis and occurs more often, as noted by some authors, in cases of “open” technique. At the same time, S. Connor et al. (2005) emphasize that all patients with colonic necrosis had delayed diagnosis of infected pancreonecrosis and they underwent minimally invasive surgical interventions, which is a disadvantage of this technique [1].

One of the advantages of the “open” abdomen method is the possibility of visual control over the course of purulent-necrotic process during the next revision of the abdominal cavity. This circumstance only in 4.2% of cases led to unplanned relaparotomy due to the formation of undrained interintestinal and paracolic abscesses [8].

B. C. Savelyev et al. (2001) diagnosed digestive fistulas in 5% of cases in patients who underwent “open” interventions for pancreonecrosis. Among all digestive tract fistulas, the most frequent complication was the formation of an external pancreatic fistula in 50% of cases. The second frequent complication in the structure of digestive fistulas was an external colonic fistula, the development of which was observed in 38% of cases. Localization of these fistulas was observed in the most “interested” zones of massive necrosis of retroperitoneal tissue, accompanied by thrombosis of mainly venous mesenteric branches [5].

B. C. Savelyev et al. (2001) found that in the pathomorphogenesis of external fistulosis in pancreonecrosis the leading role is played by the degree of process prevalence in the retroperitoneal tissue, the fact of infection of necrotic tissues and the nature of surgical intervention, which in their combination determine the frequency of development, localization and outcomes of digestive fistulas [5]. Drainage of hard rubber, especially left in the abdomen for a long period of time, can cause decubitus of the intestinal wall. The role of tampons in the pathogenesis of intestinal fistulas is

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insignificant. However, it should be emphasized that tampons standing in close proximity to the intestine, from the abdominal cavity should be removed carefully, after their “soaking”. Such factors as early removal of tampons, untimely and inadequate drainage of purulent focus, euteration and suppuration of the surgical wound can contribute to the formation of intestinal fistula in the postoperative period. Purulent impregnation of the intestinal wall, its drying and inevitable trauma to the serous cover in these conditions cause destruction of the intestinal wall with the formation of an intestinal fistula.

Such causes of colonic fistula development as abrupt bloating, infiltration of the wall, containing a large amount of dense fecal masses and gaseous contents, and lack of natural passage can also be noted [5].

Late complications after sequestrectomy range from 50-62% in different studies [1, 18]. The frequency of pseudocysts ranges from 1 to 22% . A. C. Butkevich et al. (2007) found cysts in 30.4% of patients treated with the “open abdomen” technique and in 40% of patients treated with traditional surgical methods in the distant period, up to 5 years after surgery [14].

И. N. Grishin et al. (2009) consider cysts, fistulas and complications from the position that they are different forms of chronic pancreatitis. In addition, this group of authors believe that such two concepts as cyst and fistula are pathogenetically related, their clinical course is difficult to predict, as it can lead to various complications up to lethal outcomes .

In acutely developing cysts, a number of authors suggest postponing surgery for several weeks or even months until the formation of a more dense cyst wall and pancreatitis subsides. Other surgeons recognize the necessity to resort to surgical treatment regardless of the timing of cyst development . The necessity of such active surgical tactics is justified by the possibility of development of severe complications of pancreatic cysts, such as bleeding, suppuration, perforation.

According to different authors, in 12-18% of observations, laparostomy, programmed abdominal cavity sanation and phlegmon of the anterior abdominal wall in peritonitis are the causes of postoperative, sometimes giant ventral hernias .

In the study of A. Ц. Butkevich (2007) in the main group of patients in whom the “open abdomen” method was used, ventral hernias were noted in 73.9% of cases. While in the group with the use of traditional interventions the frequency of hernia formation was 30% [8].

One of the leading factors leading to postoperative ventral hernia are foreign bodies, drains, tampons placed in the abdominal cavity , wound suppuration leading to their healing by secondary tension with the formation of a thinning scar, which does not have sufficient strength and elasticity and therefore cannot withstand increased intra-abdominal pressure, hypoproteinemia, anemia, tissue edema, cachexia, obesity, diabetes mellitus, complications of the postoperative period - pneumonia, bronchitis, prolonged intestinal paresis, flatulence .

The peculiarity of hernias formed after application of the “open abdomen” technique is their large size and impossibility of hernia defect plasty with local tissues, and the only possibility of hernia sac closure is a non-tensioned plasty with polypropylene mesh.

Conclusions: The frequency of complications after surgical treatment of pancreonecrosis, the wide variability of occurrence, and the lack of recommendations for implementation in practice that could reduce the number of complications are grounds for additional clinical studies.

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