THE ROLE OF COMPUTED TOMOGRAPHY IN DEFINING THE THERAPEUTIC APPROACH AND CHOICE OF THE OPERATION METHOD FOR PATIENTS WITH ACUTE PANCREATITIS

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Abstract. The results of examination and treatment of 110 patients with acute pancreatitis (AP) have been analyzed; 47 (42.7%) of these patients underwent computed tomography (CT) of the pancreas and of the retroperitoneal space prior to the operation. The analysis of the results showed that the CT of the pancreas and retroperitoneal space allows inferring the infected nature of liquid formations with an accuracy of 93.8%, which provided the basis for the development of a method of acute pancreatitis treatment based on the evaluation of the integrity of the retroperitoneal space fascias (Fride, Toldt, Treitz, Gerota fascias), as well as the localization of liquid formations in the retroperitoneal space.

Keywords: acute pancreatitis, pancreas, computed tomography, retroperitoneal space, liquid formation.

Introduction

The leading cause of fatal outcomes in patients with AP is the delayed contagion of the pancreas and/or the surrounding cellular tissue spaces. The above factor accounts for up to 50% of the cases in the structure of delayed lethality (Ablayev, 2013; Carnovale et al., 2005). Surgical sanitation methods are the leading treatment methods for this complication (Beger et al., 2008, p. 332-342; Takeda et al., 2006).

From the surgical perspective, two circumstances are critical in the assessment of a patient’s potential for survival:
- the impossibility of single-step surgical sanitation of infected foci;
- the high frequency of relaparotomies.

For the above reasons, the course of the disease is characterized by the long existence of a local purulonecrotic inflammatory process in the pancreas itself and in the retroperitoneal space, which leads to sepsis and delayed multiple organ dysfunction syndrome (MODS), arrosion hemorrhage (AH), hollow organ perforation with the development of external and internal fistula, peritonitis (Liakhovskiy et al., 2011; Miller et al., 2012).

Consequently, solving the task of the fastest and most adequate sanitation of local delayed purulonecrotic complications possible while minimizing the frequency of relaparotomy performance is a potential reserve to decrease the delayed lethality in patients with AP.

Currently the key methods of surgical sanitation of local delayed purulonecrotic complications in patients with AP include “closed” external puncture drainage under ultrasonic control (USC) and “open” laparotomy operations (Minakov, 2009; Sandakov et al., 2013; Ivanov et al., 2014).

Nevertheless, the accumulated experience of “closed” puncture drainage interventions under USC shows that the latter are not always adequate and justified (Bensman et al., 2013; Lankisch, 2009). Their application often leads only to the progression of the purulonecrotic process and its local spreading and, consequently, to a delay in open-access wide-scale sanitation. It is a cause of the origin of retroperitoneal space phlegmons (RSP), sepsis, delayed MODS, AH, and the relaparotomies performed in these cases are often life-saving by nature (Riazanov, 2008; Kondratenko et al., 2013).

On the other hand, a primary open operation does not solve the problem of the single-step sanitation of all purulonecrotic foci either, both due to the peculiarities of the course of the condition itself and its complications and due to the impossibility of its application in a significant number of patients due to the...
severity of their overall condition (MODS, sepsis, comorbid condition decompensation) and leads only to the recurrent contagion of the patients with sterile pancreatonecrosis (SP) and/or sterile liquid collections in the second phase of the condition with subsequent relaparotomies (Werner et al., 2005).

To our opinion, the approach of “preventive” performance of surgical interventions with the specification of the indications for the use of this or that operation method will allow solving the problem of fast and adequate sanitation of the infected foci of the pancreas and retroperitoneal cellular tissue more effectively, prevent recurrent contagion of sterile necroses and liquid formations, which will allow minimizing the number of relaparotomies, local and systemic complications, decrease delayed lethality. Further study of the role of CT, whose possibilities in the AP course prognosis have not been fully studied yet, may contribute to the solution of this problem (King et al., 2003).

The aim of the research
To define the role of CT in determining the therapeutic approach and choice of the operation method in patients with AP in order to decrease post-operative lethality.

Materials and methods
110 patients with AP were receiving hospital treatment in the clinic of the surgery chair with a course of purulent-septic surgery of ZMAPE of MoH of Ukraine SI, Zaporozhye, from 2005 till 2012; 42 (38.2%) of them underwent relaparotomies.

To diagnose the severity of AP, the distribution of the necrosis foci of the pancreas and retroperitoneal cellular tissue, the existence of local complications, clinical laboratory and biochemical examinations, plan radiography of abdominal cavity organs, stomach and duodenal radiography, ultrasound scanning (USS), CT with intravenous contrast bolus enhancement, fibrogastroduodenoscopy, laparoscopy, cytological and bacteriological examination of the content of the abdominal cavity with the definition of the causative agent species and its sensitivity to antimicrobials, amylase analysis and transdrainage fistulography were applied.

94 patients (85.4%) had complications: 37 (39.3%) had RSP, 33 (35.1%) had peritonitis, 30 (31.9%) had sepsis, 20 (21.2%) had pancreatic abscess (PA), 8 (8.4%) had acute liquid formation (ALF).

47 (42.7%) patients underwent CT. The degree of pancreas damage according to E.J.Balthazar and E.L.Bradly amounted to: В in 4 (8.5%) patients, D in 21 (44.7%), E in 22 (46.8%). The data of the pre-operative CT allow suggesting the presence of an infected process during the analysis of natural fascia structure destruction and by the character of liquid collection distribution in the retroperitoneal cellular tissue space.

42 patients (38.2%) underwent 95 relaparotomies. 61 (64.2%) interventions were performed “out of necessity”, 34 (35.8%) – “by the program”. Relaparotomy was performed once for 15 (35.7%) patients, twice for 10 (23.8%), three times for 9 (21.5%), four times and more for 8 (19%). The progression of the spreading of the purulent process in the retroperitoneal space, the existence of large sequesters and inadequately drained abscess cavities, the need for the rupture and redrainage of limited spaces and cavities caused the need to perform relaparotomy interventions “out of necessity”.

Results and Discussion
The absolute indications for the performance of primary operations on patients with AP included: the presence of free liquid in the abdominal cavity, presence of ALFs, infection development in pancreas necrosis foci, origination of RSPs, the biliary causation of the condition.

97 (88.2%) of the patients were operated on in total. 46 (47.4%) of them underwent one operation, 20 (20.6%) underwent two, 10 (10.3%) underwent three, 10 (10.3%) underwent four, 10 (10.3%) underwent five and 1 (1.1%) patient underwent six.

Traditional laparotomy surgery was performed on 42 (43.3%) patients and minimally invasive surgery – on 55 (56.7%). The minimally invasive intervention group included the patients who underwent external laparoscopy drainage of the abdominal cavity, external ALF drainage under USC and endoscopic papillosphincterotomy (EPST).

The surgical treatment of the patients was carried out on a stage-by-stage basis. Minimally invasive interventions in view of the indications (EPST; laparoscopy sanitation and drainage of the abdominal cavity; ALF and RSP drainage under USC) were applied on the first stage, which allowed decreasing the signs of systemic inflammation response syndrome, SIRS. Intensive therapy was performed later on. Such interventions became the ultimate method of surgical treatment for 46 (47.4%) patients.
The second stage of the treatment, laparotomy, mostly from selective short-scan incisions with a pancreatequeestionectomy (PSNE), liquid formation and retroperitoneal space drainage, was performed in case of a negative course of the condition, local complication development and persistence of long-lasting infection, i.e. maintenance or aggravation of the patient’s state by Ranson’s criteria, maintenance of fever response and purulent discharge in the drainage with no decrease trends, maintenance of the size of the residual cavity or in the cases of its growth, detection of unlysed residual sequesters of the pancreas and/or retroperitoneal cellular tissue during USS or CT.

The indications for a recurrent operation included: persistent signs of long-lasting infection, evolving peritonitis, early adhesive acute intestinal obstruction, AH, abdominal cavity abscesses.

According to the results of CT, 3 patients underwent operations on the В-G stage, all of them once: 2 underwent external laparoscopy drainage of the abdominal cavity, 1 underwent external drainage under USC. 18 (85.7%) patients out of 21 underwent operations on the D stage, 3 of them once, 5 – twice, 2 – three times and 8 patients – four times and up. Primary operations consisted in the performance of external laparoscopy drainage of the abdominal cavity in 6 patients, external ALF drainage under USC in 8, PSNE in 2, cholecystectomy in 1, EPST in 1. Repeated operations were performed for 15 patients who had underwent stage-by-stage interventions: PSNE for 6 patients, external redrainage of the omental bursa and retroperitoneal cellular tissue for 4, AH stop for 3, nasogastric small intestine intubation for 2.

20 (90.9%) of 22 patients underwent operations on the E stage. 10 patients were operated on once, 2 – twice, 2 – three times, 7 – four times and up. The primary operations consisted in the performance of external laparoscopy drainage of the abdominal cavity for 3 patients, external ALF drainage under USC for 4, PSNE for 3, sanitation and drainage of the omental bursa and retroperitoneal space for 10. Repeated operations were performed for 10 patients who had underwent stage-by-stage interventions: PSNE for 4 patients, external redrainage under USC for 2, nasogastric small intestine intubation for 2, AH stop for 2.

The analysis of the pre-operative CT data showed that fascia structure damage was observed in 10 (90.9%) of the 11 patients with infected AP whose surgical treatment began with “closed” external drainage under USC. Contagion was also observed in 10 (90.9%) out of 11 patients according to the results of the primary bacteriological examination. The content in 1 patient with fascia damage proved to be uninfected, while in 1 without fascia damage it was infected. The average number of laparotomies amounted to 3.6±0.42, the number of complications being 3.47±0.38 and lethality amounting to 4 (36.3%). These figures amounted to 0.08±0.08; 0.16±0.11; 0% respectively for uninfected AP observed in 16 patients.

The similar analysis of the results of those patients whose treatment had begun with an “open” operation showed that fascia structure damage was observed in 12 (80.0%) out of 15 cases. The average number of laparotomies amounted to 2.26±0.40 (t=2.24; P<0.05), the number of complications being 2.45±0.23 (t=2.47; P<0.05) and lethality amounting to 1 (6.3%) (χ²=4.85; P<0.05). Contagion was observed in 11 (73.3%) out of 15 patients according to the results of the primary bacteriological examination. The content in 1 patient with fascia damage proved to be uninfected, while in 1 without fascia damage it was infected. These figures amounted to 0.4±0.24; 0.6±0.24; 0% respectively for uninfected AP observed in 5 patients.

The informative value of CT in determining the contagion of the liquid collections of the retroperitoneal space during the analysis of the character of their distribution and natural fascia structure damage amounted to: sensitivity – 95.6%; specificity – 92.0%; positive result validity – 91.7%; negative result validity – 95.8%; overall share of correct conclusions – 93.8%, whereas the correlation coefficient amounted to R=0.829; P<0.001.

As a result of the analysis of the data obtained, we developed a method of treatment of patients in the second period of acute pancreatitis (Riazanov and Antonevich, 2013).

The method is applied in the following way: the localization of the liquid collection is determined and the presence of natural retroperitoneal space fascia (Fride, Toldt, Treitz, Gerota fascias) deterioration is established using the computed tomography data. The indications and choice of the operation method are determined based on the three possible variants of the interpretation of the data obtained:

1) if natural fascia deterioration is detected, an “open” operation is performed with subsequent open relaparotomies “out of necessity”;

2) if there is no natural fascia deterioration, but the volume of the liquid formation is over 100 cm³, “closed” external puncture drainage under USC is performed;
3) if the liquid formation in the abdominal cavity is smaller than 100 cm$^3$, conservative therapy is conducted and an “open” operation is performed only in cases of a negative course (increase in the original liquid formation volume).

The proposed method allows determining the therapeutic approach, establishing the indications for the operation method choice based on the data of a physical examination, performing adequate sanitation of the infected foci of the pancreas and retroperitoneal cellular tissue, preventing recurrent contagion of the sterile necroses, which, in its turn, allows decreasing the number of relaparotomies, local and systemic complications, decreasing post-operative lethality and avoiding surgery for a number of patients.

12 operated patients out of 97 died. Post-operative lethality amounted to 12.4%. 9 (75%) of them underwent early PSNE (1st to 7th day), 1 (8.3%) underwent late PSNE (on the 21st day). 2 (16.6%) patients underwent no pancreas intervention.

The analysis of the causes of the lethal outcome showed that its immediate causes included MODS associated with general peritonitis and severe sepsis in 6 (50.0%) patients, RSP in 4 (33.3%) and AH in 2 (16.6%).

Consequently, the lethal outcome was caused by the severity of the course of SP and the systemic complications that originated in 50% out of the 12 patients who died and by its delayed infected local complications in the remaining 50%.

An algorithm of acute pancreatitis diagnostics and treatment in the second period of the disease using the data of pre-operative CT was created based on the results of the study.

Fig. 1. The algorithm of therapeutic approach and operation method choice based on the CT data in patients with acute pancreatitis in the second period of the condition

Thus, the results of pre-operative CT with an analysis of natural fascia structure damage and the character of liquid formation distribution in the retroperitoneal space allow diagnosing the infected nature of the content reliably with a precision of 93.8% and choose the operation method: “closed” external drainage under USC is justified if the integrity of the natural fascia structures is maintained and an “open” operation if they are destroyed. Conservative therapy and ultrasound monitoring are justified in case of local liquid collection with a nominal volume up to 100 cm$^3$, maintenance of the natural fascia structure integrity and no increase in the liquid volume over time.

Conclusion

To determine the therapeutic approach and choose the operation methods, it is advisable to perform an assessment of the integrity of the natural retroperitoneal fascia (Fride, Toldt, Treitz, Gerota fascias) integrity.
and take into account the localization of the liquid formations in the retroperitoneal space while performing the computed tomography of the pancreas and retroperitoneal space for all patients with acute pancreatitis.

The proposed method of acute pancreatitis treatment based on the computed tomography data of the pancreas and retroperitoneal space allows determining the optimal method for the primary operation, decreasing the frequency of relaparotomy and decreasing post-operative lethality.

References


