ULTRASOUND DIAGNOSTICS AND NAVIGATION SURGERY IN ACUTE PANCREATITIS

Azat Minvagizovich Zainutdinov, Igor Sergeevich Malkov, Almir Rashidovich Abashev
PhD in Medicine, assistant professor of the Department of fundamentals of clinical medicine of Kazan Federal University, Department of surgery SBEI CPE KSMA of Federal Service on Surveillance in Healthcare, 89172682534 – e-mail: zainoutdinov@mail.ru
MD, Professor, Head of Department of surgery SBEI CPE KSMA of Federal Service on Surveillance in Healthcare, 8965 5944007.
PhD in Medicine, assistant professor of the Department of fundamentals of clinical medicine of Kazan Federal University. 89046623100.
Email: almir75@mail.ru

Received on 14-08-2016
Accepted on 20-09-2016

Abstract
This paper presents a method of puncture treatment in 87 patients with acute destructive pancreatitis. The developed at the Department indications and contraindications for puncture drainage are presented in the publication. The technique of ultrasound-guided puncture and drainage, and their subsequent management have been described. The most frequently used approaches in infected pancreatic necrosis and retroperitoneal infection are given. The technique, improving the ultrasound imaging of the pancreas and retroperitoneal space, is presented. The selected clinical cases present the ultrasonographic criteria ensuring the solution of tactical problems.

Keywords: acute pancreatitis, puncture, drainage, ultrasound guidance

Introduction
In recent years, there have been revolutionary changes in surgical treatment of pancreatic necrosis. Nevertheless, the problem of treatment of infected pancreatic necrosis remains still relevant because of the high postoperative mortality of patients (Table 1) (H.G. Beger and R. Isenmann, 2002).

Methods of puncture drainage of abdominal and retroperitoneal structures, performed under the ultrasound and computed tomographic guidance, have allowed revising the views on the treatment of many diseases and surgical complications, including the treatment of necrotizing pancreatitis. According to foreign studies, 75% of patients who had indications for open surgical procedures established, were successfully treated with puncture methods in case of infected pancreatic necrosis. This approach is based on the works by Hans G. Beger and Rainer Isenmann (University of Ulm, Germany, 1993, 2002). The authors found that the majority of patients with aseptic pancreatic necrosis
achieved positive results with the help of conservative therapy. One of the authors who first focused on the great importance of conservative therapy, conducted in the intensive care unit in patients with this pathology, were Bradley and Allen, 1991. At the same time, the conducted therapy was effective in all patients. In subsequent years, according to various authors, the success of conservative treatment of patients with aseptic form of pancreatic necrosis ranged from 40% to 98%, and mortality ranged from 2% to 11%. C.R. Carter et al. in 2000 [5] developed an original method necrosequestrectomy performed under CT guidance with the expansion of puncture channel with a special urological bougie with an optical cannula and a balloon dilator. Puncture channel to the site of infection passed, in most cases, through the left lumbar region between the spleen and the colon, or through the right upper quadrant between the colon and the liver in front of the duodenum. The programmed debridement of the abscess was conducted every 7-10 days to clean its cavity. The authors have achieved a significant reduction in mortality.

Materials and methods:
The clinic of the Department of Surgery SBEI CPE KSMA have applied the method of puncture treatment of pancreatic necrosis in patients with localized forms of acute destructive pancreatitis since 1999. Currently, the indications and contraindications for the use of this method have been developed.

Indications for puncture drainage in the treatment of patients with destructive forms of acute pancreatitis:
1. Localized fluid accumulation in omental and retroperitoneal fat of more than 40.0 ml.
2. The presence of fluid formations with the proven infection of the content by fine-needle aspiration with punctate Gram staining.
3. Omental and retroperitoneal abscesses with clear boundaries.

There is also a vast experience gained in terms of complications. For example, multiple punctures in one patient resulted in enteric fistulas and erosive bleeding from the pancreatic bed. A promising direction in the prevention and treatment of erosive bleeding in destructive pancreatitis, in our opinion, is the use of endovascular X-ray surgery [13]. Therefore, like any other method of treatment, it has its limitations and is contraindicated in the following cases:
1. Generalized foci of infection in the retroperitoneal fat.
2. The presence of free-lying sequesters larger than 30.0 mm.
3. The absence of abdominal structures with fluid content.

Eighty-seven patients with proven infected pancreatic necrosis received treatment. Total 121 punctures and drainages of omental and retroperitoneal space were conducted. All these punctures ended with drainage, that is, they were
diagnostic and therapeutic in nature. Infection was determined by the clinical indicators, such as SIRS-syndrome, punctate Gram staining, and bacteriological examination.

In order to develop and improve the methods of puncture drainage under ultrasound guidance, we have analyzed the results of treatment, as well as morphological changes in the pancreas against the background of the treatment in 125 patients with pancreatic necrosis, admitted to the emergency station.

All hospitalized patients underwent a pathogenetic intensive therapy. 104 patients of them managed to undergo a conservative therapy under dynamic ultrasound guidance, without any surgical interventions. Indications for puncture drainage in 87 patients under ultrasound guidance were the presence of infected fluid accumulation in the omental sac, paracolon fat tissue, retroperitoneal space and abdominal cavity.

The main methods of determining the nature of morphological changes in the pancreas were ultrasonography (US) and computed tomography (CT). Giving a comparative evaluation of the diagnostic value of these methods of investigation it should be noted a high information content (90.2%) of the computer tomography in case of infected forms of pancreatic necrosis, when the pathological process extends to a retroperitoneal fat. The information content of the US at the same time was 88.6%. Diagnosis of infected pancreatic necrosis was carried out under the x-ray guidance by percutaneous puncture of the abdominal cavity and retroperitoneal space, followed by Gram staining of exudate and the microscopy. Currently, according to foreign authors, there has been growth of Gram-positive and fungal flora, the cause of which is not established [1]. However, some experts found the relationship between fungal flora and poor outcome of the disease [7]. To assess the prognosis of pancreatic necrosis and analysis of results of treatment results, we used our modified assessment system of patients’ condition proposed by I.I. Dzhanelidze St. Petersburg Institute of Emergency Care. It consists of two sections, including basic and advanced features of the disease severity [8]. Group 1 included patients, who had 2 main symptoms or 1 main and 2 additional symptoms of their state severity recorded on day 1 of the disease (severe pancreatic necrosis). Group 2 included patients only with 2 additional symptoms (moderate pancreatic necrosis). In case of the development of infected pancreatic necrosis, we evaluated the severity of the patients’ condition by the systemic inflammatory response syndrome (SIRS). In case of 3 signs of systemic inflammatory response (SIRS 3), a local non-homogeneous cluster formation in the omental sac and retroperitoneal space, and inefficient puncture treatment, we have established indications for the open method of treatment of infected pancreatic necrosis. We used original approaches to the localized foci of infected pancreatic necrosis. Manipulation was carried out using a rigid trocar. Skin puncture was conducted perpendicular by “Free
The "hand" method under the guidance with ultrasonic sensor. The trocar advanced to the purulent focus, bypassing the adjacent organs. The direction of the trocar advancement changed constantly depending on the location of the adjacent organs. One of the most frequent approaches, according to our data, was an approach in the left upper quadrant, in contrast to foreign authors [4,7], who more often use an approach through the left lumbar region between the spleen and colon. The approach in the left upper quadrant was used more often due to the presence of so-called "acoustic window" (a window in the lig. gastrocolicum between the stomach bottom contour, the left lobe of the liver, and the transverse colon) mainly for drainage of omental bursa. The second most frequent approach was in the right upper quadrant, which is consistent with Sarter C.R., 2000 [7]. This approach is used in case of the pathologic focus localized in the pancreatic head and body, between the stomach and the transverse colon, in front of duodenum. The approach in the right and left lumbar regions was carried out in combination with other approaches. The trocar passed between the spleen and colon towards the abscessed focus located in the pancreatic tail or in paracolon fat tissue. Rare use of this approach is due, in our opinion, to the risk of damage to the gate of the spleen and middle intestine. In case of abscessed paracolon fat tissue, the approach in spina iliaca posterior superior is used. In several cases, a dual drainage of one focus is performed due to the large abscess size and inefficiency of the first drainage, detected with ultrasound immediately after installation, as well as two multi-hole drainage installed face-to-face.

During 28±21 days, the debridement of infected cavities was performed with antiseptic solution through the installed drains. Starting from day 9±3 after laparoscopic debridement in case of the formation of purulent lesions, the indications for multiple (up to 14 times) punctures under ultrasound guidance with drainages were established in 5 patients. In case of complicated ultrasonographic examination of the pancreas after remaining pneumoperitoneum, the "hydroacoustic screen" technique was used (priority reference No. 021929) that allows for visualization of the structure of the pancreas, omental sac and retroperitoneal space. The technique implies filling the stomach with a balloon with a saline solution to improve the examination of the said organs [14]. Patients subjected to punctures under ultrasound guidance were divided into 2 groups according to severity of their state: a group with moderate and severe condition.

Results:

Patients subjected to punctures under ultrasound guidance were divided into 2 groups according to severity of their state: a group with moderate and severe condition. Frequency of using the puncture treatment in the structure of all surgical interventions in pancreatic necrosis in group of moderate condition was 16%, while in the group of severe
In the group of moderate condition (16 patients), we revealed 4% of early toxic complications in the form of acute circulatory failure (1 patient), pneumonia (1 patient), and 5% of late postnecrotic complications such as abscesses of paracolon space (1 patient), wounds purulence (2 patients), intestinal fistula (1 patient). In the group of severe condition (5 patients), the early toxic complications accounted for 10%, mostly in the form of pneumonia (2 patients). Late postnecrotic complications accounted for 14%, in the form of a retroperitoneal abscess (2 patients), wounds purulence (2 patients), intestinal fistula (1 patient), and erosive bleeding (1 patient). Overall mortality was 12% (group of moderate condition - 9%, group of severe condition - 15%).

Gram-negative flora of pancreatic necrosis was revealed in 63% of cases, while in other cases it was mixed, which required the prescription of additional antibacterial drugs. As for the detection of candidal bacterial flora in the punctures, their detection rate was 50%, which is due, in our opinion, to a nosocomial infection on the background of long-term antibiotic treatment and, possibly, antibiotic preventive treatment. At the same time, the autopsy of one died patient aged 76 years found no progression of pancreatic necrosis. The spread purulent lesions in the retroperitoneal fat are an indication for the treatment by open methods, which had not been included in this study group. In most cases, the cavity lesions were drained with two tubes. In case of delineated clusters over 100 ml a daily lavage was carried out with the solution of Dioxydin for 28±21 days. One patient underwent 8-multiple punctures of cavity lesions until the complete resolution of the pathological process.

Indications for a change-over to laparotomy occurred in one patient with enteric fistulas and erosive bleeding from the pancreatic bed resulting from multiple punctures.

After laparoscopic debridement of the abdomen in acute destructive pancreatitis, 5 patients on day 9±3 had the abdominal purulent lesions formed, which were drained in the omental sac and retroperitoneal space under ultrasound guidance. In case of complicated ultrasonographic examination of the pancreas due to flatulence, we applied the method of “Intracorporeal screen” (a favorable action to grant a patent for the invention of the Russian Federation No. 2003120741/021929 of 07.07.2003), which allows visualizing the structure of the pancreas, omental sac and retroperitoneal space. The technique implies filling the stomach with a balloon with saline solution to improve the resolution of echosonography. Our experience allows us to recommend 4 approaches to the limited infected foci of pancreatic necrosis for the puncture treatment under ultrasound guidance. At the same time, the safest for the omental sac approach is a puncture from the left hypochondrium, where in most cases there is an "acoustic window".
The monitoring of the course of the pathological process in patients with destructive forms of acute pancreatitis identified the characteristic ultrasonographic criteria that solve the tactical problems. Two variants of the disease have been identified. In variant 1, the volume of treatment was limited to intensive medical therapy with puncture drainage under ultrasound or CT guidance. Variant 2 was characterized by the absence of a positive effect of minimally invasive therapies, and required laparotomy.

These data illustrate the following clinical examples.

On day 3 after admission to the emergency station, the patients with moderate acute pancreatitis in the epigastric region of the abdominal cavity had a gigantic cavernous formation defined, with a non-uniform rough formation in the form of "villous surface" or "seaweed" on its broad basis - a lobule of the pancreas - on the dorsal wall (Fig. 1).

Ultrasound pattern of abdominal cavity of patient Kh. on day 3 after admission to the emergency station with acute pancreatitis.

At this stage of the disease, in the absence of signs of infection in the gland, the puncture was performed with drainage due to subcapsular and hypertension clinic intoxication. On day 10-14, the intersections were defined, indicating the formation of connective tissue structures, the heterogeneity with a predominance of hypoechoic areas, which means the remaining acute attack. At the same time, there is swelling in the retroperitoneal space, erasing boundaries defined between the tissue of the pancreas and retroperitoneal space due to the involvement of the retroperitoneal fat in inflammation process (Fig. 2).

Ultrasound pattern of abdominal cavity of patient M. on day 14 after admission to the hospital, and the stabilization of the condition by conservative methods of treatment.
There is a strip of fluid under the pancreatic capsule.

On day 16, the formation of sequesters is defined in different parts of the pancreas, depending on the process localization. The rounded formations are defined in the body of the pancreas, the presence of sequesters in the form of non-uniform rounded formations with a predominance of hypo- and isoechoic formations. The areas of sequestration are defined, the size of the pancreatic head is normal, of increased echogenicity; there is the elimination of edema, the inhomogeneous areas with a predominance of hypoechoic areas are defined in the area of the body, indicating the formation of sequesters (Fig. 3).

Ultrasound pattern of abdominal cavity of patient G. on day 16 after admission to the hospital, and the stabilization of the condition by conservative methods of treatment.

This program of the dynamic ultrasonographic monitoring of patients with pancreatic necrosis is particularly designed for its use in the hospitals with no X-ray CT and MRI examination.

Summary

Thus, we recommend to perform punctures under ultrasound guidance in case of infected fluid clusters depending on the clinical situation and ultrasonographic protocol. The various methods of trocars with drainage have been developed. The frequency of use of drainage localization has been determined. The dynamic ultrasonographic surveillance program allows for its effective use in health care facilities, not equipped with CT and MRI. A promising direction in the prevention and treatment of erosive bleeding during punctures and drainage of abdominal lesions under ultrasound guidance in destructive pancreatitis is the use of endovascular X-ray surgery.

Acknowledgements

The work is performed according to the Russian Government Program of Competitive Growth of Kazan Federal University.
References.


