Value and limits of surgery in acute pancreatitis – forensic dilemma in case of death in acute pancreatitis

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Abstract: Acute pancreatitis is one of the pathological conditions known as surgical abdominal emergencies, in which surgery is reserved only for lithiasic etiology and / or local complications of the disease. The risk of death is still high, despite the big understanding progress of the etiopathogenic mechanisms of the disease. It is forensic the one who is called in those situations with medical failure find the death-generating causes that can be attributed to medical and surgical gesture.

Key Words: acute pancreatitis, organic failure, infected necrosis, hemorrhage.

INTRODUCTION

Acute pancreatitis is one of the major medical-surgical emergencies, where the first priority is represented by the intensive care treatment, but where at any time in the evolution can arise the need for one or more surgical interventions aimed to remove the causative factor or to solve the complications of the disease. Also, mainly due to its severity, acute pancreatitis still continues to be one of the pathologies encumbered by very high mortality (1-5% of overall mortality, 20-50% mortality in severe cases), thus raising many questions about the cause of death and how it could be avoided (2, 5, 10, 19, 24, 28, 29, 32). Considering the etiopathogical and anatomo-clinical complexity of the severe cases of necrotizing-hemorrhagic acute pancreatitis, one recommends the treatment to be carried out by highly experienced surgical services, which benefit from performance intensive care units with rich expertise and material resource. In cases resulted in failure when the patient dies, the first analysis of the cause of death is done by pathologist of Pathology Departments inside the hospitals where the patients were hospitalized and treated. Whenever it raises suspicions about the death-generating causes, the case will be referred to special forensic services, which will have to make a careful distinction between situations of bad evolution which is due to the disease itself and those where less well-chosen and / or less correctly executed surgical gesture greatly contributed to death.
DISCUSSION

Atlanta classification of 1992, revised in 2012 (after a meeting of the working group for pancreatitis in 2007 also) classified acute pancreatitis by gravity into 3 main types: mild (without organic failure and without local or systemic complications), moderately severe (organic failure for maximum 48 hours, local and systemic complications usually with no need for surgical gestures) and severe (organic failure that lasts over 48 hours, local and systemic complications) (7, 10, 11, 23, 35). Considering the morpho-clinical appearance, the 3 types of acute pancreatitis described above manifest themselves as interstitial or edematous acute pancreatitis, as necrotizing-hemorrhagic acute pancreatitis or respectively as forms with infected necrosis. Microscopic lesions met in these pathologic entities are represented by edema, by acute inflammation with characteristic leukocyte influx, by enzymatic necrosis of the fat tissue, by proteolytic destruction of pancreatic parenchyma, by destruction of blood vessels under the action of elastase with subsequent interstitial hemorrhage (3, 4, 33).

There are numerous attempts, mainly Americans and Japanese, to establish a stage dependent procedural approach that includes both modalities for a more efficient diagnostic evaluation in the very early stage of the disease, as well as the therapeutic modalities and timing for each of them, thus seeking to obtain maximum benefit with minimum additional risk induced by the medical intervention. Thus, both the American guide IAP/APA (International Association of Pancreatology / American Pancreatic Association) in 2013 (23, 35) and the Japanese guide JPN in 2010 (16, 25, 41, 42), insist on very clear establishing of therapeutic steps to be covered in case of a patient with acute pancreatitis, trying to allow a clear distinction between inauspicious evolution due to the illness and the one due to an unexpected or wrong surgical gesture.

Most recent studies insist on a as long as possible delay of the interventional gestures (preferably to be done after the period of the first 4 weeks of illness), thus enabling local complications of the disease to be delimited and avoiding both risk of infection of peri-pancreatic collections and of inefficient gestures while at risk gestures (4, 9, 11, 17, 20, 21). These, in the context in which the pancreas is a not very big retroperitoneal organ (100 grams per adult), bounded by a poorly differentiated capsule and intimate neighboured by digestive structures (bile duct, duodenum, transverse colon) and especially by important blood vessels (vein portal and its tributaries, branches of the vessels in the celiac trunk, superior mesenteric artery and its branches).

It is considered that there are 2 progressive phases in the evolution of acute pancreatitis: an early phase (the first 2 weeks) and a late phase (subsequent evolution after the first 2 weeks). The risk of death during
the first two weeks is mainly due to the occurrence of SIRS with development of MSOF, the most frequently involved being the lung; main task at this stage returns to intensive care gestures, which must conduct a prompt hydro-electrolyte and metabolic support. Late stage is dominated by the emergence of a so-called inflammatory counteraction response syndrome (CARS), with MSOF generating potential by his turn, most often in the context of pancreatic and peripancreatic collections superinfection (40). The risk of death in the late phase is due, therefore, to development of local complications with septic and hemorrhagic potential; interventional gestures, most commonly surgical, are those that can bring resolution, but in the same time are yet full of risks because they interfere on particular friable tissue, where they have to achieve the removal of devitalized infected areas, meanwhile sparing both vascular and digestive structures of the neighbourhood. At this moment there is a tendency to find minimally invasive modalities to evacuate the super infected collections, most often mentioned being the VARD technique (video-assisted retroperitoneal debridement, first described in 2000 by Carter which used a nephroscope to achieve retroperitoneal approach, enhanced recently by Bucher as single port laparoscopic technique) and the LTPD technique (infracolic laparoscopic necrosectomy described by Cuschieri) (5, 40).

Local complications of acute pancreatitis are represented by the so-called pancreatic and peripancreatic collections, these presenting themselves in evolution as one of the following 5 forms: 1 - acute fluid peripancreatic collections (are developing in the early phase of acute pancreatitis, most remain sterile and resolve themselves spontaneously without intervention), 2 – pancreatic pseudocysts pancreatic (fluid collections of the peripancreatic tissues and occasionally intrapancreatic, surrounded by a wall made up of tissues of the around organs, often occur in more than 4 weeks since onset and are mainly due to ductal breaches), 3 - acute necrotic collections (collections formed in the first 4 weeks and presenting also necrotic tissue besides the fluid content, difficult to be imagistic differentiated from the first type during the first week of evolution), 4 – delimited necrosis (is the so-called maturated type of the previous collection, revealed after four weeks of disease evolution, when the necrotic tissue is bounded by an inflammatory wall; formerly known as organized pancreatic necrosis, necroma, pancreatic sequester, pseudocyst associated with necrosis or subacute pancreatic necrosis) and respectively 5 - infected necrosis (possible appearance in the evolution of the previous two types of collections, which raises diagnostic problems and clearly requires interventional, most often surgical, action).

There is a 15-20% incidence of severe necrotizing-hemorrhagic forms, mortality in these cases ranging between 20-50% (5, 24, 26).

As regards the deaths caused by acute pancreatitis, it was found that there is a relatively equal number between deaths occurred during the so-called early stage of disease (first 2 weeks) and the so-called late phase (after the first 2 weeks of evolution). In the first 2 weeks, the deaths are mainly due to MSOF produced by fulminant evolution of the disease, in the forefront being the pulmonary complications: enzymatic pleurisy, enzymatic pneumonia. After the first 2 weeks of evolution, deaths are mainly due to local complications of the disease, where infection of the necrosis areas with subsequent sepsis plays the leading role.

It is very important to appreciate as early as possible the subsequent progressive manner of pancreatitis, to detect the forms with severe evolution severe that require proper treatment. Most existing scores (Ranson, Glasgow-Imrie, APACHE I/II/O) need 48 hours to gather predictive data, time that is considered to be too long. Recently special importance is given to 2 different evaluation systems: BISAP score and HAPS score. BISAP score takes into account 5 parameters: SIRS, age, pulmonary condition, nitrogen retention and altered mental status, assigning 1 point to the presence of modifications to any of these 5 aspects and considering that 3 for a value is already a sign of a bad subsequent evolution. HAPS score (Harmless Acute Pancreatitis Score) consider that a patient which at the onset of the disease presents normal hematocrit and serum creatinine together with lack of abdominal muscle defense will have a further simple development. It has not to be neglected the Computed Tomography Severity Index (CTSI), which is based on the Balthazar score and presents 10 points where the first 4 points refer to the existence of edema and fluid collections and the next 6 points relate...
to the extension of pancreatic necrosis (1, 14, 15, 38).

Establishing of infection appearance amidst pancreatic collections represents the fundamental moment that guides the treatment towards evacuation intervention with debridement, lavage and drainage. Affirmation of infection existence is based on one of the following elements: detection of gas bubbles in the collections on the CT and existence of positive blood cultures in the context of the interpretation of clinical worsening condition of the patient. When in diagnostic doubt one recommend the fine needle aspiration (FNA) puncture in the collection under the guidance of computer tomography, echo-endoscopy or magnetic resonance imaging (5, 7, 9, 10).

Acute pancreatitis is therefore a medical-surgical emergency where supportive treatment in intensive care unit comes first, but surgery has a well-defined role. Surgery can be performed within 48 hours of onset in the context of determining the biliary etiology of disease, as well as in those forms with massive intraperitoneal or retroperitoneal collections; otherwise, it addresses to the complications of the disease, of which the most important is the infection of the pancreatic necrosis areas. In this regard, the identification timing of infection appearance is important in determining of surgical indication thus not to miss the moment when surgery can manifest its effectiveness.

Death due to acute pancreatitis in which the surgical intervention was practiced is most often the result of natural evolution of the disease. Forensic medicine’s role is to decide whether or not the surgical gesture was generator for potential death-causing consequences that may be charged to the surgeon.

In forensic context, possible vascular injury must be attributed either to the illness or to a possible medical error.

The appearance of vascular lesions during the natural course of acute pancreatitis is due to reactive changes within the pancreatic microcirculation (changes in the fluid-coagulant balance, predisposing to micro-thrombosis contributing to the process of tissue necrosis) and also to phenomena of vascular weakening and breaking under the action of proteolytic enzymes discharged from pancreatic acini as result of pancreatic destructive phenomena characteristic to acute pancreatitis. On this background, the surgery, which aims to clear as much as possible all the necrotic tissue and to realize a very complete lavage and drainage of the anatomic retroperitoneal spaces, area with such important vascular disposition, can cause vascular damage which, if not recognized in time, can explain postoperative bleeding that can result in death of the patient.

Also forensics has a duty to discern to what extent the surgery managed to achieve what it aims, meaning to achieve an as accurate removal of potentially become infected necrotic tissues, which otherwise can maintain a decompenstation mechanism of patient evolution on septic background, despite intensive therapeutic arsenal (strong antibiotics, pancreatic anti-secretive etc.).

The main situations encountered in death occurrence in case of acute pancreatitis deaths are as it follows:

fulminant development of acute pancreatitis in which the death occurs in the first hours or days, before there was the possibility of establishing an accurate evolution stage diagnosis; most often, death occurs as a result of multiple organ dysfunction development, pulmonary decompensation being the most incriminated;

no possibility for precise diagnosis of the moment when aseptic pancreatic necrosis suffers super-infection; computed tomography monitoring (CTSI) is performed at weekly intervals and the possible presence of gas in the collection is not always easy to identify since the moment of occurrence; performing of aspiration puncture with goal to obtain culture material also presents a degree of risk and failure;

surgical intervention presents major risks due to tissue friability and to possible vascular involvement; postoperative bleeding are often encountered, in the context of possible developments of the disease towards CID (22, 26);

surgery performed in front of a picture of acute abdomen without a clear cause, where the presence of acute pancreatitis in an initial form is intra-operative discovered, increase the risk for bacterial contamination with subsequent further bad evolution.

Thus, the forensic practitioner has the task, for so many times so difficult, to find the cause of death to a patient often with multiple interventions and extensive changes to the anatomy of the regions concerned during the course of the disease, where frequently the strict delimitation between lesions caused by disease course despite correct treatment, and situations where the wrong carried surgical gesture generated subsequent progression to death, is very difficult to be done.

CONCLUSIONS

1. Acute pancreatitis is one of the pathologies that belong to surgical emergencies, but it has to be underlined that the surgical act that is just part of a complex of intensive care measures.

2. Necrotizing-hemorrhagic acute pancreatitis is fraught with great risk of death, mortality encountered in speciality literature being of 20-50%.

3. Surgery is encumbered with risks determined by destructive nature of the disease, with subsequent embrittlement of the tissues that develop septic-enzymatic collections inside. A complete evacuation of the collections developed in the retroperitoneal space requires surgery often involving blind gestures made in regions with rich vascularity.
4. A thorough knowledge of the surgical anatomy is compulsory for knowing when to stop the effort for debridement and to complete it with abundant lavage and efficient drainage.

5. The drainage tubes placed on site must be as effective without being at risk of erosion of large peripancreatic vessels.

6. In turn, the disease itself, by activating various enzymatic cascades, including CID, brings a significant risk for bleeding, where cautious surgical gestures, requiring debridement and wide open access to peripancreatic spaces, may expose you to postoperative bleeding that does not have a cause represented by an unnoticed vessel rupture or ligation skid.

7. The death occurred in patients with acute pancreatitis is always analyzed in pathology departments of hospitals where patients were treated, but suspected cases need further forensic analysis that will differentiate between a poor outcome due to disease development and a medical-surgical error.

8. Acute pancreatitis is a classic example of surgical pathology where forensic medicine is sometimes called to distinguish between a natural evolution of the disease and an eventual wrong medical act.

Conflict of interest. The authors declare that they have no conflict of interest concerning this article.

References


