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Septic Remnants, A Crucial Factor in the Outcome of Suppurated Pancreatitis

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Rezumat

Restanța septică, factor decisiv în evoluția pancreatitelor supurate

Reintervențiile programate sau de necesitate pentru asanarea focarelor septice ocupă un loc important în chirurgia supurațiilor pancreatice. Aproximativ 50% din pacienții operați necesită una sau mai multe reintervenții, în scopul debridării și evacuării restanțelor necrotico-supurate. Autorii reanalizează spațiul retroperitoneal ca sediu al proceselor necrotico-supurative, accentuând asupra insuficienței abordării retroperitoneului doar prin bursa omentală. Considerentele anatomice infirmă credința conform căreia abordul bursei omentale ar fi gestul principal de acces retroperitoneal. Pancreasul și atmosfera înconjurătoare sunt gazduite în spațiul pararenal anterior și posterior. Pentru evitarea restanțelor septice se insistă asupra a 6 căi de acces în spațiul pararenal. Aceste căi de abord sunt dictate în funcție de topografia necrozelor supurate. Viitorul evolutiv postoperator al pacientului este direct dependent de prezența sau absența restanțelor după prima intervenție chirurgicală. Evident restanțele vor fi acolo unde nu a avut loc debridarea și evacuarea sepsisului - adică în toate dependințele spațiului pararenal. Drenajul larg, multiplu, închis sau deschis, cu sau fără lavaj continuu, nu poate corecta omisiunile septice. Debridările parțiale și incomplete nu trebuie să se bazeze pe corectările prin reintervenții programate.

Cuvinte cheie: supurație pancreatică, debridare, retroperitoneal, restante supurative, necroza pancreatică, pararenal

Abstract

Scheduled reinterventions, or dictated by necessity in order to drain the septic foci occupy an important place in the surgery of the pancreatic suppurations. Approximately 50% of the operated patients require one or more reinterventions, in order to accomplish the debridement and evacuation of the necrotic-suppurative remnants. The authors reanalyze the retroperitoneal space as a center of the necrotic-suppurative processes, emphasizing over the insufficiency of the approach of the retroperitoneum only through the omental bursa. The anatomical considerations infirm the belief according to which the approach of the omental bursa would be the primary gesture of retroperitoneal access. The pancreas and the surrounding atmosphere are hosted within the anterior an posterior pararenal space. In order to avoid septic remnants it is insisted on six access pathways to the pararenal space. These ways of approach are dictated according to topography of the suppurated necrosis. Post surgical evolutional future of the patient is directly dependent on the presence or absence of the remnants after the first surgical intervention. Evidently, the remnants will

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be present where the debridement and evacuation of the sepsis didn't take place- meaning all the dependencies of the pararenal space. The large, multiple drainage, closed or opened, with or without continuous lavage, can not correct the septic omissions. Partial and incomplete debridements must not be based on the corrections through the scheduled reinterventions.

Key words: pancreatic suppuration, debridement, retroperitoneal, suppurative remnants, pancreatic necrosis, pararenal

Introduction

The guarantee for therapeutic success in pancreatic suppuration surgery resides, in fact, in the fulfillment of two conditions: establishing as exactly as possible the topographic region and the limits of the septic foci, on the one hand, and choosing access paths which are adequate for a wide approach of the suppuration, in order to completely evacuate and drain it, on the other. In essence, the final purpose is that of avoiding postoperative septic restances. Their persistence is directly responsible for an evolution towards therapeutic failure.

Taking this information into account, it becomes obvious that the first, essential, step is that of precisely identifying the limits of the suppuration, an identification possible to be made by means of carefully interpreted imaging exams. The second step involves establishing a strategy for choosing the adequate access paths to the topographic regions containing the septic foci.

Anatomical considerations regarding the retroperitoneal space

In order to have a clear image of what is happening in the retroperitoneal space during the evolution of necrosis, one must highlight the possible pathways for diffusion of the sepsis from the pancreatic area. These pathways have been thoroughly and precisely described in a mammoth range of publications, for a very long time. They are well known. However, a broad majority of surgeons rest satisfied with the exclusive approach of the omental bursa and the retroperitoneal space through the retrogastric space before mentioned. The situation is somewhat similar to that where the surgeon hopes to successfully drain a "collar button abscess" ("shirt-stud") through an approach of the superficial chamber only, of the "overfill" area. The retroperitoneal space, located at L1-L2 level, next to the pancreas, cannot be approached through only one access path. Meyers, taking a series of fascial planes as references, separates the retroperitoneal compartments thusly: (*Fig. 1, 2*)

a) A perirenal compartment or space, closed between the renal capsule and Gerota's fascia. The perirenal compartments do not communicate among themselves, meaning the left one and the right one, as the posterior layer of the Gerota fascia ends at the great vessels and at the transversalis fascia covering the psoas and quadratus muscles of the lumbar region. Therefore, a suppuration in the perirenal space, rare but possible, will not spread from one side of the vertebral column to the other. This aspect is obvious even in the case of perirenal phlegmons of urologic aetiology.

b) The anterior pararenal (prerenal) space. This is limited anteriorly by the posterior parietal peritoneum, and spreads towards the posterior up until the anterior layer of Gerota's fascia. (*Fig. 3*)

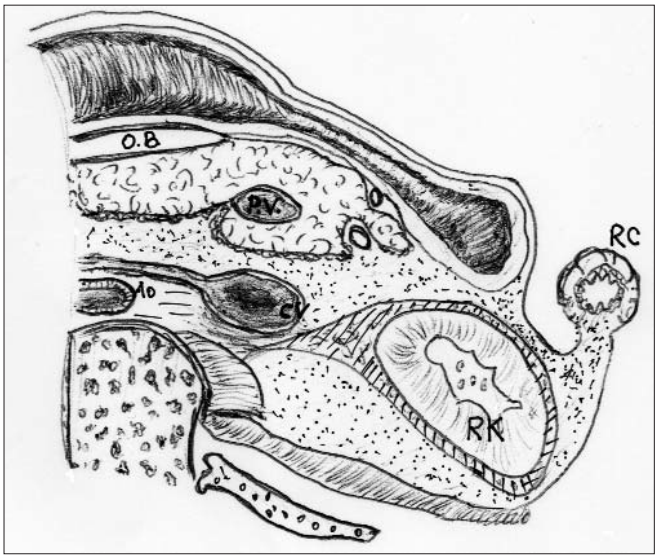

Figure 1. *Right anterior and posterior pararenal space (dotted area). Ao - aorta; CV - cava vein; PV - portal vein; OB - omental bursa; RK - right kidney; RC- right colon; shaded area - perirenal space*

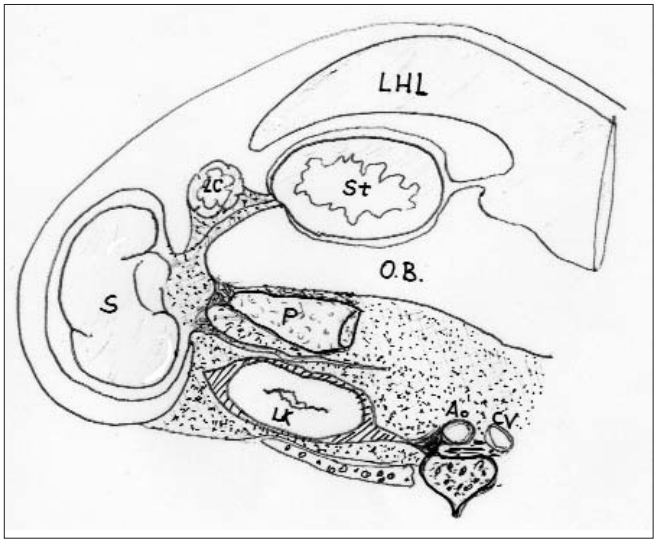

Figure 2. *Left anterior and posterior pararenal space (dotted area). LHL - left hepatic lobe; St - stomach; OB - omental bursa; LC - left colic angle; P - pancreas; LK- left kidney; Ao - aorta; CV - cava vein; S - spleen; shaded area - perirenal space*

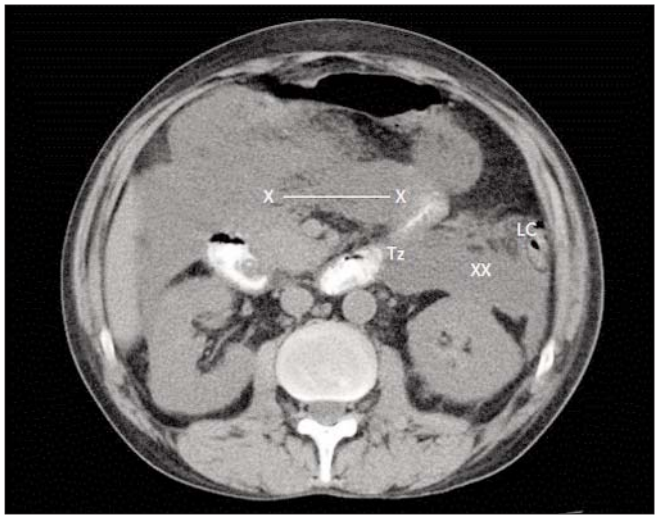

Figure 3. *CT scan (native) - Septic necrosis in omental bursa and left anterior prerenal and left retrocolic areas. X-X-omental bursa collection; XX - left prerenal and retrocolic suppuration; LC- left colic angle; Tz- Treitz angle*

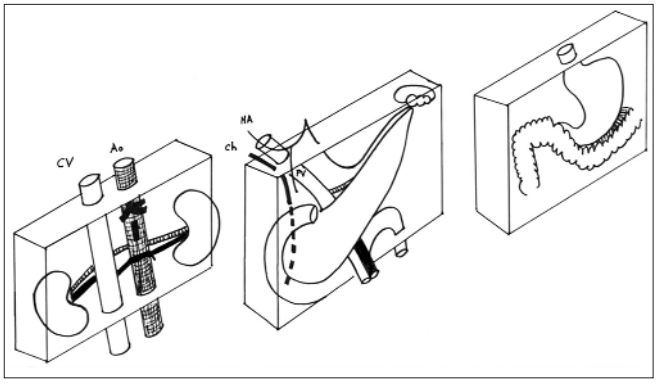

Figure 4. *Axial anatomical sections (schema) - antero-posterior visceral placement. Left image: pararenal space. Middle image: pancreatic area. Right image: anterior viscus. Cv - cava vein; Ao - aorta; Ch - choledocus; HA - hepatic artery; PV - portal vein*

c) The posterior pararenal (retrorenal) space. Located between the Gerota and transversalis fasciae.

It is to be noted that the pararenal anterior and posterior spaces spread towards the back and towards the bottom up to the retrocolic spaces, and present a broad communication between them, crossing the vertebral column right to left. *The pancreas, part of the duodenum, the ascending and descending colon are located in the anterior pararenal space*. (1,2) (*Fig. 4*) These pararenal spaces can be described as a belt holding retroperitoneal structures, starting from the left side, from the retrocolic space, and advancing towards the right side. On this route one can find encompassed the left prerenal area, the retropancreatic area, and then the right prerenal area, before finally reaching the right retrocolic space. This belt passes before and behind both kidneys. There is also a large communication between the anterior and posterior compartments of the pararenal spaces, as well as between the right and left compartments. It is therefore obvious that the enzyme and active amines overflow characteristic for an acute pancreatitis will find an easy path for diffusing into the entire anterior prerenal space initially, and afterwards into the posterior one. The difference in expression will be made only by the amplitude and spread of the necrotic-haemorrhagic effect of the proteo-lipolytic assault.

Avoiding septic remnants

The belief that an exclusive approach of the omental bursa is sufficient to gain access to a pancreatic suppuration is deeply flawed. Various methods of approaching and treating the omental bursa have been imagined and used, from broad and multiple drainage to lavage, laparostomy, half-open abdomen, scheduled reinterventions. None offered the results and satisfactions awaited. This is because all these tactical variants are primarily addressed to an intraperitoneal space – the omental bursa - an appendix of the peritoneal cavity. In essence, one attempts to remove all necrotic tissues and completely drain septic foci through a space that does not belong to the retroperitoneum. By using only this approach residues will remain in the retropancreatic, retrocolic, pre- and retrorenal spaces etc. Through the omental bursa one can only indirectly, therefore incompletely, attempt to debride and drain the retroperitoneum. Pancreatic and peripancreatic suppurations limited to the pancreatic sector represent 34% of post-operative suppurations, and those extending outside the pancreatic sector represent 31%. (3,4) Septic processes limited to the pancreas or to the immediate peripancreatic area can be approached through the omental bursa. The access through the bursa is obviously mandatory, but not sufficient as well. This approach must be associated with other, more direct, retroperitoneal access paths.

In order to completely debride the area, surgeons have imagined a vast array of techniques. All have been used in medical practice, as they came along. Results have been, however, fairly similar among them, the differences claimed failing to be supported by statistic data. (5,6,7) The explanation for this uniformity of results resides, probably, in the fact that they were all centred, as main or sole surgical gesture, on the approach of the omental bursa. Lavages, debriding, schedules reintervention, laparostomies, closed drainages are addressed to this intraperitoneal space. (8,9,10,11,12,13,14,15,16,17)

Disposing currently of imaging support highlighted by adequate reconstructions, the surgeon can precisely evaluate the amplitude, time-length and location of the suppurations, which usually occupy the anterior prerenal space and sometimes the posterior one. (*Fig. 5*) The main concern of the operating team is that of debriding all appendiceal cavities of the necrotic and infected pararenal spaces.

"The golden rule" is that of performing during the first intervention a necrectomy as complete as possible. This is not possible through an approach of the omental bursa only. One must also approach, led by imaging results, the anterior pararenal spaces, to the right and left sides of the vertebral column. This type of approach involves multiple access paths

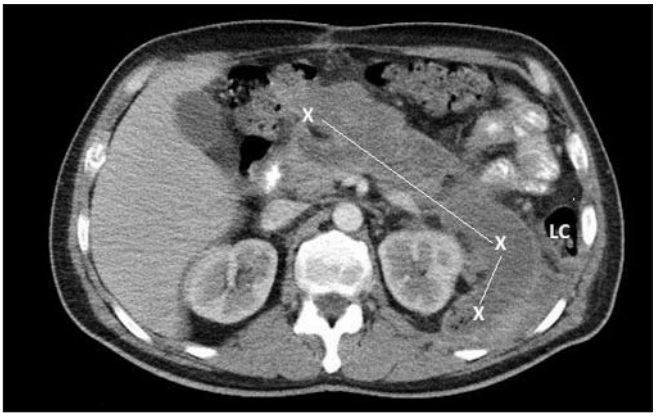

Figure 5. *CT scan (contrast) - Massive left pararenal collection in pre and retrorenal spaces. X-X-X- collection; LC - left colic angle*

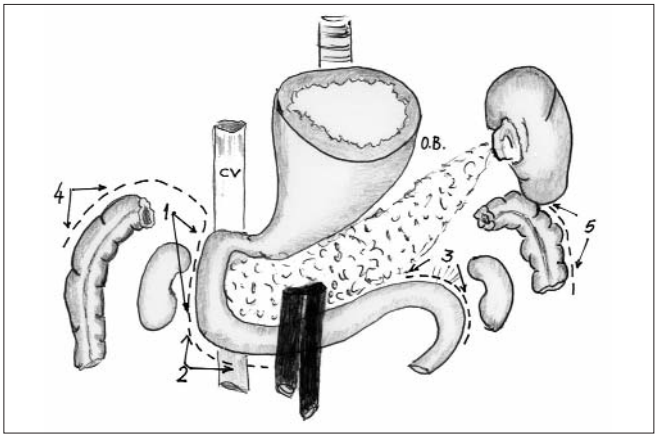

Figure 6. *Pathways to anterior and posterior pararenal space. 1 and 2 - Kocher maneuver submesocolic extended; 3 - Treitz angle decollement and right reclination; 4 - right retrocolic route; 5 - left retrocolic route; OB - omental bursa; CV - cava vein*

into the retroperitoneum (18). For the right pararenal space, these access paths are: (*Fig.* 6)

- parieto-colic exposure, revealing the hepatic flexure of the colon;
- Koher duodeno-pancreatic maneuver through an incision of the peritoneum starting from the superior flexure of the duodenum and up until the superior duodenal flexure;
- exposing the IIInd segment of the duodenum through an approach beneath the transverse mesocolon, by incising the peritoneum at the level of the inferior edge of the duodenum, from the inferior flexure of the duodenum towards the angle of Treitz.

This way, a large window opened towards the anterior and posterior right pararenal space is created, from its right limit to the axis of the great vessels.

For the left pararenal space one must take into account: (*Fig.* 6)

- parieto-colic exposure of the left colic flexure, giving access to the left retropancreatic sector – that of the tail of the pancreas (*Fig.* 7);
- exposing, lowering and pushing to the right the Treitz angle, giving access to the retropancreatic space corresponding to the body of the pancreas. Its decollement stops to the left of the aortic-mesenteric axis. (19) (*Fig.* 8)

By means of this combined approach, of the omental bursa and of the two sectors (left and right) of the pararenal space one gets complete access to the necrotic areas and to the suppurations. It is to be noted that the splenic-pancreatic exposure, recommended by some authors, remains the most hazardous approach access path, as it usually leads (in 90% of the cases) to the need for a splenectomy, which is to be made in the most disadvantaging conditions for the patient. This is why it has not even been mentioned in this paper. Clearly, it is rarely necessary to complete this entire array of approaches. In most cases, under imaging guidance, 2 or 3 access paths are used. (20,21,22,23,24)

Once debriding and evacuation of puss collections have

Figure 7. *CT scan (oral contrast) - Suppurative gas collection into the left anterior pararenal space drained through left retrocolic route. LC - left colic angle; D - drain*

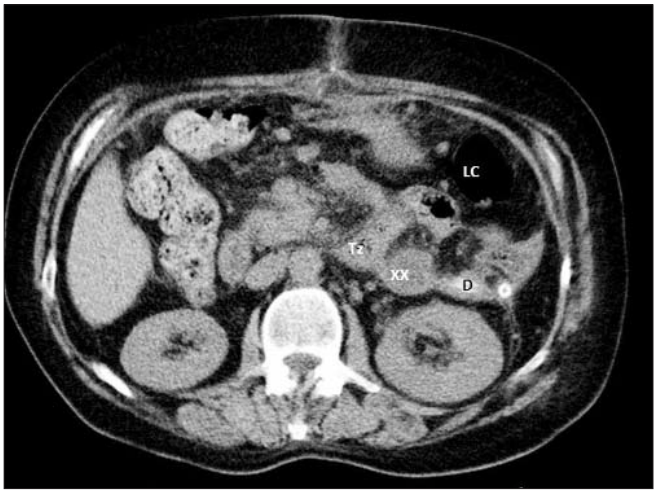

Figure 8. *CT scan (native) - Placement of the drain using the submesocolic approach - Treit's angle access. Tz - Treitz angle; XX - remnant collection; D - drain; LC - left colic angle*

been finalized, the reinforcement of the treatment applied must include a large and efficient retroperitoneal drainage of the debrided areas. This can be performed in various ways: closed, open, half-open. In the case of open or half-open abdomen formula, the term refers in fact only to the peritoneal space of the abdomen, even if the "pouching of the omental bursa" is performed through laparotomy. Indeed, the peritoneum remains in reality open, but no matter how one proceeds the retroperitoneum will be a drained space. This is why no significant differences are noted between the open and closed abdomen methods, with or without lavage, including only the omental bursa. If necrotic-septic foci persist in the pararenal space after the first intervention, these residues will lead to a reintervention, regardless of the method applied to the peritoneal cavity. Not even the lavage of the omental bursa with 7-8 litres of liquid applied daily through the drainage tube can act as a continuous wash of a peritoneal space. Retroperitoneal necrotic remnants are untouchable to this procedure. (12,25)

Resuming, current surgical procedures encompass several approach methods: debriding via the omental bursa, with its variants – closed or open abdomen with or without continuous lavage, and the retroperitoneostomy approach. (15,26,27) The first method is addressed almost exclusively to the omental bursa and from here arise all the insufficiencies of its variants. These are by far the most frequently used surgical techniques. Retroperitoneostomy aims correctly and really opens the retroperitoneal space, meaning the anterior and posterior pararenal space. (26) But, there are at least two faults to this technique – it does not offer access to the omental bursa, and it involves two incisions beneath the rib cage through which the exposure manoeuvers for the colic flexures are performed. This technique can also be finalized with an open or closed drainage. (15,26,27)

We have left aside the discussion regarding schedules reinterventions. These are bared with difficulty by a patient with sepsis and SIRS, having underwent 2-3 days of general anaesthesia, parenteral or jejunostomy feeding. Also, the reassuring idea that other scheduled interventions will follow might determine the surgeon to declare oneself satisfied with the first intervention, even after partially or incompletely debriding, relying on interventions to come. These reschedulings will also have the purpose of correcting omissions and initial residues. The medical literature of the past 8-10 years has considerably diminuished the enthusiasm generated by this programmed method of approach. What volume of resistance must this patient possess to cope with repeated surgical aggressions. These aggressions aim the omental bursa again, an area relatively distant to the source of the suppurated processes. Also, one accepts the adding of extra risks such as haemorrhages and digestive fistulas. Last but not least, when one would finally obtain survival, this would leave the patient with an important parieto-abdominal defect which is to be corrected by means of one or more parietoplasty surgeries – each with its own risks, complications and relapses. (20, 21,28,29)

Conclusions

Faced with a suppurative pancreatitis, a surgeon has to solve three essential problems: choosing the right surgical moment, locating as exactly as possible the areas of necrotic suppuration and choosing the right retroperitoneal access paths, as well as the drainage methods.

1) *Choosing the correct surgical moment* - decided when:
   - finding a clinically obvious septic state, with all known signs;
   - obtaining a laboratory exam confirmation of the septic state (increasing number of leucocytes, nitrate retention, multiple enzyme increases);
   - confirming by means of an imaging exam of the constitution of underperfused or avascular areas, or of abscesses;
   - confirming the infection by means of a percutaneous guided puncture, considered a dispensable method due to its risks and errors.
2) *Establishing the topographic suppurative areas.*

One wishes to obtain precise topographic maps. This involves carefully appreciating the imaging proof, in different approaches, obtained by means of native and contrasting multi-axial or coronal reconstructions. Comparing the collections to anatomic reference points is very helpful and should be put into practice.

   - Appreciating the actual pancreatic area;
   - Appreciating the extensions towards the right and left, anterior and posterior pararenal spaces.

3) *Choosing the surgical approach* - involves chosing access paths to the pancreas and the retroperitoneal space, as well as drainage methods after debriding the foci.
   - Necrectomy and evacuation of abscesses through combined access paths, including the mandatory approach of the omental bursa, based on imaging indications and of the intraoperative evaluation. This gesture is essential and must be performed as correctly as possible. Septic omissions lead to failure.
   - Broad, multiple drainage of the remaining cavities, open or closed, with or without continuous or discontinuous lavage. The method of drainage is to be chosen by the surgeon, based on his or her experience and taking into account current tendencies expressed in medical literature. One fact is certain – isolated drainage of the omental bursa, regardless of the variant, proves insufficient in most cases.

As a final conclusion, one might say that the extension of infected necrosis and its surgical control clearly determine the postoperative evolution of the patient. Hence, septic residues and their postoperative presence are directly responsible for the patient's future. According to an autopsy study of acute pancreatitis, one can find an answer to the question "where are the possible septic residues?" (30) Obviously, the residues will be where debriding and sepsis evacuation were not performed, meaning in all the appendiceal cavities of the pararenal space.

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