

## Initial minimally invasive retroperitoneal necrosectomy for acute necrotizing pancreatitis

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### **Abstract**

#### Introduction:

Minimally invasive approaches in treatment of acute necrotizing pancreatitis and/or infected pancreatic necrosis gain a notable advantage compared with open surgery.

#### Aim:

We present our experience in treatment of acute necrotizing pancreatitis by an original minimally invasive retroperitoneal necrosectomy technique, evaluate feasibility and safety of this method, compare our results to other studies.

#### Patients and methods:

A retrospective analysis of 22 patients with acute necrotizing pancreatitis and large fluid collections in retroperitoneal space was performed. All patients underwent retroperitoneal necrosectomy as an initial interventional procedure in treatment of infected pancreatic necrosis.

#### Results:

Sixteen males and six females aged between 24 and 60 with an average age of  $42.59 \pm 7.3$  years were included. Alcohol abuse was an etiologic factor of acute necrotizing pancreatitis for 18 patients (81.8%). Average time between diagnosis and performance of necrosectomy was  $28.6 \pm 13.2$  days. Ten patients (45.5%) did not undergo any additional intervention after initial retroperitoneal necrosectomy. Other 12 patients (54.5%) required additional procedures. 3

patients (13.6%) needed 5 or more reinterventions: 4 sonoscopically-guided drainages, 4 retroperitoneal necrosectomies and 11 laparotomies. 9 patients (40.9%) required less than 5 reinterventions: 2 sonoscopically-guided drainages, 12 retroperitoneal necrosectomies and 3 laparotomies. Most of reinterventions were performed due to insufficient drainage and bleeding. 63.6% of our patients did not require more than one reintervention. Postoperative hospitalisation ranged from 9 to 148 days with an average of 52.2 ±35.2 days. The mortality rate in our study was 0%.

### Conclusions:

Minimally invasive techniques should be considered as a first-choice surgical option in treating patients with acute necrotizing pancreatitis whenever possible. Pancreatic necrosis occupying less than 30% and with massive fluid collections can be safely managed by an initial minimally invasive retroperitoneoscopic necrosectomy when an appropriate gap in the left retroperitoneum between the colon and the kidney exist.

**Key words:** *acute necrotizing pancreatitis, infected pancreatic necrosis, retroperitoneal necrosectomy, retroperitoneoscopy, minimally invasive pancreatic necrosectomy*

## **1. Introduction**

Management of acute necrotizing pancreatitis and/or infected pancreatic necrosis has now shifted away from open surgery to a more conservative management and minimally invasive approaches<sup>14</sup>. The latter have many advantages in comparison with open surgical debridement such as reduced inflammatory response to intervention, considerably reduced extent of bacteriemia, reduced risk of development of multiorgan failure, reduced rate of postoperative respiratory and wound complications, shorter stay in an intensive care unit (ICU) and faster convalescence<sup>2, 6, 10, 16, 21</sup>. Therefore minimally invasive approaches such as endoscopic, laparoscopic, or video assisted retroperitoneoscopic debridement, present encouraging outcomes<sup>14, 19</sup>. The main issue is a broad variety of minimally invasive techniques used in treatment of acute necrotizing pancreatitis. The optimal method of necrosectomy is still unclear<sup>27</sup>.

The aim of this study is to present our experience in treatment of acute necrotizing pancreatitis and infected pancreatic necrosis by an original minimally invasive retroperitoneal necrosectomy technique, to evaluate the

safety and feasibility of this method and to compare our results to other studies.

## **2. Patients and methods**

### **2.1 Patients**

A total of 248 patients were treated for acute necrotizing pancreatitis at Center of Abdominal Surgery, Vilnius University Hospital from 2007 to 2014. Among these patients, 96 required an interventional procedure: 58 patients (60.4%) underwent open necrosectomy and closed lavage (mortality rate 38%), 16 patients (16.7%) required sonoscopically-guided drainage and 22 patients (22.9%) had a retroperitoneal necrosectomy performed (mortality rate 0%).

A final analysis of 22 patients with acute necrotizing pancreatitis was performed retrospectively. The main criteria for selection of patients for retroperitoneal necrosectomy were large retroperitoneal pancreatic fluid collections and an appropriate gap in retroperitoneum between the colon and the kidney to provide enough space for introduction of trocars (Figure 1). The principal indication for intervention was persistence of sepsis or proven infection of (peri)pancreatic necrosis. Operation outcomes were evaluated and compared to other studies.

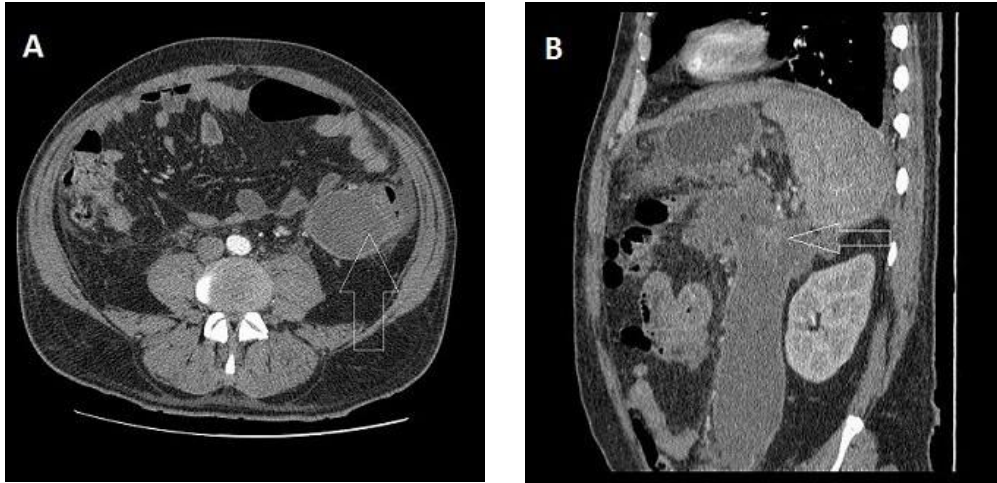


Figure 1. Contrast-enhanced axial CT section (A) and sagittal CT section (B) of the same patient with acute necrotizing pancreatitis, showing a well-defined (peri)pancreatic fluid collection in the left retroperitoneal space (arrows).

## 2.2 Operative Technique

An original minimally invasive three-port retroperitoneoscopic necrosectomy technique, which was earlier published by Šileikis *et al.*<sup>21, 22</sup>, was performed for all 22 patients as the first procedure for treatment of infected pancreatic necrosis.

Briefly, a method involved placement of the patient in the right lateral decubitus position and bend of the waist with the help of a roll. The first 10 mm trocar was inserted into retroperitoneal fluid collection on the left midaxillary line near

the end of the 12th rib under ultrasound guidance (Figure 2).

Pneumoretroperitoneum was then created (up to 14 mm Hg pressure). Subsequently, a 10 mm videoscope was introduced to evaluate the cavity and content. Next two trocars were inserted under videoscope guidance on the left anterior and posterior axillary lines. Suction irrigator and forceps were introduced through these trocars (Figure 3); evacuation of necrotic debris and pus under visual guidance was then possible. Finally, drains were placed through the sites of trocar punctures (Figure 4), and on the following day continuous lavage of the cleansed cavity proceeded. If purulent fluid collections extended to the pelvis minor, the fourth drain was placed there. During repeated retroperitoneoscopic necrosectomies, trocars were inserted through the same apertures along drain tracts.



Figure 2. Sonoscopically-guided trocar introduction into retroperitoneal fluid collection (intraoperative view)



Figure 3. Introduction of suction irrigator and forceps through trocars (intraoperative view)

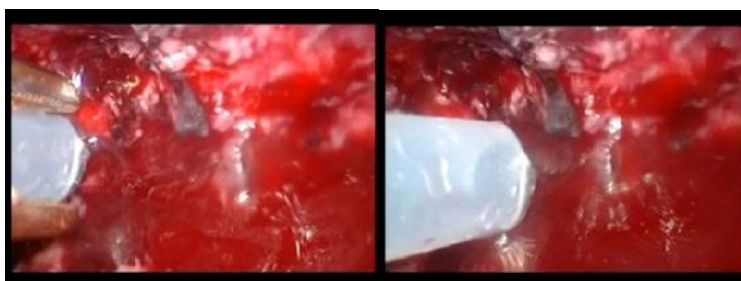


Figure 4. Placement of drains through the sites of trocar punctures (intraoperative view)

### 3.0. Results

Baseline characteristics of patients included in our study are presented in Table 1. The initial retroperitoneal necrosectomy for treatment of infected pancreatic necrosis was the only interventional procedure for 10 patients (45.5%). 7 of these patients were diagnosed with pancreatic fluid collections in the left retroperitoneal space. Also, 3 patients in this group had

outspread necrosis in >50% of pancreas, 6 patients were identified with 30% pancreatic necrosis. Other 12 patients (54.5%) required additional interventions (Table 2). 3 patients (13.6%) needed 5 or more reinterventions: 4 sonoscopically-guided drainages (1 for infected walled-off pancreatic necrosis and 3 for inadequate drainage), 4 retroperitoneal renecrosectomies (all for insufficient drainage) and 11 laparotomies (2 for

insufficient drainage, 5 due to bleeding, suspected fistula and ileus, 1 ileostomy formation due to intestinal fistula, 3 revisions and tamponations due to bleeding). 9 patients (40.9%) required less than 5 reinterventions: 2 sonoscopically-guided drainages for insufficiency of drainage, 12 retroperitoneal necrosectomies (1 revision and 2 lavages for necrosectomy, 9 for inadequate drainage) and 3 laparotomies (1 for necrosectomy, 2 revisions and tamponations due to bleeding). 63.6% of patients did not undergo more than one additional procedure.

Our study outcomes demonstrate that original retroperitoneal necrosectomy technique we use at our institution is an appropriate choice of treatment for acute necrotizing pancreatitis and infected pancreatic necrosis, especially with diagnosed unilateral pancreatic fluid collections and necrosus occupying 30% of pancreas. Patients required less additional procedures after initial retroperitoneal necrosectomy in the latter conditions (Table 2). The mortality rate in our study was 0%.

Table 1. Basic characteristics of patients with necrotizing pancreatitis

Characteristic	Total (n=22)
Age (years), median (range)	42.59±7.3 (24-60)
Gender, n (%)	
Males	16 (72.7%)
Females	6 (27.3%)
Etiology of pancreatitis, n (%)	
Alcohol	18 (81.8%)
Biliary	2 (9.1%)
Post ERCP	
Iatrogenic	1 (4.55%)
Computed tomography findings, n (%)	
Fluid collections in retroperitoneal space	22 (100%)
Left-sided	12 (54.5%)
Right-sided	
Both-sided	5 (22.7%)
30% pancreatic necrosis	5 (22.7%)
30-50% pancreatic necrosis	11 (50%)
>50% pancreatic necrosis	4 (18.2%)
Infected necrosis, n (%)	22 (100%)

Preoperative hospitalisation (days), n (range)	28.6±13.2 (6-68)
Postoperative hospitalisation (days), n (range)	52.2±35.2 (9-148)

Table 2. Characteristics of patients, grouped by the number of required additional interventions

Characteristic	Total	5 reinterventions	<5 reinterventions
Number of patients who required additional procedures, n (%)	12 (54.5%)	3 (13.6%)	9 (40.9%)
Additional procedures, n	41	24	17
Sonoscopically-guided drainages, n	6	4	2
Retroperitoneal reneurosectomies, n	14	4	12
Laparotomies, n	14	11	3
Pancreatic fluid collections			
In one side of retroperitoneum, n	17	0	7
In both sides of retroperitoneum, n	5	3	2
Outspread of pancreatic necrosis, n			
30%	11	1	10
30-50%	4	2	2
>50%	7	0	7

#### 4. Discussion

Suspected or confirmed infection of pancreatic necrosis is one of the indications for intervention (radiological, endoscopic or surgical) in acute necrotizing pancreatitis<sup>4,8,14,23,26,27</sup>. Mortality is assumed to be up to 30-50% once (peri)pancreatic necrosis becomes infected<sup>5,8,13</sup>. Septic necrosis is generally followed by multiorgan failure and associated with an exceptionally high mortality rates in the absence of specific

treatment<sup>2,4,11</sup>. Clinical signs (persistent fever, increasing inflammatory markers, i.e. procalcitonin, CRP) and imaging signs (gas bubbles within (peri)pancreatic necrosis on CT) are accurate predictors in the diagnosis of infection in the majority of patients<sup>12,27</sup>. Therefore routine percutaneous fine needle aspiration (FNA) of (peri)pancreatic collections is not indicated<sup>14,27</sup>. Nevertheless, the diagnosis of infection can be confirmed by FNA, but the risk of



false-negative results has been reported to be up to 12-25%<sup>27</sup>.

Early surgical intervention should be avoided whenever possible due to high morbidity and mortality<sup>23</sup>. With a delay of 4 to 6 weeks, resection of vital tissue is minimized, leading to better long-term exocrine and endocrine function and a reduction in postoperative adverse events<sup>13</sup>. Although the time of postponement may vary, surgical intervention is considered to be optimal when infected necrosis is walled-off and demarcated with at least partial liquefaction and separate encapsulation<sup>17,23,27</sup>.

According to Freeman *et al.* (2012)<sup>13</sup>, interventions to drain and/or debride (peri)pancreatic necrosis can be classified into open surgical, minimally invasive surgical approaches (including laparoscopy and retroperitoneoscopy), image-guided percutaneous, and endoscopic, and hybrid approaches. Open necrosectomy is associated with relatively high morbidity (34%-95%) and mortality ranging from 6% to 25%<sup>4,13</sup>. Advantages of minimally invasive approaches compared with open surgery include a reduction in systemic complications after intervention, a lower risk of developing new organ failure and less surgical trauma in patients who are already severely ill<sup>11,24</sup>.

Original step-up approach, presented by van Santvoort *et al.* (2010)<sup>24</sup>, is claimed to have decreased major short-term complications such as new onset multiorgan failure and long-term complications such as endocrine insufficiency and decreased costs as compared to primary open necrosectomy<sup>3,24,27</sup>. This step-up strategy consists of initial percutaneous or endoscopic drainage of the infected fluid collection to diminish sepsis; it is stated that this step may postpone or even obviate

surgical necrosectomy<sup>23</sup>. If drainage does not lead to clinical improvement, the next step is minimally invasive retroperitoneal necrosectomy. However, according to our experience, if space in retroperitoneum between the colon and the kidney is appropriate (Figure 1), better results were achieved with an initial retroperitoneal necrosectomy, not with drainage. Pancreatic fluid collections reduce after primary sonoscopically-guided drainage, thereafter performance of retroperitoneal necrosectomy becomes technically impossible.

One of the most significant matters to the successful drainage and debridement of infected pancreatic necrosis via retroperitoneal approach is a proper selection of patients<sup>26</sup>. Several studies (Babu *et al.*, 2009; Shelat *et al.*, 2007)<sup>1,20</sup> indicate that the retroperitoneal approach might be applicable when necrosus is primarily located in the left side of retroperitoneum with mainly semi-solid collections. The potentiality of successful retroperitoneal necrosectomy highly diminishes with necrosis being multifocal, discontinuous and located in the head or uncinate process of pancreas<sup>15, 20</sup>. Nevertheless, Chang *et al.* (2006)<sup>9</sup> claim that multiple retroperitoneal spaces usually communicate. According to our experience, if modified, retroperitoneal necrosectomy might be performed despite the localization of necrosis. It is imperative that there would be an appropriate gap in retroperitoneum identified by CT scan (Figure 1) to provide enough space for an original retroperitoneal necrosectomy technique we use in our centre. The extension of fluid collections to the pelvis is also important due to safe placement of drains in order to avoid injury to the viscera. Necrosis can be completely evacuated when fluid collections extend to the left side of retroperitoneum. Although only partial evacuation of necrosus is possible (due to anatomical peculiarities) when fluid collections extend to the right side of

retroperitoneum, the procedure might delay open or laparoscopic necrosectomy.

technique using an ultrasound-guided introduction of trocars.

Worth noting that a number of different variations of retroperitoneal necrosectomy exist today<sup>1,10,16</sup>. Raraty *et al.*(2010)<sup>18</sup> claim that the percutaneous, retroperitoneal approach can be applied to up to 85% of patients requiring surgery for infected pancreatic necrosis. Except their variation requires CT-guided trocar introduction. Advantageously, our method include a cheaper and more beneficial for the patient

Table 3 presents our management results compared with other studies<sup>2, 7, 14, 18, 25, 28</sup>. Although a range of different techniques exist, all studies present comparable mortality and complication rates and represent retroperitoneal approach as safe and feasible for the treatment of acute necrotizing pancreatitis.

Table 3. Comparison of our data with other series of retroperitoneal necrosectomies

Study	<i>n</i>	Delay to necrosectomy, days, median	Infected necrosis, <i>n</i>	Technique	Procedures per patient, <i>n</i> (range)	Requirement of laparotomy, patients, <i>n</i>	Postoperative stay, days, median	In-hospital mortality
van Santvoort <i>et al.</i> 2007 <sup>25</sup>	15	41	14	Left flank incision and VARD	3 (1-11)	4	57	1
Lakshmanan <i>et al.</i> 2010 <sup>14</sup>	5	48	5	Left flank incision and nephroscopy	3 (1-5)	1	N/A	0
Raraty <i>et al.</i> 2010 <sup>18</sup>	137	32	74/116	Left flank incision and nephroscopy	3 (1-9)	19	64	26
Bausch <i>et al.</i> 2012 <sup>2</sup>	14	39	13	Retroperitoneal necrosectomy, rectoscopy	N/A	3	N/A	3
Castellanos <i>et al.</i> 2013 <sup>7</sup>	32	19	32	Left/right translumbar approach, blunt dissection and flexible endoscope	3 (1-10)	1	N/A	5
Zhao <i>et al.</i> 2014 <sup>28</sup>	17	29	17	Single-stage video-assisted retroperitoneal necrosectomy	N/A	1	40	1
Our data	22	29	22	Three-port retroperitoneoscopic necrosectomy	2 (1-8)	6	52	0

N/A, data not available, VARD, videoscope-assisted retroperitoneal debridement

We conclude that minimally invasive techniques should be considered as a first-choice surgical option in treatment of acute necrotizing pancreatitis whenever possible. Open surgery should be reserved for cases refractory to any other approach<sup>14</sup>. According to our experience, pancreatic necrosis, occupying less

than 30%, with massive pancreatic fluid collections can be safely managed by an initial minimally invasive retroperitoneoscopic necrosectomy when an appropriate gap in the left retroperitoneum between the colon and the kidney exist.



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