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Original Research Article

Two port laparoscopic retroperitoneal pancreatic necrosectomy: improvement in morbidity and mortality with a less invasive approach

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ABSTRACT

Background: Severe pancreatitis is associated with a high rate of mortality even with advanced surgical care and practices worldwide. Morbidity and mortality rates are much higher in the presence of infected pancreatic necrosis. From open necrosectomy, simple percutaneous drainage or one of several minimal access approaches, the question of optimal or best treatment is yet debatable. Step-up approach is currently practised by many physicians. We describe our technique of early drainage by minimal invasive two-port laparoscopic retroperitoneal pancreatic necrosectomy in our centre.
Methods: Thirteen consecutive patients with proven infected pancreatic necrosis were treated by 2P-LRPN over a two-year period in the setting of a teaching hospital. The median patient age was 44 years (range: 28-66 years) and 10 of the patients were male.
Results: The median time to discharge following the procedure of 14 days (range: 08-21 days). There was no mortality and the morbidity rate was 37%, consisting mainly of pancreatic fistula (37%).
Conclusions: Two-port laparoscopic retroperitoneal pancreatic necrosectomy is an effective and minimally invasive procedure which had better outcomes with improved patient morbidity, shorter hospital stay and lesser complication rate. Early intervention with necrosectomy has better patient compliance.

Keywords: Acute necrotising pancreatitis, Minimally invasive surgery, Pancreatic necrosectomy

INTRODUCTION

Initially the treatment of acute necrotizing pancreatitis is mainly conservative.[1-4] Severe pancreatitis carries a significant risk of potentially life-threatening complications including the development of necrosis, ARDS, AKI and systemic complications. The mortality rate for the same remains around 15% and can be up to 30% in the presence of infected necrosis. Improvements in critical care, better imaging, early radiological intervention and evidence-based management can reduce the death rates in specialised tertiary centres providing multi-disciplinary care.[5-7]

The 2012 Atlanta classification defines acute necrotising pancreatitis as acute necrotic collections (ANCs), which contain fluid and variable amounts of necrotic tissue on contrast enhanced computed tomography (CT). The entity of walled off necrosis (WON), a well-defined collection consisting of necrotic tissue with an enhancing wall of reactive tissue on contrast enhanced CT, normally occurs after four weeks from onset of necrosis. This may also be multiple and found at sites away from the pancreas.[8]

When both ANCs and WONs become infected, deterioration in the patient's clinical course and the

presence of gas in the collections is visualised on contrast enhanced CT. The 2002 International Acute Pancreatitis guidelines recommended non-operative management for those patients with sterile necrosis and surgical intervention for those with evidence of infection.[9] The guidelines also advise avoiding surgical intervention during the first 14 days unless there is progressive multi-organ failure and clinical deterioration. Subsequent studies have suggested that morbidity and mortality can be reduced further if surgery is delayed beyond four weeks, allowing clear demarcation between necrotic and normal tissue.[10]

Routinely, pancreatic necrosectomy is carried out as an open procedure through a midline incision with trans-peritoneal access to the necrotic tissues. Repeat laparotomies are usually needed to ensure complete debridement and perioperative mortality varies from 11% to 50%.[9-11] Of late, various techniques for minimal access methods of debridement of the pancreatic bed have been described.

At an international conference in 2010, organised by the American Pancreatic Association, to develop a consensus on interventions for necrotising pancreatitis, several minimal access necrosectomy methods were discussed and a classification taxonomy has been developed. This was based on method of visualisation (open, radiological, endoscopic, laparoscopic, hybrid or other), route (per oral transpapillary or transmural, percutaneous transmural or other) and purpose (drainage, lavage, fragmentation, debridement, excision or other). The main advantages of minimal access approaches other general benefits are a reduction in systemic complications and a lower risk of developing new organ failure. While local complications were slightly increased in some retrospective studies, it can be attributed to a learning curve. The use of radiologically placed drain tracts to carry out necrosectomy is termed sinus tract endoscopy when endoscopic debridement is carried out and video assisted retroperitoneal debridement (VARD) when direct access is used. The adverse event rate is reported to be less than 5% and the morbidity rate as low as 10-30% with a mortality rate of 0-20%.[11]

At our unit, we practice pancreatic necrosectomy using a variety of minimal invasive as well as open methods and two port retroperitoneal pancreatic necrosectomy is a technique that we have found to be effective and safe with minimal morbidity, technical feasibility and better tolerance by the patient. We detail the technique here and outline our early outcomes.

METHODS

This series reports the outcomes of 13 consecutive patients transferred or admitted to our unit in Vydehi hospital with a diagnosis of acute necrotising pancreatitis over a period of 2 years between October 2018 and September 2020. All patients were managed in an intensive care unit and underwent contrast enhanced CT only after adequate hydration and once renal perfusion was good. Inclusion criteria included those with clinical and radiological evidence of infected ANCs or WONs (according to the 2012 Atlanta classification) with signs of infection and no clinical improvement 48-72 hours later, were considered for surgical management i.e., retroperitoneal necrosectomy as described below.[1] Patients fit for general anaesthesia only were considered for study, or else other non-invasive approaches were considered.

Ethical committee clearance from the institute was obtained for the study.

Study design

An observational clinical study.

Statistical method

Descriptive and inferential statistical analysis has been carried out in the present study. Results on continuous measurements are presented on Mean±SD (min-max) and results on categorical measurements are presented in number (%). Significance is assessed at 5% level of significance. The following assumptions on data is made, assumptions (a) dependent variables should be normally distributed; (b) samples drawn from the population should be random; (c) cases of the samples should be independent.

Student t test (two tailed, independent) has been used to find the significance of study parameters on continuous scale between two groups (Inter group analysis) on metric parameters. Leven`s test for homogeneity of variance has been performed to assess the homogeneity of variance. Chi-square/ Fisher exact test has been used to find the significance of study parameters on categorical scale between two or more groups, non-parametric setting for qualitative data analysis. Fisher exact test used when cell samples are very small.

Technique

The anaesthetised patient was paced in supine position with the left flank elevated by use of sand bags and left arm abducted at the shoulder and positioned on an arm board.

Accurate initial evaluation is essential using CT image as guidance, and confirmed by aspiration technique for initial port placement. Some cases required retroperitoneal blunt dissection as well. With one placed more superiorly in the necrotic cavity and the other placed more posteriorly to maximise the subsequent operating angles between ports (Figure 1). Sometimes there may be a need for a third 5 mm port, if difficulty is encountered in necrosectomy. Higher pressures than standard pressure is required and pressures up to 20

mmHg may be used for good visualisation of the abscess cavity. Routine laparoscopic forceps and graspers can be used to perform the necrosectomy under direct vision. Initially pus is drained and irrigated thoroughly with normal saline. Devitalised tissue is gently dissected and removed via the operating port and endobag can be used. At the end of the procedure, bed was inspected for any fresh bleed and coagulated with bipolar diathermy. Only one case required clips for control of active bleed.

Typical appearances of the necrotic cavity during and after debridement are shown in Figure 2. Port tracts were used for placement of drains into the cavity for post-operative irrigation and drainage (Figure 3).

Figure 1: Initial port placement techniques.

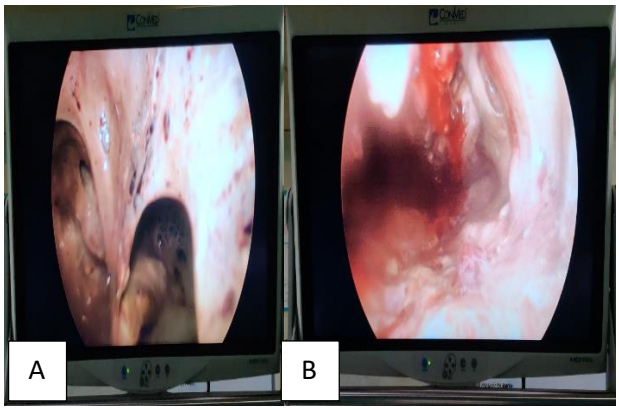

Figure 2: (A) Typical operative appearances of the pancreatic necrosis and cavity during; (B) two-port laparoscopic retroperitoneal necrosectomy.

Figure 3: Debrided pancreatic necrosis and post-operative photograph with drains insitu.

RESULTS

Thirteen patients underwent two-port laparoscopic retro-peritoneal pancreatic necrosectomy (2P-LRPN) between October 2018 and September 2020 (Table 1).

Sixteen of the patients in the series were male and the overall median age was 44 years (range: 38–66 years). The cause of pancreatitis was confirmed as gall-stones in two, ERCP in one, idiopathic in one and rest all were related to alcohol related disease.

The median time to surgery was 32 days (range: 20-40 days) since onset of symptoms and median duration of hospital stay was 27 days (range: 20-39 days).

None of the patients needed a laparotomy or re-exploration. The median time to discharge after the procedure was 14 days (range:08-21 days) and the median length of hospital stay was 27 days (range: 20-39 days). There were no mortalities within six months of the procedures. Four patients developed controlled pancreatic fistula, and was managed conservatively. Patients were discharged with drain in-situ and a colostomy pouch applied for the drain site. A pancreatic fistula (as per the International Study Group of Pancreatic Fistula definition of any measurable volume of fluid on or after postoperative day 3 with an amylase level greater than three times the normal limit of serum amylase was present in four patients (37%).[9]

Table 1: Patients undergoing two-port laparoscopic retroperitoneal necrosectomy.

Age/ sex	Aetiology	Apache II score	Time to first procedure	No. of procedure	Time to Discharge	Total hospital stay	Procedure related morbidity
38/M	Alcohol	8	40 days	1	21 days	24 days	
40/M	Alcohol	9	22 days	1	14 days	39 days	Pancreatic fistula
44/M	Alcohol	11	20 days	1	18 days	26 days	Pancreatic fistula
50/M	Alcohol	6	34 days	1	12 days	34 days	Pancreatic fistula
28/M	Alcohol	6	23 days	1	11 days	27 days	Pancreatic fistula
54/M	Idiopathic	10	39 days	1	13 days	20 days	
47/M	Gallstones	12	37 days	1	08 days	26 days	

Continued.

Age/ sex	Aetiology	Apache II score	Time to first procedure	No. of procedure	Time to Discharge	Total hospital stay	Procedure related morbidity
39/M	ERCP	10	40 days	1	20 days	34 days	Bleeding – splenic artery clipped
41/F	Alcohol	14	23 days	1	14 days	21 days	
52/F	Alcohol	10	36 days	1	11 days	26 days	
66/F	Alcohol	12	28 days	1	12 days	31 days	
46/M	Gallstones	11	30 days	1	15 days	32 days	
44/M	Alcohol	14	32 days	1	18 days	29 days	
44			32		14	27	(Median)

APACHE= Acute Physiology and Chronic Health Evaluation; ERCP= Endoscopic Retrograde Cholangiopancreatography; ICU= Intensive Care Unit.

DISCUSSION

The two-port laparoscopic retroperitoneal approach technique is a straight forward method of directly accessing the pancreatic bed and provides good visualisation of the necrotic tissue. It is technically feasible and with the availability of various laparoscopic instruments, effective debridement of necrotic tissue is possible. The crucial advantage over the non-invasive techniques is the enhanced view of the cavity containing the necrosis, and the improved ergonomics afforded by separating the optical and operating ports. This allows for more efficient debridement and therefore fewer visits to the operating theatre than the conventional step up approach.[12] While this series does not reflect a randomised trial or even a direct comparison, the median number of procedures required per patient was only 1, which is lower than most retroperitoneal necrosectomy series, where it varies from 3 to 5.[13] However, lower numbers have been reported from endoscopic, trans-peritoneal and combined approaches.[2,14-16]

Consequently, our 90-day procedural mortality rate was 0%. Despite the limitations outlined above (of a descriptive series versus a trial), this compares extremely favourably with other published mortality rates following retro-peritoneoscopic necrosectomy of 0-26%.[13,17]

A systematic review of endoscopic necrosectomy suggested outcomes may be improved with this route compared to open or direct retroperitoneal access as the overall morbidity and mortality rates were found to be 27% and 5% respectively, which was lower than with minimal access surgical methods.[18]

The multicentre PENGUIN (pancreatitis, endoscopic transgastric versus primary necrosectomy in patients with infected necrosis) trial by the Dutch pancreatitis study group randomised patients to either endoscopic or surgical necrosectomy and found endoscopic necrosectomy to be superior with significantly less new onset organ failure (0% vs 50%, p=0.03) and fewer pancreatic fistulas (10% vs 70%, p=0.02).[19] Mortality was also lower (10% vs 40%) but this was not statistically significant.

This method, however, is not applicable to all patients as the collections to be drained need to be within 2 cm of the gastric or duodenal wall. A visible swelling indicating the site for transmural puncture is only present in 50-60% of patients and endoscopic ultrasonography (EUS) is therefore needed to reach a higher technical success rate (95%).[17] While this requires advanced endoscopic and EUS skills, a prospective randomised study has shown lower adverse event rates of 0-4%.[20] Typically, 3-6 sessions are required to complete the debridement through the endoscopic route, which is significantly more than our experience of 2P-LRN. Whether a combination of endoscopic debridement with percutaneous drainage might be the best way forward is being studied in an ongoing randomised trial.[17]

In one patient, bleeding was encountered intraoperative and was found to be originating from a pulsatile vessel. With the use of suction irrigation, the bleeding point was isolated and the vessel was clipped using a 10 mm laparoscopic clip applicator. No other adverse events were encountered during these procedures, which is consistent with the low rate reported by the American Pancreatic Association.[17] Pancreatic fistula is a common problem following necrosectomy and our rate of 37% is consistent or better than what others have found with minimally invasive techniques although comparisons are hindered by varying definitions.[2,10,15]

Several operative techniques for minimally invasive necrosectomy have been described over the past 10-15 years. Like ours, most descriptive series consist of small numbers but various approaches have been found to be safe and effective. The advantages of minimally invasive techniques over open surgery were highlighted by the multicentre PANTER (pancreatitis, necrosectomy versus step up approach) trial in the Netherlands where patients with necrotising pancreatitis or infected necrosis were randomised to either a ‘step-up’ approach that initially involved percutaneous or endoscopic drainage followed by necrosectomy being performed via a flank incision if there was no clinical improvement within three days or to

a group that went straight to open surgery.[16] Patients assigned to the step-up approach had a lower rate of major morbidity and mortality than the open surgery group (40% vs 69%, p=0.006) as well as a lower total number of operations (p=0.004).

Our overall morbidity rate of 37% compares extremely favourably with the Dutch experience as the PANTER study did not include pancreatic fistulas in the stated morbidity figure as they were not considered a major complication.[16] If pancreatic fistulas are similarly excluded from our analysis, our morbidity rate would be nil.

The minimally invasive technique used in the PANTER trial was the VARD technique whereby a 5-7 cm subcostal incision is made to allow direct access to the necrotic tissue. While this allows easier removal of large pieces of necrotic tissue, we have not faced problem through the 10 mm laparoscopic port, where the gas valve can be disconnected to allow retrieval of large fragments of necrosis. Indeed, Gambiez et al, reported that 2 out of 20 patients developed late hernias through the lumbotomy wound following endoscopic retroperitoneal drainage and both needed reoperation.[21] Minimising the number and length of incisions can prevent this complication, and we have not had any issues with hernias at the laparoscopic port sites.

A further advantage of direct percutaneous access to the retroperitoneum over a transperitoneal laparoscopic approach is the avoidance of a pneumo-peritoneum in a critically ill and potentially unstable patient. Our technique also requires less dissection, is easier technically and avoids contamination of the peritoneal cavity by infected material from within the pancreatic bed.

Access to the pancreatic bed from the left flank, as described in our technique, allows drainage of collections from the distal portion of the pancreas, along the left retro-colic gutter and even to the pelvis. We have also used the two port sites for placement of drains, for post-operative irrigation of the residual abscess cavity. Most areas of WON may therefore be accessed via the 2P-LRN approach, with the possible exception of those in the transverse mesocolon or mesenteric root.[21]

CONCLUSION

Minimal access methods for pancreatic necrosectomy offer benefits superior to traditional open surgery for the majority of patients, leading to fewer complications and faster recovery. Early minimal invasive drainage can be considered to step up approach for better patient compliance and improved patient morbidity. In our study 2P-LRPN appears to be effective and beneficial. Superior visualisation and better access to the necrotic cavity with small laparoscopic incisions is an advantage over other techniques for minimal access debridement.

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