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Retroperitoneal Laparoscopy for Pancreatic Necrosis

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Abstract: ***Objective: To study the feasibility and efficacy of retroperitoneal laparoscopy for debridement in patients with infected pancreatic necrosis or non-resolving sterile necrotizing pancreatitis. Methods: All patients with necrotizing pancreatitis detected on contrast enhanced computed tomography admitted in the Department of Gastroenterology and GI Surgery in AIIMS new Delhi from March 2011-June 2012 were included in this study. Patients with infected pancreatic necrosis or extensive non-resolving sterile pancreatic necrosis safely accessible through a left retroperitoneal approach were included for retroperitoneal laparoscopic debridement and a percutaneous drain in the peripancreatic collection was placed under ultrasound guidance preoperatively. Postoperatively the cavity was irrigated with isotonic saline and drained through two 32 French tube drains placed in the cavity during surgery. Results: Ten patients underwent retroperitoneal laparoscopy out of 129 patients with necrotizing pancreatitis. Various complications of necrotizing pancreatitis included ileus, seizures, metabolic encephalopathy, sepsis, pleural effusion and chest infection. The median preoperative duration of illness was 38 days (34-70 days). The median operative time was 2 hours and the mean blood loss was 425 ml (100-1700 ml). The median values of postoperative clinical parameters like oral intake, mobility, number of days of antibiotic continuity, postoperative hospital stay, drain removal and wound healing were 4, 5, 30, 31, 72 and 87 days respectively. Three patients died. Conclusion: Retroperitoneal laparoscopic debridement is feasible in about one-third of patients with acute necrotizing pancreatitis requiring necrosectomy with an acceptable operating time, blood loss, conversion to open, post operative morbidity and mortality.***

Keywords: Infected pancreatic necrosis, extensive non-resolving sterile pancreatic necrosis, percutaneous drain, retroperitoneal laparoscopic debridement, retroperitoneal lavage

1. Introduction

Necrotizing pancreatitis accounts for approximately 20% cases of acute pancreatitis[1]. Infection of pancreatic necrosis occurs in 10% to 50% of patients with necrotizing pancreatitis when it becomes a dreadful surgical disease[2]. In contrast to mild acute pancreatitis, which has a mortality rate lower than 1%, the death rates of severe acute pancreatitis is much higher: about 12% with sterile and approximately 30% with infected pancreatic necrosis[3]. Sterile necrosis is usually treated conservatively. In contrast, without surgery the mortality for infected pancreatic necrosis may approach 90%[4]. There is no universal consensus on the ideal therapeutic approach to patients with infected pancreatic necrosis. Conventional open necrosectomy is associated with significant surgical morbidity such as wound complications, fascial dehiscence, and intestinal fistulae. Large series report mortality associated with open surgery for infected pancreatic necrosis ranging between 15–50 % [5-7].

2. Methods

After approval from ethical committee of AIIMS, New Delhi, on 22nd March 2011, patients were recruited into the study up to June, 2012. All patients admitted in the Department of Gastroenterology and GI Surgery in AIIMS, New Delhi with infected or non-resolving sterile pancreatic necrosis were evaluated for inclusion in the study.

Two groups of patients with acute necrotizing pancreatitis were included in the study.

(i) infected pancreatic necrosis: a) contrast enhanced computed tomography (CECT) scan showing pancreatic necrosis > 30%, ± peripancreatic necrosis or collections with or without evidence of retroperitoneal gas, b) clinical evidence of sepsis – fever > 100°F; tachycardia (heart rate> 100 / min.); increased total leucocyte counts (>11,000 / mm^3), c) positive fine-needle aspiration bacteriology (FNAB) of pancreatic bed or any culture positivity from a previously placed percutaneous drain (PCD);

(ii) extensive non-resolving sterile pancreatic necrosis: CECT scan showing pancreatic necrosis > 50% with a) failure to improve after 2-4 weeks of medical and intensive care unit (ICU) management b) clinical deterioration in the form of development or deterioration of at least one organ failure and/ or worsening systemic inflammatory response syndrome (SIRS) with no bacteriological evidence of sepsis c) intra abdominal bleed.

Following group of patients were excluded from this study. (i) lack of safe retroperitoneal access route to the pancreatic necrosis by a PCD based on CECT evaluation, such as interposition of a hollow viscus in the proposed drainage path, (ii) associated intra abdominal pathology needing laparotomy such as bowel ischemia, perforated viscus, significant intra abdominal / intra visceral bleeding and bowel fistula, (iii) peripancreatic necrosis extending into areas not accessible from a left retroperitoneal approach, e.g., right paracolic gutter, (iv) general contraindications to surgery, including medical risk factors like renal failure etc., (v) patients who refused to participate in the study.

Technique of retroperitoneal laparoscopic debridement (RLD)

A PCD in the form of a pig tail catheter was placed in the (peri-) pancreatic collection through a left retroperitoneal approach under ultrasound guidance. A 12 French catheter was used at the outset which was upgraded by 2-4 Fr. every 3-4 days till a 20 Fr. catheter is finally put in. If drainage through the catheter did not lead to clinical improvement (reduction of temperature, total leucocyte count, C-reactive protein and subsidence of organ failure), surgical intervention was done. Surgery was done four weeks or beyond after onset of the disease to allow pancreatic necrosis to be demarcated, wall of the cavity to mature, and general condition of the patient to be optimized for surgery.

Patient was laid in supine position with a roll above and below the proposed line of incision (See fig. 1). A 3-5 cm long subcostal incision was made on the left flank at the midaxillary line, close to the exit point of the previously placed PCD. Muscles cut in the line of the incision and peripancreatic collection entered by blunt dissection, guided by preoperative CECT images and following the PCD track. Loose necrotic material was removed with the help of a sponge holding forceps &/or ovum forceps. The PCD was followed deeper into the cavity and further debridement carried out while periodic irrigation through the PCD was done along with the suction by a cannula put inside the cavity to clear the debris and enhance vision. When debridement could no longer be proceeded under direct vision, a 10 mm camera port was placed into the incision and a 10 mm 0^0 telescope was introduced through it (See fig. 2). At this stage CO_2 gas was insufflated through this port, at a rate of 10 litres/minute, to inflate the cavity, thereby facilitating retroperitoneal inspection. The incision site was closed with Allis forceps to prevent gas leak and maintain pneumoretroperitoneum. A 10 mm working port was put at a suitable adjacent place and under videoscopic assistance further debridement of retained pancreatic necrotic tissue was done with laparoscopic graspers through this port (See fig. 3). The necrotic material /pus was sent for Gram staining and bacteriological and fungal culture and sensitivity.

After removal of most of the necrotic tissue, the working port was removed and the cavity was irrigated with copious amounts of hydrogen peroxide diluted with isotonic saline through the PCD. The PCD was removed following irrigation and two 32 Fr. tube drains were positioned in the cavity, one through the working port site and placed at the deepest point of the cavity under telescopic guidance and another, either through one end of the incision after removal of the camera port or through a stab incision at a nearby dependent site and placed at a superficial plane within the cavity. Wound was closed by using interrupted 2-0 vicryl sutures for muscles and skin stapler. Drains were fixed to the skin using 2-0 polyamide sutures (See fig.4).

Figure 1: Position of the patient (PCD in situ)

Figure 2: Placement of camera port

Figure 3: Videoscopic view showing necrotic tissue and pigtail catheter (PCD)

Figure 4: Completion of the procedure

3. Postoperative Management

Continuous retroperitoneal lavage was done with 7- 10 litres of isotonic saline daily through one of the tube drains while the other one being used for drainage of the effluent, until the effluent became clear. Parenteral antibiotics coverage included cefoperazone-sulbactam, amikacin and metronidazole and changed according to culture sensitivity reports. Antifungals were added prophylactically after two weeks of broad spectrum antibiotic usage or if indicated following fungal culture positivity. Aseptic precautions taken; intravenous lines, abdominal drains and Foley's catheter taken care of and oral hygiene ensured. Assisted ventilation was maintained in patients requiring respiratory support. Nutritional support was ensured with oral or nasogastric tube feeding or via feeding jejunostomy (FJ). Parenteral nutrition was supplemented in cases with inadequate enteral nutrition. CT scan(s) were repeated, if clinically indicated, to look for residual necrosis or collection.

Postoperative day (POD) of oral intake and mobility or ambulation were noted and total duration of postoperative antibiotic usage was recorded. Duration of postoperative intensive care unit (ICU) stay and hospital stay, ventilator requirement including ventilator based respiratory complications, and total duration of hospitalization were also noted. Postoperative organ dysfunction and pancreatic fistula were managed appropriately and mortality recorded. Drain(s) were removed during hospitalization or after discharge from the hospital and the POD of drain removal and surgical wound healing were recorded. Surgical wound related complications were looked for, recorded and managed.

Follow up

All patients undergoing RLD were followed up for 1 year at the following intervals: 6 weeks, 3 months, 6 months and 1 year. At each follow up patients underwent clinical examination, hemogram and relevant biochemical tests, and abdominal ultrasound or CECT if required. Readmissions were recorded. Steatorrhea or new-onset diabetes mellitus requiring pancreatic enzyme supplementation or insulin (or oral hypoglycemic agents) respectively were recorded.

4. Results and Discussion

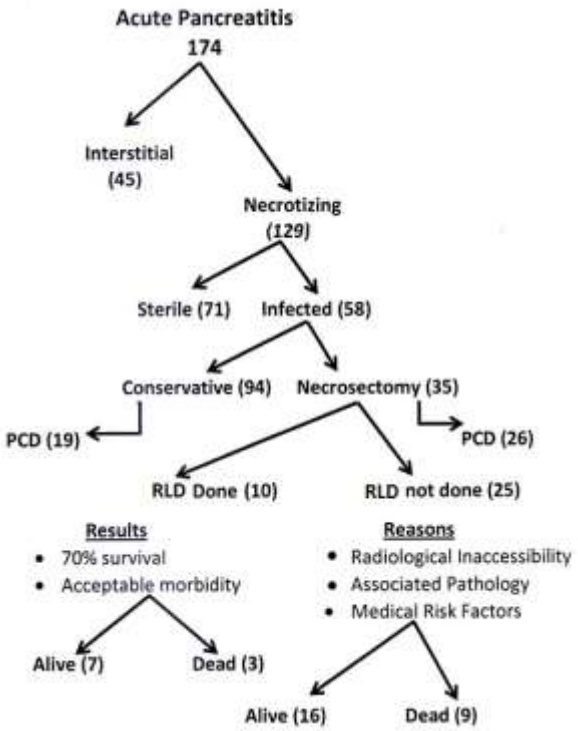

Figure 5: Clinical profile of patients with acute pancreatitis

Table 1: Demographic details of the patients

Parameters	Mean	Median	Standard Deviation	Minimum	Maximum
Age (year)	27.8	28	6.6	18	40
Height (cm)	168	169	4.4	161	172
Weight (kg)	63	61	14.1	42.5	90
BMI (kg/m^2)	22.2	22.2	4.3	16	31

Nine out of 10 patients were male.

Table 2: Preoperative clinical parameters

Parameters	Mean	Median	Standard Deviation	Minimum	Maximum
Duration of illness (days)	43.3	38	10.9	34	70
APACHE II	11	11	4.35	6	22
CRP (mg/l)	58.7	63.6	26.8	18	94
Blood sugar (mg/dl)	137.8	135.5	53.5	74	236
CTSI	9.4	10	0.9	8	10
ICU duration (days)	13.1	9.5	11.3	0	31

APACHE II-Acute Physiology and Chronic Health Evaluation II; CRP- C- reactive protein; CTSI- CT Severity Index; ICU- Intensive Care Unit.

5. Complications

Nine patients developed complications due to acute necrotizing pancreatitis preoperatively. Respiratory failure was the most common complicating nine patients and pleural effusion was present in six patients. Acute renal

failure followed next in frequency- two patients underwent two sessions of dialysis, each. Two other patients were oliguric with deranged kidney function tests that resolved with conservative management. Three patients developed ileus. One patient developed seizure and the other developed metabolic encephalopathy. One patient was in septic shock 2 days prior to surgery requiring oxygen supplementation and inotropes. One patient required ventilatory support for 38 days prior to surgery. Two patients developed complications of percutaneous drain insertion- in one patient the drain was put inadvertently through transverse colon, which was not evident till intraoperative evaluation and the other patient developed bleeding during upgradation of the catheter size from 16 to 20 Fr. Baudin *et al.,* also had encountered two non lethal bleeding complications[8] in their series of 48 patients who were treated with CT-guided PCD insertion into the necrotic collection. Four patients became diabetic as a complication of acute necrotizing pancreatitis during illness and required insulin.

6. Bacteriology

Five out of ten patients were septicemic with bacteria grown in blood culture. Pus drained by the percutaneous drain revealed Escherichia coli and Enterobacter in three patients each. Proteus was found in two patients. Acinetobacter, Pseudomonas, Methicillin-resistant Staphylococcus aureus (MRSA), Staphylococcus epidermidis, Candida albicans and Candida glabrata were found in one patient each. The gut origin of most of the bacterial isolates is indicative of intestinal mucosal barrier disruption in necrotizing pancreatitis. pFarkas *et al.,* also found enteric bacteria predominantly in the isolates from infected pancreatic necrosis[9]. Candida infection resulted in 84% mortality in patients with necrotizing pancreatitis in the study by Gotzinger *et al[10]*.

Table 3: Operative parameters

Parameters	Mean	Median	Standard Deviation	Minimum	Maximum
Necrosis (g)	125	100	35.3	100	200
Blood loss (ml)	425	350	476	100	1700
Blood transfusion units (no.)	1.2	0.5	1.6	0	5
Operating time (min.)	129	120	21.4	105	180
Procedures done (no.)	1.3	1	0.9	1	4

Intraoperative bleeding occurred in two patients resulting in hypotension and one of them required conversion to open procedure for control of bleeding. Other minimally invasive procedures also have 10-20% chance of bleeding, as supported by Carter *et al.,* who encountered bleeding in 1 out of 10 patients during nephroscopic necrosectomy[11]. One patient required two units of blood transfusion for intraoperative bleed which settled automatically and another patient required five units of transfusion who was converted to open surgery for control of bleeding. Eight patients of single large-port laparoscopic necrosectomy by Buchler *et al.,* did not require any blood transfusion[1]. Two patients were converted to open surgery. First conversion was due to inadvertent intracolonic placement of the PCD, resulting in failure of retroperitoneal dissection and the second was due to intraoperative bleeding. The excellent result by Hamouda *et al.,*[12] where no conversion was needed in 29 patients treated by minimally invasive necrosectomy, reflects high level of expertise in radiologic and surgical group.

Mean operating time in our study was 129 minutes (105-180 minutes) and the median time was 120 minutes. The two patients who were converted to open surgery required longer operating time (150 minutes and 180 minutes respectively). Comparable operating time is also seen by other minimally invasive techniques. Mean duration of endoscopic necrosectomy session was 3.5 hours (range, 2.5-4 hours) by Escourrou *et al.,*[13] and that of laparoscopic necrosectomy was 120 +/- 10 minutes by Wani *et al[14]*. The median operative time was 87 +/- 42 minutes by Buchler *et al.,*[1] who studied 8 patients of single large-port laparoscopic necrosectomy. Additional procedures were required in two patients. One patient required pack removal (retroperitoneal packing was done in first surgery due to intraoperative bleeding) and placement of drains two days after surgery. Second patient underwent three additional procedures after he underwent loop ileostomy, abdominal drain placement with laparostomy at the initial surgery due to colonic perforation inflicted by the percutaneous drain. He was taken for surgery 12 days later. Adhesiolysis, lavage and closure of laparostomy were done. He required subsequent surgery 17 days later due to persistence of fever with multiple intra-abdominal collections on CECT. Further necrosectomy, drainage of pus cavities, splenectomy (due to bleeding at splenic hilum) and packing performed. Reexploration was done after two days and pack removal, lavage and drainage done. The patient recovered after a prolonged hospital stay.

Table 4: Postoperative clinical parameters

Parameters (days)	Mean	Median	SD	Minimum	Maximum
Ventilator requirement	4.7	1	9.5	0	31
ICU stay	12.1	5	14.4	1	44
Time for ambulation	6.2	5	5.5	2	18
Time for oral intake	6.7	4	4.9	2	15
Postop. hospital stay	31	31	19.7	1	73
Total hospital stay	62.4	55	28.2	32	132
Duration of antibiotic usage	28.2	30	11.7	13	42
Drain removal	72.2	72	33	24	114
Wound healing time	82.4	87	36.6	30	121

ICU- Intensive care unit; SD-Standard Deviation

The mean postoperative ICU stay was 12.1 days (1-44 days) compared to median stay of 5 days. One patient stayed for 31 days in ICU because he could not be weaned off the ventilator due to bilateral chest infections with inadequate respiratory effort. Another patient stayed for 44 days in ICU as he underwent four sessions of surgery. The mean postoperative hospital stay was 31 days (1-73 days) with the median duration of 31 days. The patient who underwent surgery four times remained in the hospital for 73 days. Three patients died in our study (Mortality = 30%).

Table V. Studies related to hospital stay and mortality

Study	Surgery	No. of patients	Mean postop. stay (days)	Death (%)
Carter *et al.*	Nephroscopic necrosectomy	10	42	20
Hamouda *et al.*	Nephroscopic necrosectomy	30	124.3	0
Sileikis *et al.*	MIRPN	8	49	0
Connor *et al.*	MIRPN	64	51	32.8
Gambiez *et al.*	MIRPN	20	62	10
Bruennler *et al.*	Percutaneous necrosectomy	10	N/A	40
Fagniez *et al.*	MIRPN	40	N/A	33

MIRPN- Minimally invasive retroperitoneal pancreatic necrosectomy; N/A- No data available

Oral feeding started 6.7 days (2-15 days) after surgery. The median duration of oral intake was 4 days. Two patients were not taking orally for which nasogastric tube was put in one patient and nasojejunal tube in another before surgery. Both of them tolerated oral intake on POD 10. One patient was very sick with renal failure who was put on total parenteral nutrition (TPN) along with nasogastric feeding preoperatively. He was able to take orally on POD 15. Oral intake began within 2.4 days (1-5 days) after delayed, mini-retroperitoneal drainage in 19 patients by Chang *et al*[15].

Abdominal drains used for irrigation and drainage were kept for a mean of 72.2 days (24-114 days) and a median of 72 days after surgery. The patients were discharged usually with a single drain cut and put in a stoma bag which was removed during follow up visits when there was no drain output. In the delayed, mini-retroperitoneal drainage by Chang *et al.*,[15] drains were removed subsequently after a mean of 120.6 days (60-250 days). The prolonged drain-in situ period in the reviewed series could be due to the fact that, patients underwent retroperitoneal drainage via a small left flank incision without debridement and irrigation, possibly with significant residual necrotic tissue left behind, which liquefied and drained slowly. None of the seven patients followed had persistent pancreatic fistula following removal of the drains. The drain track closed in all patients within 7 days.

A small pseudocyst was present near the tail of the pancreas on ultrasound in one patient at 8 months of follow up (14.3%). Ahmed *et al.,* followed 27 patients of minimally invasive retroperitoneal necrosectomy and had found pancreatic pseudocysts in 14.8% (4/27) of patients[16]. Pancreatic atrophy was noted in 3 patients in the follow up period out of 7 surviving patients. No patient suffered from steatorrhea and one patient was diabetic requiring insulin on follow up. One patient developed an incisional hernia which required surgery 1 year later.

7. Conclusion

Pancreatic necrosis is the devitalized tissue that can involve either pancreatic parenchyma or peripancreatic tissues. The consensus is for the removal of the necrosum and preservation of viable pancreas along with maximal physiological support. In acute necrotizing pancreatitis, conventional open surgery is thought to exemplify the stress on the patient by the phenomenon of 'second hit'. This concept, added by the fact that minimal access surgery causes lesser degree of activation of the systemic inflammatory response compared to conventional open surgery in already critically ill patients paved the way for Retroperitoneal laparoscopic debridement. RLD is unlikely to be successful when the necrosis extends into both paracolic gutters, and when the extent of necrosis is multifocal and discontinuous. It is also not suitable for necrosis of head/uncinate process of pancreas due to difficult access. Lack of access route for percutaneous drain insertion due to interposition of bowel loop is also a contraindication for RLD. RLD is a new technique, technically feasible in about one-third of patients with acute necrotizing pancreatitis requiring necrosectomy with an acceptable operating time, blood loss, conversion to open surgery, post operative morbidity and mortality. When it is used, there are benefits of reducing the physiological insult in these gravely-ill patients, which in turn may translate into a reduction in mortality. So RLD should be considered in selected patients with severe acute necrotizing pancreatitis when necrosectomy is indicated.

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