Role of percutaneous catheter drainage as primary treatment of necrotizing pancreatitis

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ABSTRACT

Background/Aims: *Necrotizing pancreatitis has morbidity and mortality rates exceeding most of the other acute medical emergencies despite the best possible medical and surgical care. Early surgical intervention has a high operative risk.*

Materials and Methods: *This prospective open-label study was designed to evaluate the role of percutaneous catheter drainage (PCD) of pancreatic necrosis as primary treatment of acute necrotizing pancreatitis. An ultrasound/computed tomography-guided drainage was performed with 10 or 12 Fr catheters using a 0.35 mm guide wire, irrespective of whether necrosis was infected or not. Patients were followed up for organ dysfunction, need for surgical intervention, and survival at week 8.*

Results: *A total of 20 (65% males) patients who had acute necrotizing pancreatitis with varied etiology were enrolled in the present study. Of these patients, 9 (45%) did not need surgery after PCD. The remaining 11 (55%) patients showed significant reversal of organ failure after PCD insertion ($p<0.05$ for improvement in serum creatinine, need for mechanical ventilation, and decline in C-reactive protein). Survival at week 8 was 95%. PCD was well tolerated with only two catheter-related complications being observed.*

Conclusion: *Percutaneous catheter drainage can be a primary treatment option for necrotizing pancreatitis. In addition, it helps to stabilize critically ill patients and delay the surgical procedure to beyond 4 weeks to improve the surgical outcomes.*

Keywords: *Percutaneous catheter drainage, necrotizing pancreatitis, peripancreatic collections, primary treatment*

INTRODUCTION

Necrotizing pancreatitis develops in approximately 20% of patients with acute pancreatitis and is associated with a mortality of 8% to 39% (1). One of the most important concerns in patients with acute severe necrotizing pancreatitis is the development of compartment syndrome due to a large-sized acute fluid collection. Other complications include pain, abdominal distension affecting the efficiency of breathing (2), and compression of adjacent organs leading to either obstructive biliopathy or gastric outlet obstruction (GOO). Until recently, the choice of intervention in infected necrotizing pancreatitis has been surgical necrosectomy with the aim of removing all infected necrosis. This approach is associated with considerable morbidity (34%-95%) and mortality (11%-39%) (3). Some patients with sterile necrosis also eventually undergo surgical necrosectomy in the event of clinical deterioration (multiple organ dysfunction) despite maximal supportive therapy. Percutaneous catheter drainage (PCD) is an attractive and technically feasible alternative in patients who are not candidates for surgical intervention. The present study focused on PCD as a primary treatment option for necrotizing pancreatitis.

MATERIALS AND METHODS

Study design

This was prospective open-label study. The study was conducted in a tertiary care center in North India between January 2012 and November 2013. A total of 20 consecutive patients with acute severe pancreatitis who were admitted in a single surgical unit at Dayanand Medical College and Hospital, Ludhiana, India were enrolled in the study. The Institutional Review Board approved the study in accordance with the principles of the Declaration of Helsinki. Written informed consent was obtained from all patients.

Study population

Adults who were ≥18 years old and who were diagnosed with acute severe pancreatitis were included in the study. The diagnosis of acute severe pancreatitis was confirmed based on the documentation of severe/necrotizing pancreatitis on contrast enhanced computed tomography (CECT) of the abdomen. Data on patient demographics, disease characteristics, such as duration and severity, and organ failure were recorded. Complete

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blood count, erythrocyte sedimentation rate, renal and hepatic function tests, highly sensitive C-reactive protein (CRP), and need for organ support were recorded at baseline and subsequent follow-up.

Intervention

An ultrasound/CT-guided drainage was performed with 10 or 12 Fr catheters (Biorad Medisys Pvt. Ltd., India) using a 0.35 mm guide wire by the Seldinger technique via the most direct transperitoneal route. The retroperitoneal route was not used in our study population as (1) it was the decision of the interventional radiologist (S.P.) for the most direct route and (2) PCD was not performed as a part of the step-up approach as surgery was not being contemplated in all patients at the time of PCD insertion. Malecot or locking loop catheters were used. PCDs were placed for gravity drainage of the collection. Catheters were routinely flushed with 100 mL normal saline to avoid clogging of the catheter. After catheter placement, radiological assessment was periodically performed to check the amount of residual collection and to reposition the catheter if needed. Repeat cross-sectional imaging was performed at the discretion of the physician if there was evidence of clinical and/or biochemical derangements. The PCD catheters were removed when drainage was <10 mL for 2 consecutive days. Surgical intervention was applied if there was either clinical deterioration or locoregional complications occurred.

Clinical outcome

The clinical status, laboratory parameters, and need for organ support systems were recorded daily. The primary end point was recovery without surgical intervention. Secondary end points were improvements in renal, respiratory, and cardiovascular functions.

Statistical analysis

The clinical response rates were assessed using the Student's t-test and chi-square test. Statistical Package for Social Sciences version 21.0 (IBM Corp.; Armonk, NY, USA) was used for statistical analysis. A p-value <0.05 was considered as statistically significant using the standard α=0.05 cutoff.

RESULTS

Baseline demographics

A total of 20 (65% males) patients with acute severe necrotizing pancreatitis were enrolled in the study. The mean age of the patients was 36.9±10.7 years. Majority (n=11, 55%) of the patients had pancreatitis secondary to alcohol abuse, whereas 7 (35%) had biliary pancreatitis, and 2 (10%) had pancreatitis secondary to abdominal trauma.

Treatment received

All the patients were initially managed with fluid resuscitation, nutritional supplementation (enteral), organ system support, pain alleviation, and antibiotics, as required.

Indication of PCD insertion

Patients who had pancreatic/peripancreatic collection(s) with persistent infection, infected necrosis, persistent organ failure, or clinical deterioration (development of multiorgan dysfunction, fever, leukocytosis, or locoregional pressure effects even with sterile collection) were considered for image-guided PCD. The authors would like to clarify that infected necrosis was not the only indication of PCD. Even if there were pressure effects or persistent systemic inflammatory response syndrome or development of multiorgan failure in the background of a large collection, PCD insertion was considered as a therapy to decrease the disease burden and buy more time. Thus, PCD, even without infected necrosis, acted as a bridge to a more radical intervention in the form of necrosectomy.

Outcomes

In total, 9 (45%) patients had 30%-50% pancreatic necrosis on CECT of the abdomen, whereas 11 (55%) had >50% necrotic pancreas. Of the 20 patients, 19 (95%) had PCD due to clinical deterioration (as described above) despite optimum medical management, whereas 1 developed GOO secondary to walled off pancreatic necrosis and, therefore, needed PCD to relieve the obstruction. The mean time of PCD insertion after the onset of pain in the abdomen was 14.75±3.17 (10-21) days. PCD was inserted only when there was evidence of liquefaction on radiological imaging; solid debris and necrotic pancreatic tissue were not the intended targets.

Of the patients, 4 (20%) had infected necrosis (extraintestinal air on CECT of the abdomen, n=3/positive image-guided fine needle aspiration cytology, n=1). The most common organism cultured from the necrotic tissue was *Escherichia coli* (*E. coli*) (50% of patients with infected necrosis), whereas the rest of the patients had mixed growth.

On comparing the pre- and post-PCD (i.e., 1 week after the insertion of PCD), there was a significant improvement in renal functions (p=0.02 for serum creatinine levels). Similarly, PCD resulted in a significant improve-

ment in the respiratory parameters with 6/17 being able to be weaned off from the mechanical ventilator support (p=0.03). Cardiovascular functions also significantly improved after PCD as depicted by a decreased requirement of vasopressors post-procedure (Table 1). There was also a significant decline in CRP values from a mean value of 267.7±41.1 pre-PCD to a mean value of 222.1±33.95 post-PCD (p=0.001).

Of the patients, 2 (10%) had PCD-related complication, 1 developed cellulitis at the insertion site that was managed conservatively, whereas the other had external pancreatic fistula. Nine patients did not require any further intervention after PCD, whereas 11 (55%) patients required additional surgical procedures after PCD (persistent sepsis (n=1) and persistent single/multiorgan failure (n=10)). Ten patients underwent open necrosectomy, whereas 1 patient was subjected to distal pancreatectomy secondary to development of external pancreatic fistula. Table 2 shows the outcome of survival at week 8. The mean time for surgery after PCD was 14.75±3.18 (10-23) days. The mean durations of intensive care and hospital stay were 20.45±7.64 and 29.85±9.16 days, respectively.

Table 1. Comparison of pre- and post-PCD in renal, respiratory, and cardiovascular functions

	No. of patients pre-PCD (n)	No. of patients post-PCD (n)	p
Serum creatinine (mg/dL)			
≤2	9 (45%)	16 (80%)	
>2	11 (55%)	4 (20%)	0.02
Respiratory failure			
Invasive mechanical ventilation	17 (85%)	11 (55%)	
Non-invasive oxygen therapy	3 (15%)	9 (45%)	0.03
Cardiovascular collapse			
Use of vasopressors	14 (70%)	6 (30%)	0.01

PCD: percutaneous catheter drainage

Table 2. Distribution of subjects according to final outcome (survival at week 8)

Final outcome	Only PCD	PCD+ necrosectomy	PCD+distal pancreatectomy	Total
Expired	0	1	0	1
Recovered	9	9	1	19
Total	9	10	1	20

PCD: percutaneous catheter drainage

DISCUSSION

We evaluated the role of PCD as primary treatment of necrotizing pancreatitis, irrespective of the fact whether necrosis was infected or sterile. A total of 20 patients with a mean age of 36.9±10.7 years with acute severe necrotizing pancreatitis (majority were alcohol-related) were studied. Of the patients, 20% had infected necrosis, whereas the remaining 80% had sterile pancreatic collections. Of the patients with infected necrosis, 50% had positive cultures for *E. coli*. Buchler et al. (4) had also documented similar proportion of patients with infected necrosis showing positive microbiological results.

A systematic review (3) revealed that in patients who underwent drainage of pancreatic and peripancreatic collections, surgery is obviated in as many as 55.7% of patients. Wig et al. (5) evaluated the effect of image-guided drainage of the pancreatic/peripancreatic collections. They revealed that 37.5% of patients are successfully managed by radiological intervention only. Our results are in accordance with the above findings. In our study, 45% of patients also recovered with PCD alone. Freeny et al. (6) had also reported that 47% of patients can be cured with PCD alone without any surgical intervention. However, the study population in most of the previous studies included patients with infected necrosis, whereas the current study comprised PCD as a bridge to surgery even in the absence of documented infection.

In the present study, 45% of patients did not require any surgery. PCD stabilized critically ill patients to facilitate a later surgical intervention in a relatively stable condition (3,7,8). Percutaneous drainage showed significant improvements in renal, cardiovascular, and respiratory functions and a decline in CRP values. Patients who underwent a surgical procedure at a later date also had a better surgical outcome (>90% survival at week 8) with pre-surgery PCD of necrosis. Early surgery entails a high mortality at 60%-65%. By 4 weeks, the necrotic process stops, and there is a clear demarcation in viable and non-viable pancreatic tissues. A delay in surgery allows time for stabilization of the patients and decreases the operative and periopertive risks. PCD acted as bridge to surgery in these patients. Patients who were managed with PCD had shorter mean hospital stay than those who were not (historical cohorts). This was associated with lower rates of complications, less hospital-acquired infections, and decreased overall cost of treatment. Complications with PCD were few probably because of proper patient selection, expert treating faculty, adequate care of PCD, and a multidisciplinary team approach. Only 2 out of the 20

patients had PCD-related complication, 1 had mild cellulitis, whereas the other had external pancreatic fistula necessitating a distal pancreatectomy. The present study has few limitations. The number of patients studied was small, and there was no control group for comparison.

PCD upfront avoids surgery in 45% of patients with acute severe necrotizing pancreatitis and acts as a bridge to surgical intervention by delaying the surgery to >4 weeks after the onset of disease. It can aid in reversal of organ failure, decrease the need for ventilatory support, and decrease total hospital and intensive care unit stay, thus reducing the cost of treatment. Large randomized trials are needed to validate the role of PCD as a primary therapeutic modality for acute necrotizing pancreatitis in the future.

Ethics Committee Approval: Ethics committee approval was received for this study from the Ethics Committee of Dayanand Medical College and Hospital.

Informed Consent: Written informed consent was obtained from the patients who participated in this study.

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