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Percutaneous Catheter Drainage in the Management of Severe Acute Pancreatitis

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Abstract: *There has been a paradigm shift in the treatment protocols of acute pancreatitis over the past two decades from an early aggressive surgical treatment to a more conservative strategy. In this study, we assess the role of image guided percutaneous catheter drainage of peri-pancreatic fluid and necrotic collections in the management protocols of severe acute pancreatitis. On admission, all the cases were resuscitated with intravenous fluids, organ dysfunction management, analgesics and antibiotics. Supportive treatment was offered to those individuals who showed improvement when compared with their status during admission. Patients who developed (i) contaminated peripancreatic collections (ii) sterile but symptomatic (abdominal hypertension or compartment syndrome) collections (iii) infected necrosis, (iv)progressive organ dysfunction underwent image-guided PCD or surgical necrosectomy. PCD was used successfully in 18 (51.4%) of the total 35 cases. Of the 18 patients, 15(42.9) patients recovered without the need for surgical management and it helped in delaying the morbidity of upfront surgery in 2 (11.1%) patients. The most common complication of PCD was catheter slippage occurring in 2(11.1%) of our patients and was tackled by image guided repositioning. In conclusion, modern treatment algorithms of SAP benefits from the ''step-up'' approach where percutaneous catheter drainage serves as a primary stabilizing measure and is often regarded as a temporizing method to tackle septicemia and prolong surgery free interval. That said,in well selected patients, PCD with appropriate caliber drains and supplementary therapy is all that is required to effectively manage SAP.*

Keywords: *percutaneous catheter drainage, acute severe pancreatitis, necrosectomy, step-up approach, necrotising pancreatitis, image-guidance, conservative management.*

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I. Introduction

"Acute pancreatitis is the most terrible of all the calamities that occur in connection with the abdominal viscera. The suddenness of its onset, the illimitable agony which accompanies it, and the mortality attendant upon it, all render it the most formidable of catastrophes" Lord Moynihan, 1925 Acute pancreatitis is an inflammatory process of the pancreas, with variable involvement of peri-pancreatic tissues and remote organ systems. In majority of the cases, the disease process is mild, with interstitial oedema and therefore leads to recovery within a few days or weeks [1]. On the other hand, severe pancreatitis, which is characterized by local or systemic complications, is very demanding and associated with severe morbidity and even death, in nearly 15-20% of the cases.The treatment of acute pancreatitis is not disease-specific, targeting underlying pathophysiology. Initial life-saving measures include fluid resuscitation and supportive therapy to various organ systems which mitigates the concomitant course of the disease process thereby decreasing the severity of acute pancreatitis [2,3].There has been a paradigm shift in the treatment protocols of acute pancreatitis over the past two decades. The management has shifted from an early aggressive surgical treatment to a more conservative strategy. Interventional treatment is seldom needed in majority of the patients with acute pancreatitis. However, interventional treatment in the form of percutaneous catheter drainage, open or minimally invasive endoscopic necrosectomy is indispensable in certain conditions of severe acute pancreatitis [4].In this study, we assess the role of image guided percutaneous catheter drainage of peri-pancreatic fluid and necrotic collections in the management protocols of severe acute pancreatitis.

Aims And Objectives

- To compare and analyze the outcome of patients with severe acute pancreatitis managed by conservative treatment, percutaneous catheter drainage and surgical necrosectomy.
- To compare the role of each management strategy in sterile and infected necrotic pancreatitis
- To study the pros and cons of different treatment groups with particular emphasis on the benefits of percutaneous catheter drainage.

II. Materials And Methods

Study Centre
Institute of General Surgery, Madras Medical College and Rajiv Gandhi Government General Hospital
Study type
Prospective study
Study duration
March 2016 to September 2016
Sample size
35 patients {Sample size $N=Z^2P(1-P)/d^2$ where Z=1.96,P=10%,d=10%}

Patient inclusion criteria

Patients above 18 years of age admitted in RGGGH with acute necrotizing pancreatitis (defined as increase in serum amylase level within the first 48 hours, with a threshold of 3 or 4 times the upper normal range, and show evidence of pancreatic necrosis on the contrast-enhanced CT performed between the 48th and 72nd hrs after the onset of abdominal pain) and having one of the following conditions,

(i)Infected necrotic peripancreatitic collections
(ii)Symptomatic sterile peripancreatitic collections

Exclusion criteria:
1. Patients with collections after pancreatic surgery
2. Patients who underwent treatment for pseudocyst, which is classified as a late (>4-6weeks) complication of pancreatitis
3. Those not willing to participate in the study
4. Patients below 18 years of age
5. Patients who are pregnant

Procedure

This is a prospective study based on 35 consecutive patients with severe acute pancreatitis managed at the Institute of General Surgery, Madras Medical College and RGGGH between March 2016 and September 2016. The diagnosis of acute pancreatitis was done based on clinical features, increased serum amylase or lipase levels and imaging criteria. The definition of severe acute pancreatitis was in accordance with the modified Atlanta classification as modified Balthazar or CT severity index (CTSI) greater than 7.

On admission, all the cases were resuscitated with intravenous fluids, organ dysfunction management, analgesics and antibiotics such as imipenem/cilastatin or meropenem and metronidazole administered prophylactically. Within three days of admission, early nutritional resuscitation was taken care of. The enteral feeding route, whether per-oral, nasogastric or nasojejunal was decided by the performance status of the individual [5]. In accordance with the culture and sensitivity of the drain fluid or blood and urine samples, appropriate antibiotics was administered. Continuous monitoring of all the cases were done round the clock to watch out for potentially life threatening complications like multi organ dysfunction and septicemia. Radiological diagnosis using usg of abdomen and/or CT was done in a periodic manner to help assess the localization or the spread of inflammatory collections and the development and delineation of necrosis.

Supportive treatment was offered to those individuals who showed improvement when compared with their status during admission. Those patients who developed (i) contaminated peripancreatic collections (ii) sterile but symptomatic (abdominal hypertension or compartment syndrome) collections (iii) infected necrosis,

(iv) progressive organ dysfunction underwent image-guided PCD or surgical necrosectomy. In cases with 5cm or greater collections, demonstrating unrelenting hyperthermia, elevated leucocytes and progressive organ dysfunction, an USG or CT-guided PCD was performed using a 12 Fr pigtail catheter by the Seldinger technique via the transperitoneal or retroperitoneal route avoiding injury to the bowel and other vital structures. This technique was preceded by Vit. K, FFP and platelet supplementation to treat coagulopathy, when required. PCD was anchored to drain by gravity and normal saline irrigation was performed when solid necrotic debris was drained or it caused blockage of the tube. Periodic ultrasonogram abdomen was performed to verify the emptying of the collections and the requirement to flush the tube and reposition the same. Periodic contrast enhanced CT scans were done, if need be, to monitor the resolution or the progression of the disease process and the requirement for surgical necrosectomy. If the drain quantity was lower than ten milliliter for 2 days, the PCD was removed under ultrasound guidance. PCD success was defined when there was reduction in the size of the fluid collections, control of septicemia and absence of requirement of surgery.

Surgery was performed if there was no clinical improvement, worsening organ failure in spite of PCD or when the individuals exhibited Warshaw's theory of un-wellness [8]. The surgery included open

necrosectomy and a irrigation and drainage of the lesser sac. The timing of the surgical treatment, no. of days of SICU care, duration of in-patient treatment and case fatality rates were noted.

Statistical Analysis

All the collected data were tabulated on MS Excel sheet. For the categorical and continuous data, the calculations were denoted by numbers and percentage of the total and mean ± S.D. respectively. Student T test and chi-squared tests were performed to calculate the continuous and categorical variables respectively using SPSS (Statistical Package for Social Science) software ver. 18.0. A "P" value < 0.05 was considered as a statistically significant result

Observation And Inference

35 consecutive patients admitted to the Institute of General Surgery, RGGGH with severe acute pancreatitis were studied. The etiology of severe acute pancreatitis were as follows, ethanol related in 32(91.4%) cases, gallstones in 2(5.7%) cases and idiopathic in 1 (2.9%) patient.Male patients constituted 31(88.6%) and females 4(11.4%) of the total study group. The age distribution of the patients were as follows- 4(11.4%) of age group 20 – 30 years, 13(37.1%) of age group 30 – 40 years, 12(34.3%) of age group 40 – 50 years, 6(17.1%) of age group 50 – 60 years. The mean and standard deviation of this age distribution was 40.71 ± 9.06. Serum amylase was elevated to more than three or four times the normal in 28 (80.0%) whereas lipase levels was increased in 31 (88.6%) cases. Acute kidney injury as suggested by elevated blood urea and serum creatinine levels was present in 6(17.1%) patients and contrast CT scans were promptly avoided in these patients. Those patients who underwent CECT abdomen had instances of SAP with a modified Balthazar or CT severity index more than seven.

Categorization Of Patients

The patients were initially treated in the SICU; based on their response to conservative treatment, they were categorized into 3 divisions: first, patients manageable by SICU treatment alone; second, patients who underwent PCD and third, patients who underwent primary surgery or surgery due to the non-improvement of the conservative and PCD management.

- Of the 35 patients, 12(34.3%) patients were treated successfully by conservative treatment alone (Group A), whereas 18(51.4%) patients required PCD (Group B).
- Out of 18 cases in Group B, 12 patients (66.7%) were treated successfully and there was no necessity for surgical management (Group B1) whereas 2 (11.1%) patients were operated on (Group B2).
- Group C consisted of patients who underwent primary surgical management-5(14.3%) patients.
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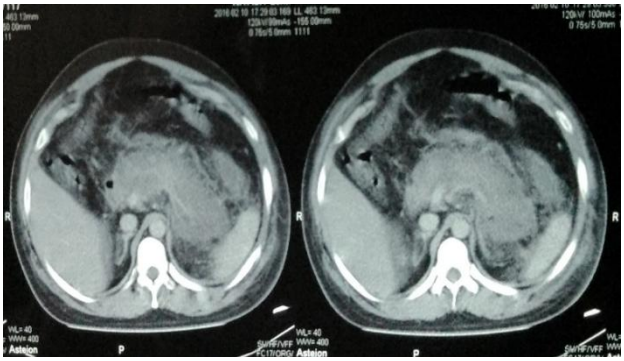


Fig.1. Conservative management

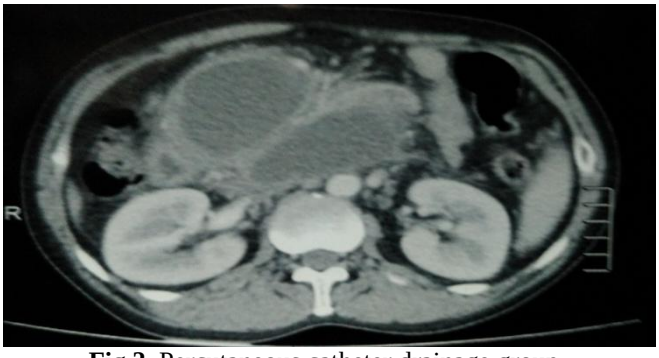


Fig.2. Percutaneous catheter drainage group

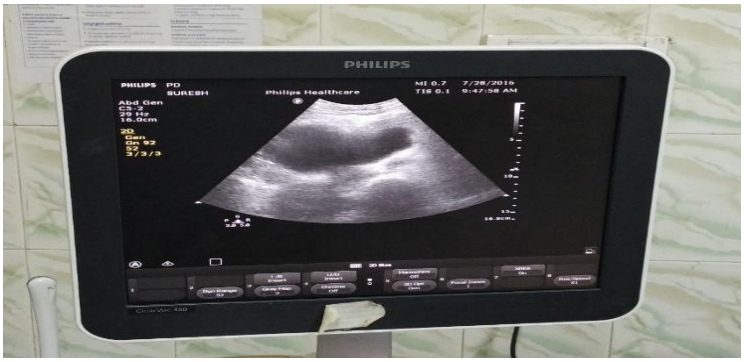


Fig.3. Usg guided pcd

Fig.4. Drain fluid

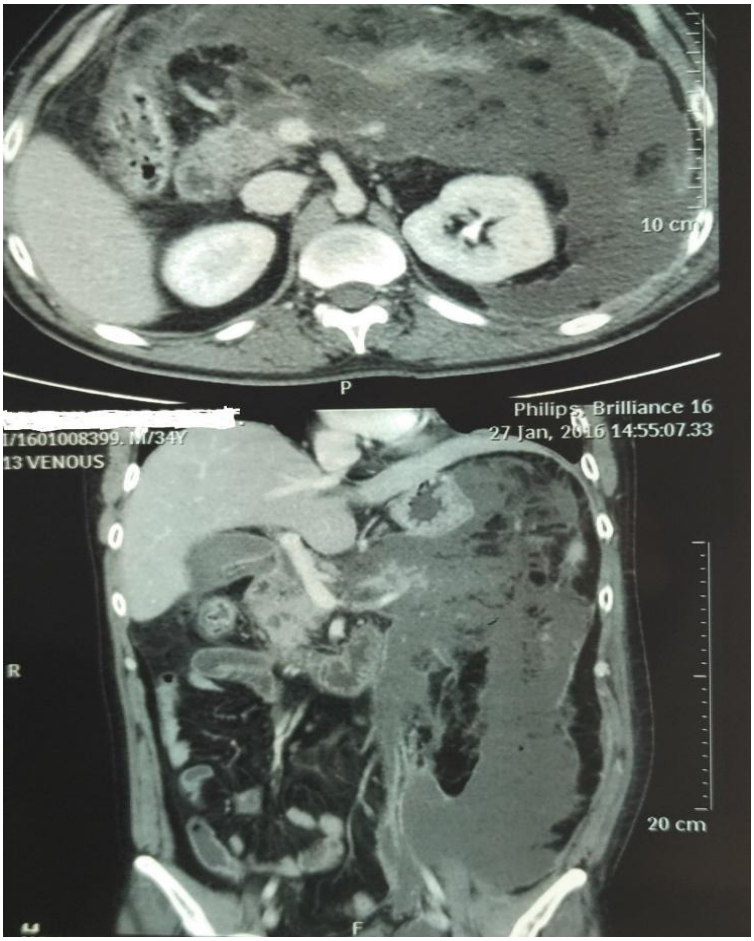


Fig.5. Extensive necrosis with mods

Fig.6. Necrosectomy Group

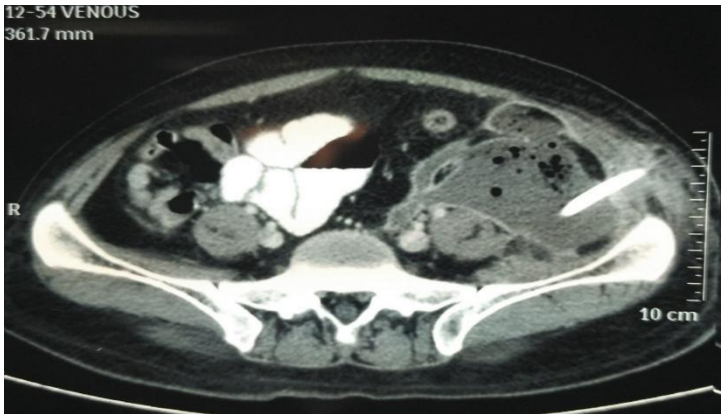
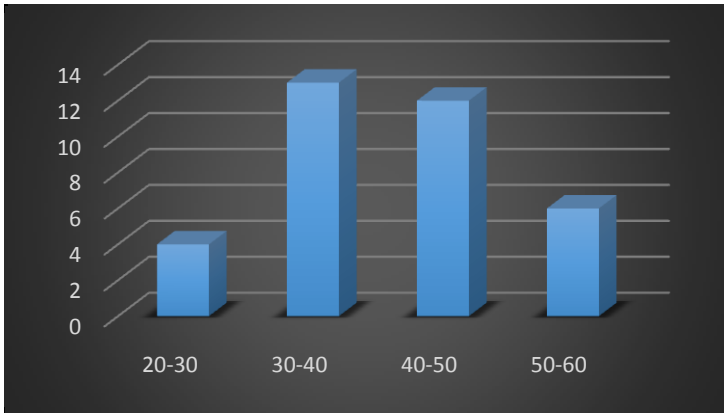
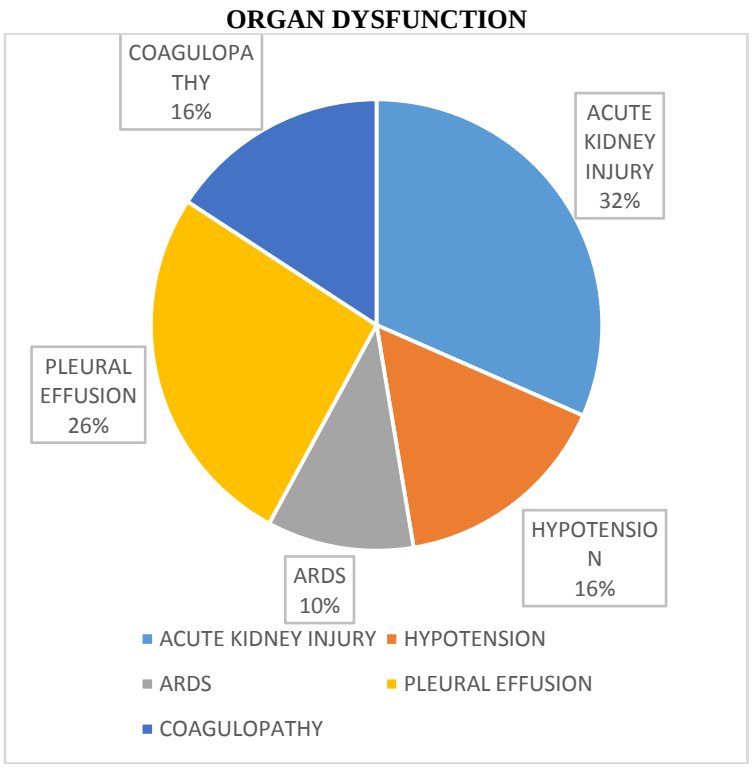


fig.7. pcd acted as a bridge to necrosectomy

Age Distribution

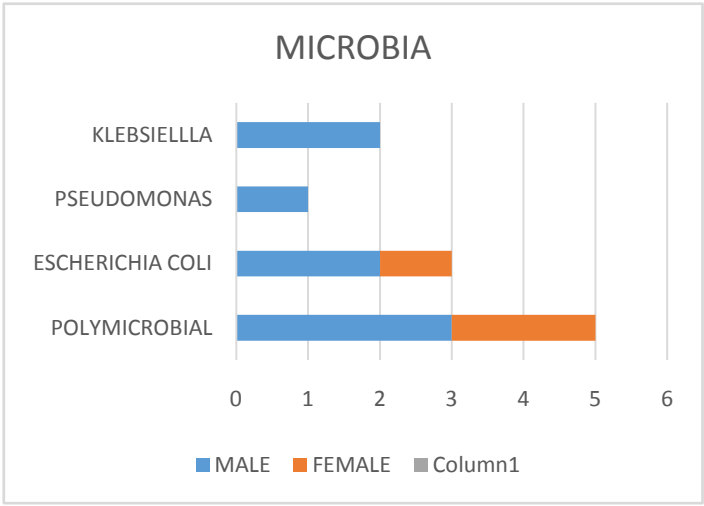
.I			**x**	/	**-x/**	**x-x/)²**	**(x-x/)²**
1-30		5	00	0	15	25	00
1-40	3	5	455	0	5	5	25
1-50	2	5	40	0		5	00
1-60		5	30	0	5	25	350
	5		**425**				**875**





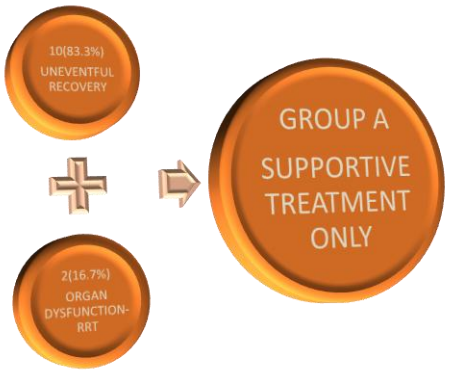
Flora Identified

Fine needle aspiration and gram staining was performed in those with no direct evidence of infection (absence of air inside the necrotic collections) and the following results were obtained.



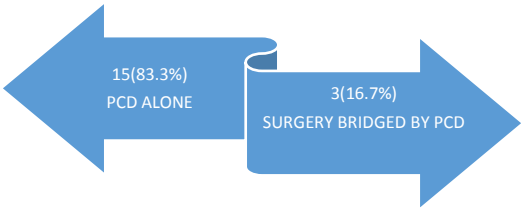
Conservative Management (Group A)

Non-operative strategy of supportive treatment including fluid resuscitation, organ system support (including renal replacement therapy), pain alleviation and prophylactic antibiotics (imipenem/cilastatin or meropenem and metronidazole) was first used in 30 (85.7%) patients. 12(340.3%) cases were successfully treated by conservative management alone (Group A) and 18(51.4) cases were treated with conservative approach and PCD (Group B). 2(16.7%) patients in Group A had organ dysfunction complication in the form of acute kidney injury and acute lung injury. 10(83.3%) patients in Group A made an uneventful recovery. 2(16.7%) patients recovered after renal replacement therapy in the form of hemodialysis



Percutaneous Catheter Drainage (Group B)

18(51.4%) patients underwent ultrasound or CT-guided drainage of the peripancreatic collections. 15(83.3%) of these patients were successfully managed by PCD drainage alone, whereas 3(16.7%) patients did not show consistent improvement with PCD alone and hence underwent laparotomy and necrosectomy thereby migrating to Group B2. The most common procedure related complications were catheter slippage which required repositioning in 2(11.1%) patients.



Necrosectomy And Closed Lesser Sac Lavage (Group C)

5(14.3%) patients underwent surgical management in the form of necrosectomy and closed lesser sac lavage due to inadequacy of conservative management (Group C) and 2(11.1%) image guided PCD (Group B2). The main indications for surgical management included infected necrotizing pancreatitis in 3(60%) patients, multi-organ dysfunction in 1(20%) patient and Warshaw's theory of un-wellness in 1(20%) patient. Progressive multi-organ dysfunction was the main indication for the 2(11.1%) patients who underwent surgery after inadequate percutaneous catheter drainage (Group B2). There wasn't any significant difference between the individuals who underwent surgical management primarily or after inadequate percutaneous catheter drainage end organ damage (acute kidney injury) (P=1.000), acute lung injury (P=0.715) and duration of in-patient management (P=0.583). Patients in Group B2 had delayed surgical intervention when compared to the patients in Group C, however this difference was not statistically significant (P=0.133).The CT severity index among the patients who were first managed conservatively (Groups A and B1) and those patients who underwent surgical management (Group B2 and Group C) was similar and not statistically significant (P=0.185).Instance of acute kidney injury during in-patient stay was significantly greater (P=0.008) in the individuals treated by surgical management in comparison to those who underwent conservative management.

The intensive care management in patients managed non-operatively and those who underwent surgery was in the range of 4-25 days and 9-35 days and the mean ± standard deviation was 6.4±7.8 days and 13.7±16.3 days. The hospital stay in non-operated patients and those who underwent surgery was in the range of 16-38 days and 17-69 days and the mean ± standard deviation was 26±5.4 days and 43.2±11.7 days. Individuals treated conservatively had a significantly decreased SICU period (P=0.002) and subsequently a decreased in-patient period (P=0.003). The overall case fatality rate was in 3(8.6%) patients with 2(5.7%) deaths occurring after surgery and 1(2.9%) patient died in the Group B due an acute coronary event. Amongst those patients managed by supportive management alone there was no mortality. Amongst the operated patients, both the deaths occurred in patients primarily operated upon (Group C) and none from inadequate percutaneous catheter drainage group (Group B2).

III. Discussion

Percutaneous catheter drainage not only decreases the necessity of surgical management but also reduces the disease severity and the development and progression of organ failure [6,7]. This study shows that PCD was used successfully in 18 (51.4%) of the total 35 cases. Of the 18 patients, 15(42.9) patients recovered without the need for surgical management and it helped in delaying the morbidity of upfront surgery in 2 (11.1%) patients. Freeny [9]and colleagues stated that 47% of their cases were successfully treated by 'PCD alone'. Moreover less than 25% of their cases needed management by surgery. Navalho [10]and colleaguesreported that percutaneous catheter drainage cured 63% of their patients with 33% of their patients necessitating necrosectomy after PCD failed to show any clinical, biological and radiological improvement. Moertle*et al*.[11] revealed that PCD procedure has the potential to be the bridging gap to surgical intervention in seven of their thirteen cases with contaminated pancreatic necrosis. This study strengthens their observations. PCD treatment therefore can help in stabilizing the individuals for a critical period that could help in postponing a morbid upfront surgery or altogether avoiding surgical intervention. However, a study by Rocha et al. [12] stated that the use of image guided intervention will not benefit patients suffering from necrotizing pancreatitis with concomitant organ failure.Bruennler*et al*. [13] reported that PCD done using multiple larger bore drainage catheters has the advantage that these drains would help perform a guided percutaneous or fistulous tract necrosectomy although most of them required subsequent open necrosectomy and therefore concluded that large bore drainage has no advantage in controlling the septic focus. Moertele [11]and colleaguesused an average pigtail catheter of 12 Fr size with no mortalities. This study uses a 12Fr. Pigtail catheter for PCD and is in accordance with the above studies.The complications of PCD include introduction of infection, bleeding, perforation of the hollow viscus or other vital structures and slippage of the catheter. Bleeding is a rare event except in patients with coagulopathy (as indicated by an elevated PT/INR) and is usually due to the disease process itself rather than PCD therapy. Arterial pseudo-aneurysms is treated by arterial embolization whereas venous bleeding is rarely catastrophic. Fistulization of the hollow viscus could be due to an inadvertent bowel injury during catheter insertion but is more commonly due to the spread of peri-pancreatic inflammation. Catheter slippage occurred in 2(11.1%) of our patients and image guided repositioning was all that was required to tackle this complication.A new entrant in the treatment algorithm of SAP is the use of upper gastrointestinal endoscopy to drain infected peri-pancreatic collections. A recent trial demonstrated a success rate of 80% with trans-gastric upper GI endoscopic necrosectomy and a complications rate of 26%. Upper GI endoscopy techniques and PCD offer a safe and an effective treatment, being a valuable addition to the armamentarium of severe acute pancreatitis management.In conclusion, this study reiterates the value of PCD in the management of patients with SAP where majority of our cases were managed successfully by non-operative strategies, thus obviating a morbid upfront surgical management. PCD bridges a critical morbid period and buys an invaluable time frame which help the patient stabilize before progression to surgical necrosectomy. Surgical measures are definitely essential in those where the disease process could not be tackled by a supportive and percutaneous catheter drainage strategy. Thus, a multimodality approach involving conservative treatment, percutaneous catheter drainage and timely surgical necrosectomy is quintessential in the treatment of individuals with severe acute pancreatitis.

IV. Conclusion

The initial treatment of acute severe pancreatitis has changed from an initial surgical management to a more conservative approach of supportive care and minimally invasive therapy. This paradigm shift in SAP treatment is a result of path-breaking trials made by various investigators who concluded that a high case fatality rate occur after early surgical management. Amongst all complications, infected pancreatic necrosis (IPN) is, by far, the most dreaded and the most severe, accounting for a major cause of mortality associated with acute pancreatitis. The risk of contamination by bacteria increases with the duration of the disease, reaching a peak during the third week with an incidence rate of 71%. It is generally accepted that, in IPN, the contaminated non-vital 'fluid under pressure' has to be debrided to control septicemia. Also the sterile fluid collections causing symptoms such as abdominal compartment syndrome, compression symptoms such as jaundice, duodenal obstruction need to be addressed. Modern treatment algorithms of SAP involves the so-called ''step-up'' approach where percutaneous catheter drainage serves as a primary stabilizing measure and is often regarded as a temporizing method to tackle septicemia and prolong surgery free interval [7]. The next step is the minimal access necrosectomy or the traditional open necrosectomy. That said, in well selected patients, PCD with appropriate caliber drains and supplementary therapy is all that is required or it acts as a bridge to a delayed necrosectomy which significantly has a low morbidity and mortality when compared to an early surgery.

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