



THE EFFICACY OF PERCUTANEOUS CATHETER DRAINAGE IN THE MANAGEMENT OF ACUTE PANCREATITIS

Surgery

Dr. Harish. D. Chauhan

Additional Professor, Department of General Surgery, SMIMER, Surat, Gujarat, India

Dr. Jignesh. K. Savsaviya

Assistant Professor, Department of General Surgery, SMIMER, Surat, Gujarat, India

Dr. Shuchi Varshney*

3rd year resident, Department of General Surgery, SMIMER, Surat, Gujarat, India.
*Corresponding Author

ABSTRACT

Background The efficacy of percutaneous catheter drainage in the management of acute pancreatitis and the factors affecting the outcome of the therapy were studied. **Methods** It is prospective observational analysis. Patients of acute interstitial edematous and acute necrotizing pancreatitis with acute peri-pancreatic fluid collections and walled off necrosis were considered for image guided percutaneous drainage. Success rate of percutaneous drainage and the variables that affect its outcome were assessed. CT diagnosed cases of acute pancreatitis with peri-pancreatic collection (APFC and WON) were included in the study. **Results** Successful resolution on PCD was seen in 58.33% of the cases where there was improvement in clinical outcome with control in sepsis and temperature, in our study surgical necrosectomy was performed in 19.4% of the cases (n=7). Successful resolution on PCD in patients with severe necrotizing pancreatitis was 40.9% as compared to moderate and mild group which was 84.6% and 100% respectively. Homogenous peri-pancreatic collection was observed in 23 patients where the outcome was successful in 17 (73.91%) of the patients. In the patients with heterogenous peri-pancreatic collection, out of 13 patients, successful outcome was seen in (n=4; 30.76%) of the patients. Presence of MODS (n=21) was a negative predictor of success. Successful outcome was seen in only (n=1; 9.01%) of the cases. Presence of more than 30% necrotic tissue was seen in (n=23) cases where successful resolution was seen in (n=10; 43.47%) of the cases. (n=13) cases had less than 30% necrosis and success rate was in (n=11; 84.61%) of the cases. **Conclusion** Percutaneous Catheter drainage is an efficacious method in the management of complicated acute pancreatitis. So PCD is efficacious technique in walled off pancreatic necrosis. Heterogeneity of collection, severity of pancreatitis, multiple organ dysfunction syndrome and increased percentage of pancreatic necrosis have negative predictive values in its management.

KEYWORDS

acute pancreatitis, infected pancreatitis necrosis, necrotizing pancreatitis, peripancreatic fluid collection, imaging-guided percutaneous catheter drainage

INTRODUCTION

Acute pancreatitis is a common gastrointestinal disorder whose incidence is rising globally. Necrotizing pancreatitis, which accounts for 10–15 % of all cases of acute pancreatitis, may be sterile or infected. Sterile pancreatic necrosis can be generally managed expectantly while infected pancreatitis necrosis always requires evacuation. The prognosis is much worse for infected necrosis, rather than that of sterile necrosis. Mortality rates of patients with infected pancreatitis necrosis vary from 20 to 30 %, and if infected necrosis is accompanied by organ failure, the disease is associated with a mortality of 40 %. Therefore, infected pancreatitis necrosis is always an indication for intervention.

Traditionally, infected pancreatitis necrosis was managed by open necrosectomy, with the goals of wide drainage of infected compartments and removal of necrotic tissue. However, such aggressive treatment is associated with significant complications and mortality in 11–39 % of patients. In this context, traditional open necrosectomy gradually was replaced by minimally invasive techniques which include percutaneous catheter drainage (PCD), video-assisted retroperitoneal debridement (VARD), endoscopic necrosectomy, and minimally invasive necrosectomy.

In 1998, Freeny first reported 34 patients with infected pancreatitis necrosis exclusively treated by PCD, in which 16 patients (47 %) were cured successfully with only PCD. The largest recent report by Robbert A. Hollema included 113 patients with infected pancreatitis necrosis initially with percutaneous catheter drainage. This observational study of 113 patients undergoing primary percutaneous catheter drainage reported a success rate of 35 %. The only randomized multicenter trial compared a surgical "step-up approach" with primary open necrosectomy in patients with (suspected) infected pancreatitis necrosis, in which PCD was considered as the first step. This trial reported that 35 % of patients were successfully treated with PCD alone.

Drainage is the least invasive procedure in the treatment for infected pancreatic necrosis and could help patients to reduce infected fluid under pressure, or at least let them improve as a transition to further

surgery. Compared with open surgery, PCD could effectively diminish the hospital stay and average hospital cost and avoid surgically related complications, such as wound infection and incisional hernia. In this study period, we performed a systematic review on percutaneous catheter drainage in infected pancreatitis necrosis. The purpose was to evaluate the effectiveness of PCD according to definitive treatment and identify factors that closely relate to the outcome of PCD, such as mortality, and complications in individual studies for providing further evidence and references for clinical decision.

MATERIALS AND METHODS

Sample Size included 36 cases prospectively of acute interstitial edematous and acute necrotizing pancreatitis that underwent percutaneous catheter drainage at our institute from August 2019 to August 2021. Study evaluated the efficacy of percutaneous catheter drainage and also the factors affecting the outcome in complicated cases of acute interstitial edematous and acute necrotizing pancreatitis.

Inclusion Criteria

Patients with infected pancreatitis necrosis undergoing percutaneous catheter drainage;

Exclusion Criteria

- patients with chronic pancreatitis or sterile pancreatic necrosis
- patients with pseudocysts or pancreatic abscesses

AP Value of <0.05 was Considered Statistically Significant.

Patients were classified according to Modified CT Severity Index. 0-3: mild acute pancreatitis, 4-6: moderate acute pancreatitis, 7-10: severe acute pancreatitis. Patient outcome was defined as successful resolution on percutaneous catheter drainage. Clinical improvement was based on temperature charting and WBC count.

PCDs were carried out under CT or Ultrasound guidance using Seldinger technique and catheters of size ranging from 8 to 18 F were used. Drain selection was done keeping in mind the ease, site and feasibility of the procedure. Quality of fluid determined the different

size of drains that were used. Drained fluid was sent for bacteriological analysis. Upsizing of catheter drain was done if previous drain was insufficient to drain the thick collections. Multiple drains were inserted when required. Irrigation of drains were done if any blockage of drain was suspected. There were relatively lesser complications associated with percutaneous drainage.

Patients Outcome

Follow up was done on 1st day, 3rd day, 5th day, 7th day, 14th day, 1 month, 3 months and 6 months and patients were categorized as:

- Successful resolution on PCD
- Successful resolution on PCD and later surgery
- Treatment failure on PCD then surgery
- Treatment failure on PCD and surgery then death

Statistical Analysis

Statistical tests were applied as follows-

- Quantitative variables were compared using Independent T test between the two groups.
- Qualitative variables were correlated using Chi-Square test/Fisher's Exact test.
- Univariate and multivariate logistic regression was used to assess the significant factors affecting successful resolution on PCD.

RESULTS AND DISCUSSION

Etiology of Pancreatitis Most common cause of pancreatitis was idiopathic (56%) followed by Gall Stone induced pancreatitis (39%).

Table 1: Distribution Of Patients

1. CTSI Score	Total
Mild	01(2.77%)
Moderate	13(36.11%)
Severe	22(61.11%)
2. Peripancreatic Collections	
Homogenous	13(36.1%)
Heterogenous	23(63.88%)
3. Necrosis	
<30%	13(36.11%)
>30%	23(63.88%)
4. Successful Resolution Of PCD	
Yes	21(58.33%)
No	15(41.66%)

Table 2: Univariate Analysis Of Modified Ct Severity Index On Successful Resolution Of Pcd

		Successful resolution on PCD(Y/N)		Total	P value
		No	Yes		
Modified CT severity index	Mild	0(0.00%)	1(100%)	1	<.0001
	Moderate	2(15.38%)	11(84.6%)	13	
	Severe	13(59%)	09(40.9%)	22	
Total		15(41.66%)	21(58.33%)	36	

More severe the pancreatitis (higher the CTSI score) lesser the resolution of collections and thereby by poorer the outcome.

Table 3: Univariate Analysis Of Type Of Peripancreatic Collection On Successful Resolution Of Pcd.

		Successful resolution on PCD(Y/N)		Total	P value
		no	yes		
Type of collection on CT	Heterogenous	09(69.2%)	04(30.76%)	13	<.0001
	Homogenous	06(26.08%)	17(73.91%)	23	
	total	15(41.66%)	21(58.33%)	36	

Heterogeneity of collection (presence of significant of solid component) is significantly affecting the drainage and thereby affecting the resolution and outcome

Table 4: Univariate Analysis Of Type Of Percentage Of Pancreatic Necrosis On Successful Resolution Of PCD.

		Successful resolution on PCD(Y/N)		Total	P value
		No	Yes		
Percentage of necrosis of pancreas	<30%	02(15.38%)	11(84.61%)	13	<.0001
	>30%	13(56.52%)	10(43.47%)	23	
	total	15(41.66%)	21(58.33%)	36	

More the area of necrosis involving the pancreatic parenchyma, lesser the resolution of pancreatic collections and thereby affecting the outcome.

Table 5: Distribution Of Cases According To The Culture Isolated From The Drain Output

Culture of drain output	Total
Gram negative	30(83.33%)
Gram positive cocci	02(5.55%)
sterile	04(11.11%)
Total	36

The most common group of organisms to be isolated was gram-negative group.

Table 6: Distribution Of Patients According To Requirement Of Surgery

Surgery done (y/n)	Total
no	29(80.55%)
yes	05- open necrosectomy(13.8%) 02-laparoscopic necrosectomy(5.55%)
Total	36

Table 7: Univariate Analysis Of Multi Organ Dysfunction Syndrome Before Pcd On Successful Resolution Of Pcd

		Successful resolution on PCD(Y/N)		Total	P value
		No	yes		
MODS	no	05(20%)	20(80%)	25	<0.0001
	yes	10(90.9%)	01(9.01%)	11	
Total		100.00%	15(41.6%)	21(58.3%)	36

Only 1 patient showed resolution of collection. The presence of multi-organ dysfunction syndrome had significant impact on resolution of collection, thereby significantly affecting the outcome and efficacy of PCD.

Table 8: Mortality In Pcd Insertion

Death	PCD Insertion
Yes	3
No	33
Total	36

Table 9: Complications In Pcd Insertion

Complications	PCD Insertion
Yes	3
No	33
Total	36

Acute pancreatitis is a common clinical entity and the main causes are Gall stone and Alcohol. Management of acute necrotizing pancreatitis includes prolongation of intervention for at least for 3-4 weeks to allow for encapsulation and liquefaction of the collection inside which reduces the risk of bleeding. In our study, the most common cause of pancreatitis was idiopathic followed by gall stone related pancreatitis which also corroborated with the study of Freeney et al. Successful resolution on PCD was seen in, 58.33% of the cases where there was improvement in clinical outcome with control in sepsis and temperature. This finding is close to the efficacy rates of various other studies.

In the study done by Rau et al., the efficacy of conventional surgery by resection with open necrosectomy and drainage was 57.9%. In our study additional surgical intervention (05 open necrosectomy and 02 cases of laparoscopic necrosectomy) was performed in 19.4% of the cases, however in the step-up approach done by Zerem et al. surgical necrosectomy was necessary in only 12.8%.

Univariate analysis showed that the higher the degree of necrotizing pancreatitis, the less favorable was the outcome. Successful resolution on PCD in patients with severe necrotizing pancreatitis was 40.9% as compared to moderate and mild group which was 84.6% and 100% respectively. This finding was statistically significant (p value < 0.0001), it is corroborating with the study done by Sahu et al.

Percentage of necrosis of pancreas with outcome was analyzed. We found out that higher percentage of necrosis is associated with less favorable outcome. Central necrosis of the pancreas is associated with less favorable outcome. This is because there is disruption of the

midsection of the main pancreatic duct and thus isolates the body and tail of the pancreas from its head.

Presence of more than 30% necrotic tissue was seen in 23 cases where successful resolution was seen in 10 cases (43.47%). 13 cases had less than 30% necrosis and success rate was in 11 (84.61%) of the cases. This finding was statistically significant

Type of peri-pancreatic collection on CT and successful resolution of PCD was statistically significant (p value < 0.0001). Successful outcome was seen in only 1 case with MODS (9.01%), rest of the cases with MODS patients were either surgically managed or death occurred, similar results were also observed in study by Holleman et al. We have studied the drain output culture and found out that the most common group of organisms to be isolated was gram-negative group.

In our study mortality after PCD insertion was seen in ($n=3$, 8.3%) cases. In all the patients in whom PCD was done, only cases where death occurred, the cause of death was septicemia. In ($n=03$; 8.3%) cases complications were noted.

In our study, complications were seen in 3 cases ($n=1$) case showed fistula formation, and ($n=2$) cases showed drain block. The median time between onset of pancreatitis and insertion of PCD in the successful and unsuccessful group was 37 days each. In the study done by Cao Xi et al. the median time between onset of acute necrotizing pancreatitis and insertion of PCD was 28 days.

The step-up approach includes primary percutaneous catheter drainage, followed, if needed, by minimally invasive necrosectomy. The step-up approach significantly reduced the major complications and death.

CONCLUSION

Percutaneous Catheter drainage is an efficacious method in the management of complicated acute pancreatitis. So PCD is efficacious technique in walled off pancreatic necrosis. Heterogeneity of collection, high grading of pancreatitis, multiple organ dysfunction syndrome and increased percentage of pancreatic necrosis have negative predictive values in its management.

REFERENCES

- Solanki R, Thumma V, Sastry RA, Bheerappa N. The role of image guided percutaneous drainage in multidisciplinary management of necrotizing pancreatitis. *Trop Gastroenterol* 2013; 34:25-30. [PMID: 23923371]
- Freeny P, Hauptmann E, Althaus S, Traverso L, Sinanan M. Percutaneous CT-guided catheter drainage of infected acute necrotizing pancreatitis: techniques and results. *AJR Am J Roentgenol* 1998; 170:969-75. [PMID: 9530046]
- Hollemans RA, Bollen TL, van Brunschot S, Bakker OJ, Ali UA, van Goor H. Predicting success of catheter drainage in infected necrotizing pancreatitis. *Ann Surg* 2016; 263:787-92. [PMID: 25775071]
- Zerem E, Imamovic G, Susic A, Haracic B. Step-up approach to infected necrotizing pancreatitis: A 20-year experience of percutaneous drainage in a single centre. *Dig Liver Dis* 2011; 43:478-83. [PMID: 21478061]
- Sahu B, Abbey P, Anand R, Kumar A, Tomer S, Malik E. Severity assessment of acute pancreatitis using CT severity index and modified CT severity index: Correlation with clinical outcomes and severity grading as per the Revised Atlanta Classification. *Indian J Radiol Imaging* 2017; 27:152. [PMID: 28744075]
- Guo Q, Li A, Hu W. Predictive factors for successful ultrasound-guided percutaneous drainage in necrotizing pancreatitis. *Surg Endosc* 2016; 30:2929-34. [PMID: 26487212]
- Solanki R, Thumma V, Sastry RA, Bheerappa N. The role of image guided percutaneous drainage in multidisciplinary management of necrotizing pancreatitis. *Trop Gastroenterol* 2013; 34:25-30. [PMID: 23923371]
- Zhao K, Adam SZ, Keshwani RN, Horowitz JM, Miller FH. Acute pancreatitis: revised Atlanta classification and the role of cross-sectional imaging. *AJR Am J Roentgenol* 2015; 205:32-41. [PMID: 26102416]
- Fu CY, Yeh CN, Hsu JT, Jan YY, Hwang TL. Timing of mortality in severe acute pancreatitis: experience from 643 patients. *World J Gastroenterol* 2007; 13:1966. [PMID: 17461498]
- Werner J, Feuerbach S, Uhl W, Buchler MW. Management of acute pancreatitis: from surgery to interventional intensive care. *Gut* 2005; 54:426-36. [PMID: 15710995]
- Carter R. Percutaneous management of necrotizing pancreatitis. *HPB* 2007; 9:235-9. [PMID: 18333229]
- Banks PA, Bollen TL, Dervenis C, Gooszen HG, Johnson CD, Sarr MG, et al. Classification of acute pancreatitis—2012: revision of the Atlanta classification and definitions by international consensus. *Gut* 2013; 62:102–111. [PMID: 23100216]
- Solanki R, Thumma V, Sastry RA, Bheerappa N. The role of image guided percutaneous drainage in multidisciplinary management of necrotizing pancreatitis. *Trop Gastroenterol* 2013; 34:25-30. [PMID: 23923371]
- Freeny P, Hauptmann E, Althaus S, Traverso L, Sinanan M. Percutaneous CT-guided catheter drainage of infected acute necrotizing pancreatitis: techniques and results. *AJR Am J Roentgenol* 1998; 170:969-75. [PMID: 9530046]
- Fotoohi M, D'Agostino HB, Wollman B, Chon K, Shahrokni S, VanSonnenberg E. Persistent pancreatocutaneous fistula after percutaneous drainage of pancreatic fluid collections: role of cause and severity of pancreatitis. *Radiology* 1999; 213:573–578. [PMID: 10551244]
- Babu RY, Gupta R, Kang M, Bhasin DK, Rana SS, Singh R. Predictors of surgery in patients with severe acute pancreatitis managed by the step-up approach. *Ann Surg* 2013; 257:737-50. [PMID: 22968079]
- Hollemans RA, Bollen TL, van Brunschot S, Bakker OJ, Ali UA, van Goor H. Predicting

- success of catheter drainage in infected necrotizing pancreatitis. *Ann Surg* 2016; 263:787-92. [PMID: 25775071]
- Li A, Cao F, Li J, Fang Y, Wang X, Liu DG, et al. Step-up minimally-invasive surgery for infected pancreatic necrosis: Results from prospective cohort study. *Pancreatology* 2016; 16:508-1. [PMID: 27083075]
- Zerem E, Imamovic G, Susic A, Haracic B. Step-up approach to infected necrotizing pancreatitis: A 20-year experience of percutaneous drainage in a single center. *Dig Liver Dis* 2011; 43:478-83. [PMID: 21478061]
- Lowenfels AB, Maisonneuve P, Sullivan T. The changing character of acute pancreatitis: epidemiology, etiology, and prognosis. *Current gastroenterology reports*. 2009; 11:97-103. [PMID: 19281696]
- Freeman ML, Werner J, van Santvoort HC, Baron TH, Besselink MG, Windsor JA, et al. International Multidisciplinary Panel of Speakers and Moderators. Interventions for necrotizing pancreatitis: summary of a multidisciplinary consensus conference. *Pancreas* 2012; 41:1176–1194. [PMID: 23086243]
- Rau B, Uhl W, Buchler MW, Beger HG. Surgical treatment of infected necrosis. *World J Surg* 1997; 21:155-61. [PMID: 8995071]
- Sahu B, Abbey P, Anand R, Kumar A, Tomer S, Malik E. Severity assessment of acute pancreatitis using CT severity index and modified CT severity index: Correlation with clinical outcomes and severity grading as per the Revised Atlanta Classification. *Indian J Radiol Imaging* 2017; 27:152. [PMID: 28744075]
- Guo Q, Li A, Hu W. Predictive factors for successful ultrasound-guided percutaneous drainage in necrotizing pancreatitis. *Surg Endosc* 2016; 30:2929-34. [PMID: 26487212]
- Johnson CD, Abu-Hilal M. Persistent organ failure during the first week as a marker of fatal outcome in acute pancreatitis. *Gut* 2004; 53:1340-4. [PMID: 15306596]
- Solanki R, Thumma V, Sastry RA, Bheerappa N. The role of image guided percutaneous drainage in multidisciplinary management of necrotizing pancreatitis. *Trop Gastroenterol* 2013; 34:25-30. [PMID: 23923371]
- Noor MT, Radhakrishna Y, Kochhar R, Ray P, Wig JD, Sinha SK, et al. Bacteriology of infection in severe acute pancreatitis. *JOP* 2011; 12:19-25. [PMID: 21206096]
- Cao X, Cao F, Li A, Gao X, Wang XH, Liu DG, et al. Predictive factors of pancreatic necrosectomy following percutaneous catheter drainage as a primary treatment of patients with infected necrotizing pancreatitis. *Exp Ther Med* 2017; 14:4397-404. [PMID: 29104650]
- Hollemans RA, Bakker OJ, Boermeester MA, Bollen TL, Bosscha K, Bruno MJ, et al. Superiority of Step-up Approach Vs Open Necrosectomy in Long-term Follow-up of Patients with Necrotizing Pancreatitis. *Gastroenterology* 2019; 156: 1016-26. [PMID: 30391468]