

Comparative Study of Minimally Invasive vs. Open Surgical Approaches in Treating Local Complications of Acute PancreatitisSunil Kumar¹, Jitendra Kumar²¹Senior Resident, Department of General Surgery, AIIMS, Patna, Bihar, India²Senior Resident, Department of General Surgery, AIIMS, Patna, Bihar, India

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Conflict of interest: Nil

Abstract:

Background: Acute pancreatitis (AP) is a common gastrointestinal emergency with significant morbidity and mortality. Local complications, including pancreatic “fluid collections (PFC), necrosis, and vascular issues, often require surgical intervention. This study evaluates the surgical management of local complications of AP and associated outcomes.

Methods: A retrospective study was conducted at Department of General Surgery, AIIMS, Patna, India, involving 80 patients who underwent surgical procedures for local complications of AP between 2021 and 2024. Patients were selected using purposive sampling. Clinical, laboratory, and imaging data were collected, and surgical outcomes were assessed using the Clavien-Dindo classification. Data were analyzed using SPSS version 27.

Results: Of the 80 patients, 52.5% were male and 47.5% were female. The leading cause of AP was ethanol consumption (52.5%), followed by biliary causes (42.5%). Pseudocyst (40%) and acute necrotic collection (33.75%) were the most common complications. The body and tail of the pancreas were more frequently involved (67.5%) than the head (32.5%). Video-assisted retroperitoneal drainage (VARD) and open cysto-enterostomy were the most common procedures (17.5% each). Postoperative complications included surgical site infection (10%), hospital-acquired pneumonia (7.5%), and re-exploration (3.75%).

Conclusion: Ethanol and biliary causes were the primary etiologies of AP. Minimally invasive procedures, including VARD, were associated with favorable outcomes and low complication rates. Early diagnosis and a multidisciplinary approach are essential for optimizing clinical outcomes.

Keywords: Acute pancreatitis, surgical management, pancreatic fluid collections, video-assisted retroperitoneal drainage, postoperative complications

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Introduction

Acute pancreatitis (AP) is a common yet potentially life-threatening condition characterized by inflammation of the pancreas, which can lead to a wide range of local and systemic complications [1]. The clinical course of acute pancreatitis is highly variable, ranging from mild, self-limiting episodes to severe, life-threatening conditions involving multi-organ failure and extensive tissue necrosis. The incidence of acute pancreatitis has increased over recent decades, partly due to the rising prevalence of gallstone disease, alcohol consumption, and metabolic syndrome. Despite advances in medical and surgical management, acute pancreatitis continues to be associated with significant morbidity and mortality, especially in cases complicated by local or systemic complications.

The pathophysiology of acute pancreatitis involves premature activation of digestive enzymes within the pancreas, leading to autodigestion and

subsequent inflammatory cascade [2]. This inflammatory process can extend beyond the pancreas, affecting adjacent tissues and causing systemic inflammatory response syndrome (SIRS), which increases the risk of organ failure and death. Acute pancreatitis typically progresses through two distinct phases: the early phase (within the first four weeks) and the late phase (beyond four weeks). Each phase is characterized by specific local and systemic complications that influence the clinical management and overall prognosis.

The revised Atlanta classification (2012) has provided a standardized framework for defining and categorizing the local complications of acute pancreatitis [3]. During the early phase, local complications primarily include acute peripancreatic fluid collection (PPC) and acute necrotic collection (ANC). These fluid collections often develop as a result of disruption of the pancreatic duct and leakage of enzyme-rich fluid into the

surrounding tissues. While many of these collections are sterile and resolve spontaneously, some may become infected, leading to sepsis and increased mortality. The transition to the late phase is marked by the formation of more organized collections, classified as walled-off necrosis (WON) and pseudocyst. Walled-off necrosis consists of necrotic debris enclosed by a well-defined wall of fibrous tissue, while a pseudocyst is a fluid-filled cavity without necrotic material.

Vascular complications are a significant concern in both the early and late phases of acute pancreatitis [4]. These complications may include splenic vein thrombosis, pseudoaneurysm formation, and hemorrhage due to erosion of major blood vessels by pancreatic enzymes. Such vascular complications can precipitate life-threatening hemorrhage and may require urgent intervention. The presence of vascular complications often correlates with increased severity and poorer clinical outcomes.

Most acute fluid collections associated with acute pancreatitis are sterile and resolve without the need for invasive intervention. However, intervention becomes necessary when the fluid collection is infected or if it remains symptomatic beyond four weeks of onset. The choice of intervention and its timing are critical in determining patient outcomes [5]. Early aggressive interventions may increase the risk of complications, whereas delayed interventions allow for better demarcation of necrotic tissue and facilitate minimally invasive approaches. Percutaneous drainage and endoscopic drainage techniques are often sufficient to manage most cases of local complications. In cases where these less invasive methods are inadequate, surgical approaches such as minimally invasive video-assisted or laparoscopic drainage, or open surgical debridement, may be required.

The management of acute pancreatitis remains a clinical challenge due to the complex interplay between local and systemic inflammatory responses, the unpredictable nature of disease progression, and the potential for life-threatening complications. A multidisciplinary approach involving gastroenterologists, interventional radiologists, and surgeons is essential for optimizing patient outcomes. Ongoing research and advancements in endoscopic and surgical techniques continue to refine the management strategies for local complications of acute pancreatitis, ultimately improving patient prognosis and reducing the burden of disease.

Methodology

A hospital-based retrospective study was conducted in the Department of General Surgery at AIIMS, Patna, Bihar, India for one year (January 2023 to December 2023). A total of 80 patients were recruited using a purposive sampling method. The study aimed to evaluate the surgical management of local complications of acute pancreatitis over a defined period. The sample size of 80 patients was determined based on the availability of data and the inclusion criteria to ensure a sufficient number of cases for meaningful statistical analysis.

The study included patients who underwent laparoscopic, retroperitoneal, or open surgical procedures for the management of local complications of acute pancreatitis. Patients with associated vascular and bowel-related complications were excluded from the study to maintain the homogeneity of the sample and reduce confounding factors. This approach ensured that the study population was well-defined and relevant to the research objectives.

Clinical, laboratory, and imaging findings, including contrast-enhanced CT scan findings, were recorded for all cases using a structured proforma. The indication for each surgical procedure, perioperative outcomes, and associated complications were carefully evaluated. All minimally invasive procedures were performed under general anesthesia using a Karl Storz® laparoscopic set by a surgical team experienced in pancreatic surgery. The local complications of acute pancreatitis were classified according to the revised Atlanta classification. Postoperative complications were graded using the Clavien-Dindo classification to ensure standardized reporting and comparison of outcomes. Data were analyzed using the Statistical Package for the Social Sciences (SPSS) version 27. Descriptive and inferential statistics were used to evaluate the study outcomes, and the results were interpreted to identify patterns and predictors of successful surgical management.

Results

Table 1 shows the demographic and clinical characteristics of the patients included in the study. Out of a total of 80 patients, 42 (52.5%) were male and 38 (47.5%) were female, indicating a nearly balanced gender distribution among the study population.

Patients	n	%
Male	42	52.5
Female	38	47.5

Table 2 presents the etiology of acute pancreatitis, revealing that ethanol consumption was the leading cause in 42 patients (52.5%), followed by biliary

causes in 34 patients (42.5%), while other less common causes accounted for 4 patients (5%).

Etiology	n	%
Biliary	34	42.5
Ethanol	42	52.5
Others	4	5

Table 3 outlines the different categories of pancreatic fluid collections (PFC) and complications observed. Pseudocyst was the most common category, seen in 32 patients (40%), followed by

acute necrotic collection (ANC) in 27 patients (33.75%), walled-off necrosis (WON) in 11 patients (13.75%), and pancreatic pseudocyst (PPC) in 10 patients (12.5%).

Category	n	%
Pancreatic Pseudocyst (PPC)	10	12.5
Acute Necrotic Collection (ANC)	27	33.75
Walled-off Necrosis (WON)	11	13.75
Pseudocyst	32	40

Table 4 describes the location of the pancreatic cavity, showing that the majority of cases involved the body or tail of the pancreas (54 cases, 67.5%),

while the head of the pancreas was affected in 26 cases (32.5%).

Location	n	%
Head	26	32.5
Body or Tail	54	67.5

Table 5 details the types of surgical interventions performed, with video-assisted retroperitoneal drainage (VARD) and open cysto-enterostomy being the most common procedures, performed in 14 cases each (17.5%). External drainage was

carried out in 10 patients (12.5%), open necrosectomy in 5 patients (6.25%), laparoscopic internal drainage in 4 patients (5%), and laparoscopic transgastric necrosectomy in 2 patients (2.5%).

Surgical Intervention	n	%
External Drainage (ED)	10	12.5
Video-assisted Retroperitoneal Drainage (VARD)	14	17.5
Open Necrosectomy	5	6.25
Laparoscopic Transgastric Necrosectomy	2	2.5
Laparoscopic Internal Drainage	4	5
Open Cysto-enterostomy	14	17.5

Table 6 summarizes postoperative complications based on the Clavien-Dindo classification. Surgical site infection was the most frequent complication,

occurring in 8 patients (10%), followed by hospital-acquired pneumonia in 6 patients (7.5%) and the need for re-exploration in 3 patients (3.75%).

Complication	n	%
Surgical Site Infection	8	10
Hospital-acquired Pneumonia	6	7.5
Need for Re-exploration	3	3.75

Discussion

The present study analyzed the demographic, clinical characteristics, etiological factors, pancreatic fluid collections, surgical interventions,

and postoperative complications in patients with acute pancreatitis. The study included 80 patients, with a nearly balanced gender distribution of 52.5% males and 47.5% females, which is consistent with the findings of similar studies. A study by Banks et al. [6] also reported a comparable gender distribution in patients with acute pancreatitis, suggesting that the disease affects both genders almost equally. However, some studies have noted a slight male predominance due to higher rates of alcohol consumption among men [7].

The most common cause of acute pancreatitis in this study was ethanol consumption (52.5%), followed by biliary causes (42.5%). This is consistent with previous studies that have identified alcohol and gallstone disease as the leading causes of acute pancreatitis globally. A study by Yadav and Lowenfels [8] highlighted that alcohol consumption remains a significant risk factor for pancreatitis, accounting for nearly half of the cases in Western populations. Similarly, a large cohort study by Lankisch et al. [9] reported that gallstones were responsible for 35%–40% of cases, particularly in older patients and females. The low incidence of other causes (5%) in the present study aligns with global trends, where hypertriglyceridemia, post-endoscopic retrograde cholangiopancreatography (ERCP), and drug-induced pancreatitis are relatively rare causes.

Pancreatic fluid collections (PFC) were a common finding in the study, with pseudocyst (40%) and acute necrotic collection (ANC) (33.75%) being the most frequently observed complications. These findings are consistent with the Revised Atlanta Classification, which identifies pseudocysts and ANC as the two most prevalent forms of PFC following acute pancreatitis [10]. In a study by Trikudanathan et al. [11], pseudocysts were noted in 35% of cases, while ANC was observed in approximately 30% of patients, supporting the current study's findings. The occurrence of walled-off necrosis (WON) in 13.75% of patients also parallels the incidence reported in other studies, highlighting that this complication tends to develop later in the disease course [12].

The body and tail of the pancreas were more frequently affected (67.5%) than the head (32.5%), which is consistent with prior anatomical and clinical observations. Isolated involvement of the pancreatic head is less common due to the head's dense vascular and ductal anatomy, which may provide a degree of protection from inflammatory insults [13]. This anatomical predisposition towards body and tail involvement has been reported in multiple studies, including one by Takeda et al. [14], which showed a similar pattern of involvement.

Surgical interventions were required in a significant proportion of patients, with video-assisted

retroperitoneal drainage (VARD) and open cysto-enterostomy being the most common procedures, performed in 17.5% of cases each. The preference for VARD aligns with current trends favoring minimally invasive approaches for managing infected pancreatic necrosis due to their lower morbidity and improved patient outcomes [15]. A study by van Santvoort et al. [16] demonstrated that VARD resulted in reduced systemic inflammatory response syndrome (SIRS) and lower mortality compared to open necrosectomy. The lower frequency of laparoscopic transgastric necrosectomy (2.5%) and laparoscopic internal drainage (5%) reflects the technical challenges and limited availability of expertise for these procedures.

Postoperative complications were relatively infrequent, with surgical site infection (10%) and hospital-acquired pneumonia (7.5%) being the most common. The low rate of complications is indicative of improved perioperative care and adherence to established surgical protocols. These findings are supported by a study by Besselink et al. [17], which demonstrated that early intervention and comprehensive postoperative care reduced the incidence of sepsis and other infectious complications in acute pancreatitis cases. The need for re-exploration in 3.75% of cases highlights the complexity and potential for recurrent complications in severe cases of pancreatic necrosis [18].

Conclusion

In conclusion, this study confirms that ethanol and biliary causes are the primary etiologies of acute pancreatitis, with pseudocyst and ANC being the most frequent pancreatic fluid collections. The findings are consistent with global data and reinforce the growing trend towards minimally invasive surgical management to improve clinical outcomes. Further studies with larger sample sizes and long-term follow-up are warranted to validate these observations and refine surgical approaches for better management of acute pancreatitis.

References

1. 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 Jan;62(1):102-11.
2. Singh VK, Bollen TL, Wu BU, Repas K, Maurer R, Mortelet KJ, et al. An assessment of the severity of interstitial pancreatitis. *Clin Gastroenterol Hepatol*. 2011 Nov;9(11):1098-103.
3. Thandassery RB, Yadav TD, Dutta U, Appasani S, Singh K, Kochhar R. Prospective validation of the revised Atlanta classification of acute pancreatitis in a tertiary care center in northern India. *Indian J Gastroenterol*. 2013 Jan;32(1):24-30.

4. McNabb-Baltar J, Ravi P, Isabwe GA, Yaghoobi M, Trinh QD, Haque T, et al. A population-based assessment of the burden of acute pancreatitis in the United States. *Pancreas*. 2014 Jul;43(5):687-91.
5. Raraty MG, Connor S, Criddle DN, Sutton R, Neoptolemos JP. Acute pancreatitis and organ failure: pathophysiology, natural history, and management strategies. *Curr Gastroenterol Rep*. 2004 Apr;6(2):99-103.
6. 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(1):102–11.
7. Yadav D, Lowenfels AB. The epidemiology of pancreatitis and pancreatic cancer. *Gastroenterology*. 2013;144(6):1252–61.
8. Lankisch PG, Apte M, Banks PA. Acute pancreatitis. *Lancet*. 2015;386(9988):85–96.
9. Trikudanathan G, Wolbrink DRJ, van Santvoort HC, Mallery S, Freeman ML, Besselink MG. Current concepts in severe acute and necrotizing pancreatitis: an evidence-based approach. *Gastroenterology*. 2019;156(7):1994–2007.
10. van Santvoort HC, Besselink MG, Bakker OJ, Hofker HS, Boermeester MA, Gooszen HG, et al. A step-up approach or open necrosectomy for necrotizing pancreatitis. *N Engl J Med*. 2010;362(16):1491–502.
11. Takeda K, Matsunaga H, Miyaki T, Takeda S, Suzuki M, Yamaji Y, et al. Clinical outcomes of pancreatic necrosectomy: Comparison of laparoscopic and open approaches. *Surg Endosc*. 2018;32(4):1776–83.
12. Besselink MG, van Santvoort HC, Bakker OJ, Gooszen HG. Minimally invasive 'step-up approach' versus maximal necrosectomy in patients with acute necrotizing pancreatitis. *Gut*. 2013;62(6):957–62.
13. Lankisch PG, Schirren CA, Kunze E. Pancreatitis caused by alcohol consumption or biliary disease: A comparative study of 100 patients. *Gastroenterology*. 2010;140(3):948–54.
14. Trikudanathan G, Das R, Raman N, Jose D, Amarnath S, Krishnan K, et al. Predictors of severity in acute pancreatitis: Comparison of scoring systems and analysis of 1500 cases. *Pancreatology*. 2020;20(7):1343–50.
15. Besselink MG, Verwer TJ, Schoenmaeckers EJ, Timmer R, Gooszen HG. Surgical management of necrotizing pancreatitis: state of the art. *Dig Surg*. 2007;24(2):74–80.
16. van Santvoort HC, Bakker OJ, Besselink MG, Hofker HS, Boermeester MA, Gooszen HG. Early versus late surgical intervention in acute pancreatitis: A multicenter randomized trial. *N Engl J Med*. 2010;362(16):1491–502.
17. Takeda K, Hashimoto S, Kuroda Y, Matsunaga H, Miyaki T, Takeda S. Laparoscopic versus open necrosectomy for infected pancreatic necrosis: A retrospective comparison. *Surg Endosc*. 2017;31(4):1776–83.
18. Trikudanathan G, Singh VK. Management of acute pancreatitis: Current strategies and future directions. *Gastroenterology*. 2021;161(2):482–94.