



## EARLY SURGICAL INTERVENTION IN ACUTE PANCREATITIS COMPLICATIONS: A PROSPECTIVE OBSERVATIONAL STUDY FROM A TERTIARY CARE CENTER IN NORTH INDIA

Dr. Paresh Ranjan<sup>1\*</sup>, Dr. Vishal Anil Chawda<sup>2</sup>, Dr. Atul Kumar Soni<sup>3</sup>

<sup>1</sup> Assistant Professor, Department of General Surgery, Varun Arjun Medical College, Shahjahanpur, Uttar Pradesh, India. ([pranjan123@gmail.com](mailto:pranjan123@gmail.com))

<sup>2</sup> Assistant Professor, Department of General Surgery, V.R.K. Women's Medical College, Aziznagar, Hyderabad, Telangana, India. ([anilchawda09@gmail.com](mailto:anilchawda09@gmail.com))

<sup>3</sup> Professor, Department of General Surgery, Varun Arjun Medical College, Shahjahanpur, Uttar Pradesh, India. ([aksoni55@gmail.com](mailto:aksoni55@gmail.com))

**\*Corresponding Author:** Dr. Paresh Ranjan

\* Department of General Surgery, Varun Arjun Medical College, Shahjahanpur, Uttar Pradesh, India.

### ABSTRACT

**Background:** Acute pancreatitis is a potentially severe inflammatory condition with significant morbidity and mortality, particularly in patients who develop complications such as pancreatic necrosis and organ failure. While current guidelines advocate delayed surgical intervention, the role of early surgery in selected complications remains controversial, especially in resource-limited settings.

**Objectives:** To evaluate the role of early surgical intervention in the management of complications of acute pancreatitis and to compare clinical outcomes with delayed or conservative management in a tertiary care hospital in North India.

**Methods:** This prospective observational study was conducted over five months (July–November 2020) and included 126 adult patients with complicated acute pancreatitis. Patients were categorized into early surgery ( $\leq 14$  days) and delayed/conservative management groups. Data on demographics, etiology, complications, and outcomes were collected using a structured proforma. Statistical analysis was performed using SPSS version 22.0, with  $p < 0.05$  considered statistically significant.

**Results:** Of the 126 patients, 58 underwent early surgical intervention and 68 were managed conservatively or with delayed procedures. The baseline characteristics were comparable between groups. Early surgery was associated with a significantly higher rate of postoperative complications (37.9% vs 23.5%,  $p = 0.048$ ). Although mortality was higher in the early surgery group (17.2% vs 8.8%), the difference was not statistically significant. The duration of hospital stay was significantly shorter in the early surgery group ( $18.6 \pm 6.2$  days vs  $22.4 \pm 7.1$  days,  $p = 0.003$ ). Patients operated within 7 days had the highest proportion of severe outcomes ( $p = 0.041$ ).

**Conclusion:** Early surgical intervention in acute pancreatitis complications is associated with increased morbidity and should be reserved for selected indications. Delayed intervention remains the preferred strategy in most cases. Individualized decision-making and improved access to minimally invasive approaches may enhance patient outcomes.

**Keywords:** Acute pancreatitis; Early surgery; Pancreatic necrosis; Surgical timing; Morbidity; Tertiary care

## INTRODUCTION

Acute pancreatitis is a common and potentially life-threatening inflammatory condition of the pancreas, with a global incidence ranging from 13 to 45 cases per 100,000 population annually and an increasing trend in both developed and developing countries [1]. While the majority of cases are mild and self-limiting, approximately 15–20% of patients develop severe acute pancreatitis characterized by local and systemic complications, leading to significant morbidity and mortality [2]. The disease spectrum includes interstitial edematous pancreatitis and necrotizing pancreatitis, with the latter associated with higher rates of infection, organ failure, and death [3].

The management of acute pancreatitis has evolved considerably over the past few decades, with a shift from early surgical intervention to a predominantly conservative approach emphasizing aggressive fluid resuscitation, nutritional support, and organ system monitoring [4]. This paradigm shift was largely driven by evidence demonstrating increased mortality associated with early operative intervention, particularly in sterile pancreatic necrosis [5]. Consequently, current guidelines advocate delaying surgical intervention until the necrosis becomes walled-off, typically after 3–4 weeks, unless there is clinical deterioration or evidence of infected necrosis [6].

However, the role of early surgery in specific complications of acute pancreatitis remains a subject of ongoing debate. Certain clinical scenarios, such as abdominal compartment syndrome, bowel ischemia, or uncontrolled sepsis due to infected necrosis, may necessitate early surgical intervention despite the general recommendation for delay [7]. Additionally, minimally invasive techniques, including percutaneous drainage and endoscopic necrosectomy, have emerged as alternatives to open surgery, further complicating decision-making regarding the timing and modality of intervention [8].

In the Indian context, acute pancreatitis presents unique challenges due to variations in etiology, delayed healthcare access, and limited availability of advanced minimally invasive facilities in many tertiary care centers. Studies from North India have reported higher rates of biliary pancreatitis and delayed presentation, often resulting in advanced disease at admission [9]. These factors may influence the outcomes of early versus delayed surgical interventions, necessitating region-specific evidence to guide clinical practice.

At the institutional level, tertiary care hospitals in North India frequently serve as referral centers for complicated cases of acute pancreatitis. Patients often present with established complications such as infected necrosis, pseudocysts, or organ failure, raising critical questions regarding the optimal timing of surgical intervention. Despite existing international guidelines, there is limited prospective data from Indian settings evaluating the outcomes of early surgery in such patients, particularly in resource-constrained environments where delays in referral and intervention are common.

The existing literature provides conflicting evidence regarding the benefits and risks of early surgical intervention in acute pancreatitis complications. While some studies suggest that early intervention in selected patients may reduce septic complications and hospital stay, others highlight increased operative morbidity and mortality associated with premature surgery [10]. This lack of consensus underscores the need for well-designed observational studies to assess the role of early surgery in real-world clinical settings.

Therefore, this study aims to evaluate the role of early surgical intervention in the management of complications of acute pancreatitis in a tertiary care hospital in North India. The specific objectives are to assess the clinical outcomes, including morbidity, mortality, and duration of hospital stay, in patients undergoing early surgery compared to those managed conservatively or with delayed intervention.

## METHODOLOGY

**Study Design:** This was a hospital-based observational analytical study with a prospective design, conducted to evaluate the outcomes of early surgical intervention in patients with complications of acute pancreatitis. The study followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines to ensure methodological rigor and transparency.

**Study Setting:** The study was carried out in the Department of General Surgery at a tertiary care teaching hospital in North India, which serves as a referral center for complex pancreatic disorders and related surgical emergencies.

**Study Duration:** The study was conducted over a period of five months, from July 2020 to November 2020.

**Study Population:** The study population comprised patients diagnosed with acute pancreatitis who developed complications requiring surgical evaluation or intervention during the course of hospitalization.

### Inclusion Criteria

- Patients aged  $\geq 18$  years
- Diagnosed with acute pancreatitis based on clinical, biochemical (serum amylase/lipase), and radiological findings
- Presence of complications such as pancreatic necrosis, infected necrosis, pseudocyst, abscess, or organ failure
- Patients who underwent early surgical intervention (within 2 weeks of onset) or were managed conservatively/delayed intervention

### Exclusion Criteria

- Patients with chronic pancreatitis
- Post-traumatic pancreatitis
- Patients with malignancy of the pancreas
- Patients unfit for surgery due to severe comorbidities
- Patients who refused consent

**Sample Size:** The sample size was calculated using the formula for comparing two proportions in observational studies:

$$n = \frac{(Z_{\alpha/2} + Z_{\beta})^2 \times [p_1(1 - p_1) + p_2(1 - p_2)]}{(p_1 - p_2)^2}$$

Assuming a proportion of adverse outcomes of 40% in the early surgery group ( $p_1 = 0.40$ ) and 20% in the delayed/conservative group ( $p_2 = 0.20$ ), with 95% confidence level ( $Z_{\alpha/2} = 1.96$ ) and 80% power ( $Z_{\beta} = 0.84$ ), the minimum required sample size was approximately 114. Accounting for potential attrition and incomplete data, a final sample size of 126 patients was included.

**Sampling Technique:** A consecutive sampling technique was employed, wherein all eligible patients presenting during the study period and meeting the inclusion criteria were enrolled until the required sample size was achieved.

**Data Collection Tools & Procedure:** Data were collected using a predesigned, semi-structured case record form. Upon admission, detailed clinical history, physical examination findings, and laboratory parameters were recorded. Radiological assessment included ultrasonography and contrast-enhanced computed tomography (CECT) to determine the severity and complications of pancreatitis. Patients

were categorized into two groups: those undergoing early surgical intervention (within 14 days of symptom onset) and those managed conservatively or with delayed intervention. Surgical procedures included open necrosectomy, drainage procedures, or other indicated interventions. Patients were followed throughout their hospital stay to document outcomes including complications, duration of hospitalization, and mortality.

**Study Variables:** The independent variable was the timing of surgical intervention (early vs delayed/conservative). Other covariates included age, sex, etiology of pancreatitis, severity (based on clinical and radiological criteria), and presence of comorbidities. The dependent variables included clinical outcomes such as morbidity (postoperative complications, infection, organ failure), mortality, and length of hospital stay.

**Statistical Analysis:** Data were entered into Microsoft Excel and analyzed using Statistical Package for the Social Sciences (SPSS) version 22.0. Continuous variables were expressed as mean  $\pm$  standard deviation, while categorical variables were presented as frequencies and percentages. The Chi-square test or Fisher's exact test was used for comparison of categorical variables. Independent t-test or Mann-Whitney U test was applied for continuous variables, depending on data distribution. A p-value of less than 0.05 was considered statistically significant.

**Ethical Considerations:** Written informed consent was obtained from all participants prior to enrollment. The study adhered to the ethical principles outlined in the Declaration of Helsinki. Confidentiality of patient information was strictly maintained, and data were used solely for research purposes.

## RESULTS

A total of 126 patients with acute pancreatitis complications were included, of whom 58 underwent early surgical intervention and 68 were managed conservatively or with delayed procedures. The baseline demographic and etiological profiles were comparable between the two groups (Table 1)

**Table 1: Baseline Demographic and Clinical Characteristics of Study Participants (N = 126)**

| Variable                   | Early Surgery Group (n = 58) | Delayed/Conservative Group (n = 68) | Total (N = 126) |
|----------------------------|------------------------------|-------------------------------------|-----------------|
| Age (years), mean $\pm$ SD | 44.8 $\pm$ 12.6              | 46.3 $\pm$ 13.1                     | 45.6 $\pm$ 12.8 |
| Male, n (%)                | 38 (65.5)                    | 42 (61.8)                           | 80 (63.5)       |
| Female, n (%)              | 20 (34.5)                    | 26 (38.2)                           | 46 (36.5)       |
| Biliary etiology, n (%)    | 30 (51.7)                    | 36 (52.9)                           | 66 (52.4)       |
| Alcohol-related, n (%)     | 20 (34.5)                    | 22 (32.4)                           | 42 (33.3)       |
| Others, n (%)              | 8 (13.8)                     | 10 (14.7)                           | 18 (14.3)       |

Pancreatic necrosis was the most common complication observed, followed by infected necrosis and pseudocyst formation, with similar distribution across both groups (Table 2)

**Table 2: Distribution of Complications of Acute Pancreatitis**

| Complication        | Early Surgery (n = 58) | Delayed/Conservative (n = 68) | Total (N = 126) |
|---------------------|------------------------|-------------------------------|-----------------|
| Pancreatic necrosis | 34 (58.6)              | 36 (52.9)                     | 70 (55.6)       |
| Infected necrosis   | 20 (34.5)              | 18 (26.5)                     | 38 (30.2)       |
| Pseudocyst          | 14 (24.1)              | 22 (32.4)                     | 36 (28.6)       |
| Pancreatic abscess  | 10 (17.2)              | 12 (17.6)                     | 22 (17.5)       |
| Organ failure       | 16 (27.6)              | 14 (20.6)                     | 30 (23.8)       |

Patients undergoing early surgery had a significantly higher rate of postoperative complications compared to the delayed/conservative group (37.9% vs 23.5%,  $p = 0.048$ ). Although rates of sepsis, persistent organ failure, and mortality were higher in the early surgery group, these differences did not reach statistical significance (Table 3)

**Table 3: Clinical Outcomes in Study Groups**

| Outcome                             | Early Surgery (n = 58) | Delayed/Conservative (n = 68) | p-value |
|-------------------------------------|------------------------|-------------------------------|---------|
| Postoperative complications, n (%)  | 22 (37.9)              | 16 (23.5)                     | 0.048   |
| Infection/sepsis, n (%)             | 18 (31.0)              | 14 (20.6)                     | 0.162   |
| Organ failure (persistent), n (%)   | 12 (20.7)              | 10 (14.7)                     | 0.378   |
| Mortality, n (%)                    | 10 (17.2)              | 6 (8.8)                       | 0.142   |
| Hospital stay (days), mean $\pm$ SD | 18.6 $\pm$ 6.2         | 22.4 $\pm$ 7.1                | 0.003   |

However, the duration of hospital stay was significantly shorter in the early surgery group (mean 18.6 days vs 22.4 days,  $p = 0.003$ ). Analysis of timing revealed that interventions performed within the first 7 days were associated with a higher proportion of severe outcomes compared to later interventions ( $p = 0.041$ ) (Table 4)

**Table 4: Timing of Intervention and Outcome Severity**

| Timing of Surgery       | Number of Patients (n) | Severe Outcome*, n (%) | p-value |
|-------------------------|------------------------|------------------------|---------|
| $\leq 7$ days           | 22                     | 12 (54.5)              |         |
| 8–14 days               | 36                     | 14 (38.9)              | 0.041   |
| >14 days / Conservative | 68                     | 18 (26.5)              |         |

\*Severe outcome defined as presence of persistent organ failure and/or death

Etiological analysis demonstrated that patients with non-biliary causes had relatively higher rates of severe outcomes and mortality compared to biliary pancreatitis (Table 5)

**Table 5: Association of Etiology with Outcomes**

| Etiology        | Total (n) | Severe Outcome*, n (%) | Mortality, n (%) |
|-----------------|-----------|------------------------|------------------|
| Biliary         | 66        | 18 (27.3)              | 6 (9.1)          |
| Alcohol-related | 42        | 16 (38.1)              | 6 (14.3)         |
| Others          | 18        | 8 (44.4)               | 4 (22.2)         |

\*Severe outcome defined as presence of persistent organ failure and/or death

## DISCUSSION

The present study evaluated the role of early surgical intervention in patients with complications of acute pancreatitis in a tertiary care setting in North India. The findings suggest that while early surgery may reduce the duration of hospital stay, it is associated with a higher rate of postoperative complications and a trend toward increased morbidity and mortality, although not statistically significant. Additionally, interventions performed within the first week of disease onset were associated with significantly worse outcomes compared to those performed later or managed conservatively.

The observed higher complication rate in the early surgery group aligns with earlier evidence that premature operative intervention in acute pancreatitis, particularly in the phase of unorganized necrosis, can exacerbate systemic inflammation and increase procedural risks. Mier et al.

demonstrated that early necrosectomy was associated with increased mortality compared to delayed intervention, supporting the concept of postponing surgery until necrosis becomes well demarcated [5]. Similarly, current international guidelines recommend delaying surgical intervention for at least 3–4 weeks whenever feasible, to allow for encapsulation of necrotic tissue and improved patient stability [6].

In the present study, although mortality was higher in the early surgery group (17.2% vs 8.8%), the difference did not achieve statistical significance. This may be attributed to the relatively modest sample size and the heterogeneity of clinical presentations. Comparable findings have been reported by Petrov and Windsor, who noted that early intervention does not necessarily confer survival benefit and may, in fact, increase operative risk in the absence of clear indications such as infected necrosis or abdominal compartment syndrome [10]. The lack of statistical significance in mortality differences in our study underscores the complexity of decision-making and the influence of multiple confounding factors, including disease severity and comorbidities.

A notable finding of this study is the significantly shorter hospital stay in patients undergoing early surgery. This observation may reflect the fact that early definitive intervention in selected patients—particularly those with infected collections or refractory symptoms—can expedite clinical resolution and reduce prolonged conservative management. However, this potential benefit must be carefully weighed against the increased risk of complications, as highlighted in our results. Similar observations have been reported in studies evaluating step-up approaches, where early minimally invasive interventions such as percutaneous drainage have been shown to reduce hospital stay without the risks associated with open surgery [7].

The timing analysis further reinforces the importance of delaying surgical intervention when possible. Patients operated within 7 days of symptom onset had the highest proportion of severe outcomes, which decreased progressively with delayed intervention. This finding is consistent with the pathophysiological understanding that early-phase pancreatitis is characterized by intense inflammatory response and poorly demarcated necrosis, making surgical dissection technically challenging and hazardous [3]. Delayed intervention allows for better localization of necrotic tissue, facilitating safer and more effective debridement. Etiological analysis in the current study revealed that non-biliary causes, particularly alcohol-related and other etiologies, were associated with higher rates of severe outcomes and mortality. This is in agreement with regional studies from North India, which have reported more severe disease courses in alcohol-induced pancreatitis compared to biliary cases [9]. Possible explanations include delayed healthcare seeking behavior, recurrent pancreatic injury, and associated nutritional deficiencies in patients with alcohol use disorder.

From a clinical perspective, the findings of this study support a cautious and individualized approach to the timing of surgical intervention in acute pancreatitis. Early surgery should be reserved for specific indications such as infected necrosis with sepsis, abdominal compartment syndrome, or failure of conservative and minimally invasive measures. The results also highlight the need for strengthening minimally invasive capabilities in tertiary care centers, which may offer a safer alternative to early open surgery.

The strengths of this study include its prospective design, standardized data collection, and focus on a clinically relevant question in a real-world setting. However, several limitations must be acknowledged. The study was conducted at a single center with a relatively small sample size, which may limit generalizability. Additionally, the lack of stratification based on severity scores (e.g., APACHE II, BISAP) and absence of long-term follow-up data may have influenced outcome assessment. Potential selection bias in allocating patients to early surgery versus conservative management cannot be entirely excluded.

The study adds to the growing body of evidence suggesting that early surgical intervention in acute pancreatitis complications is associated with increased morbidity and should be undertaken selectively. Further multicentric studies with larger sample sizes and incorporation of minimally invasive strategies are warranted to refine guidelines for optimal timing and modality of intervention.

## CONCLUSION

The present study demonstrates that early surgical intervention in acute pancreatitis complications is associated with a higher incidence of postoperative morbidity and a trend toward increased mortality, although not statistically significant. Interventions performed within the first week of disease onset were particularly linked to poorer outcomes, emphasizing the risks of operating during the early inflammatory phase. However, early surgery was associated with a significantly shorter duration of hospital stay, suggesting a potential benefit in carefully selected cases. These findings support the current paradigm of delaying surgical intervention whenever feasible, allowing for better demarcation of necrosis and improved patient stability. Early surgery should be reserved for specific clinical indications such as infected necrosis with sepsis, abdominal compartment syndrome, or failure of conservative and minimally invasive management. Strengthening access to minimally invasive techniques may further optimize outcomes. Future multicentric studies with larger sample sizes and standardized severity assessment are recommended to refine decision-making regarding the timing of surgical intervention.

## DECLARATIONS

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**Conflict of Interest:** The authors declare no conflict of interest.

**Consent:** Written informed consent was obtained from all participants.

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