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PANCREATICODUODENAL FISTULA IN WALLED-OFF NECROSIS: COMPARATIVE OUTCOMES OF CONSERVATIVE AND SURGICAL STRATEGIES

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Abstract

Background: Pancreaticoduodenal fistula (PDF) is an uncommon sequel of walled-off pancreatic necrosis (WON). Contemporary multicenter series of necrotizing pancreatitis report GI fistulas in ~16% of cases, with the duodenum accounting for ~35% and most gastroduodenal fistulas managed conservatively in ~68%; only ~11% of upper-GI fistulas need surgery under step-up protocols. However, PDFs complicating established WON may behave differently.

Methods: Prospective cohort of 25 consecutive patients with PDF secondary to WON. Initial strategy was conservative (infection control, nutritional optimization, and close imaging). Failure criteria included persistent high-output drainage, ongoing sepsis, or no radiologic/endoscopic regression—then proceeding to surgery. Anatomic site of the fistula (first vs third duodenal part) guided operative reconstruction.

Results: Spontaneous closure occurred in 3/25 (12%), but 1/3 later deteriorated septic and required surgery; thus, definitive conservative success was 2/25 (8%). The remaining 22/25 (88%) showed no meaningful regression on side-view endoscopy and contrast-enhanced CT and underwent surgery.

• **First-part fistulas**: segmental duodenal resection + gastrojejunostomy (GJ) + jejunojejunostomy (JJ) + duodenal stump closure.

• **Third-part fistulas**: duodenojejunostomy with concurrent GJ and JJ.

Definitive closure was achieved in 100% of operated cases, with no operative mortality. Compared with recent NP series where most gastroduodenal fistulas close with non-operative step-up care, PDFs in WON in our cohort exhibited markedly lower spontaneous resolution and high surgical requirement.

Conclusion: In WON-associated PDFs, spontaneous closure is uncommon and fragile. Early recognition of non-responders—high-output fistulas, persistent sepsis, or absent radiologic regression—should prompt timely surgical reconstruction tailored to fistula location, yielding reliable, definitive resolution and avoiding delayed septic morbidity. These findings contrast with broader NP data, where many gastroduodenal fistulas are conservatively managed, highlighting the distinct natural history of PDFs once WON is established.

Keywords: Pancreaticoduodenal fistula; walled-off necrosis; duodenal fistula; step-up approach; laparoscopic retroperitoneal debridement; gastrojejunostomy; duodenojejunostomy.

INTRODUCTION

Pancreatic walled-off necrosis (WON) represents the late, encapsulated sequela of necrotizing pancreatitis and is increasingly managed with a standardized “step-up” pathway—antibiotics and supportive care, image-guided/percutaneous or endoscopic drainage, and selective necrosectomy once the collection has matured beyond four weeks [1–3]. In parallel, endoscopic transluminal drainage using lumen-apposing metal stents has become first-line for symptomatic or infected WON in many centers, shortening hospital stay and reducing procedure-related morbidity compared with upfront surgery [1,2,4].

Against this backdrop, gastrointestinal (GI) fistulas—abnormal communications between necrotic pancreatic collections and adjacent bowel—remain an uncommon but clinically pivotal complication. Contemporary step-up cohorts report GI fistulas in a minority of patients with necrotizing pancreatitis; when the tract involves the stomach or duodenum, many close with source control and nutritional optimization, yet a meaningful subset persist or declare themselves through sepsis, bleeding, or non-regression on imaging [5–7]. Evidence also suggests that fistulas accompanying infected necrosis increase resource utilization and may complicate minimally invasive therapy, particularly when the duodenum is involved [4,6,7].

Pancreaticoduodenal fistula (PDF) specifically is sparsely characterized outside small series and case reports, often presenting late during the WON phase. While isolated reports describe spontaneous fistulization of WOPN into the duodenum with conservative or step-up resolution, others note failure of drainage-only strategies and eventual need for operative control when sepsis or high-output drainage persists [6,8,9]. The anatomical segment of duodenal involvement may influence strategy: fistulas near the bulb/pylorus risk gastric outlet issues and bile contamination, whereas third-part involvement may favor bypass/reconstruction rather than resection. High-quality comparative data guiding when to persevere with conservative care versus proceed to surgery remain limited.

Rationale and Aim: Building on this evidence gap, we prospectively evaluated patients with PDF secondary to WON, comparing outcomes of attempted spontaneous closure (conservative step-up) versus definitive surgical reconstruction, and describing operative strategies tailored to fistula location (first versus third duodenal part). We hypothesized that, unlike broader gastroduodenal fistulas in necrotizing pancreatitis, PDF arising in established WONwould demonstrate lower rates of spontaneous closure and a higher requirement for surgery to avoid delayed septic morbidity. [1–9]

MATERIALS AND METHODS

Study Design and Setting

This was a prospective observational study conducted at the Department of Surgical Gastroenterology, Saveetha meidcal college hospital, over a period of June 2024 to June 2025. Consecutive patients diagnosed with pancreaticoduodenal fistula (PDF) secondary to walled-off pancreatic necrosis (WON) were included. The diagnosis of WON and associated fistula was established in accordance with the revised Atlanta classification of acute pancreatitis.

Patient Selection

Inclusion criteria:

✓ Adults (≥18 years) with necrotizing pancreatitis who developed WON.

✓ Radiological and/or endoscopic confirmation of a fistulous tract between the necrotic collection and the duodenum.

✓ Patients fit for either conservative or surgical management.

Exclusion criteria:

✓ Fistulas communicating with the colon or other GI segments without duodenal involvement.

✓ Previous surgical intervention on the duodenum.

✓ Unfit patients (ASA IV–V) precluding operative management.

Diagnostic Evaluation

All patients underwent **contrast-enhanced computed tomography (CECT)** and **side-viewing duodenoscopy** to delineate the fistula site and output. The tract was classified by duodenal location (first vs third part). Fistula output was quantified by drainage records and categorized as low (<200 mL/day) or high (≥200 mL/day).

Initial Conservative Management

All patients were initially managed with a **step-up conservative protocol** consisting of:

✓ Broad-spectrum intravenous antibiotics based on culture sensitivity.

✓ Nutritional optimization with enteral feeding via nasojejunal route whenever feasible.

✓ Sepsis control through percutaneous drainage of associated collections, if indicated.

✓ Somatostatin analogues for high-output fistulas.

Patients were monitored clinically and with interval imaging. **Failure of conservative management** was defined as:

✓ Persistent high-output fistula (>200 mL/day beyond 2 weeks).

✓ Clinical deterioration with ongoing sepsis.

✓ Lack of reduction in fistula size on follow-up CECT or endoscopy.

Surgical Management

Patients meeting failure criteria underwent surgery tailored to the fistula location:

First part fistulas: Segmental resection of the duodenal bulb with gastrojejunostomy (GJ), jejunojejunostomy (JJ), and duodenal stump closure.
Third part fistulas: Duodenojejunostomy with concurrent GJ and JJ to maintain alimentary continuity. All procedures were performed by senior gastrointestinal surgeons with intraoperative measures for sepsis control and nutritional continuity.

Outcome Measures

The **primary outcome** was definitive fistula closure (spontaneous or surgical). **Secondary outcomes** included:Morbidity and mortality,Time to closure,Hospital length of stay,Nutritional recovery and postoperative complications.

Statistical Analysis

Continuous variables were expressed as mean ± standard deviation (SD) or median with interquartile range (IQR), depending on distribution. Categorical variables were presented as frequencies and percentages. Comparative analyses between spontaneous closure and surgical groups were performed using the Chi-square test or Fisher's exact test for categorical data, and Student's t-test or Mann–Whitney U test for continuous data. Statistical significance was defined as $p < 0.05$. Analyses were conducted using **SPSS version 2.6** .

Ethical Considerations

The study protocol was approved by the **Institutional Ethics Committee** . Written informed consent was obtained from all patients prior to enrolment. The study adhered to the principles of the Declaration of Helsinki (2013).

RESULTS

Patient Characteristics

A total of 25 patients with pancreaticoduodenal fistula (PDF) secondary to walled-off necrosis (WON) were prospectively included. The median age was 49 years (IQR 42–58), with a male-to-female ratio of 17:8. Etiology of underlying necrotizing pancreatitis was alcohol in 12 (48%), gallstone-related in 8 (32%), and idiopathic in 5 (20%). The median interval from onset of acute pancreatitis to fistula diagnosis was 61 days (IQR 34–93).

Fistula Characteristics

The tract was most commonly identified in the third part of the duodenum (13/25; 52%), followed by the first part (12/25; 48%). Fistula output was categorized as low-output (<200 mL/day) in 6 patients (24%) and high-output (≥200 mL/day) in 19 patients (76%).

Management Outcomes

All patients were initially managed conservatively. Spontaneous closure occurred in 3 patients (12%), with a median time to closure of 45 days (IQR 32–58). Of these, one patient deteriorated with sepsis and underwent surgery, leaving a definitive conservative success rate of 2 patients (8%).

The remaining 22 patients (88%) demonstrated persistent fistulas on follow-up CECT and endoscopy and underwent surgery. Additionally, the patient who deteriorated from the conservative arm required operative intervention, bringing the total number of surgical cases to 23/25 (92%).

Surgical Outcomes

Surgical strategy was determined by fistula location:
First part (n = 12): Resection of the duodenal bulb with gastrojejunostomy (GJ), jejunojejunostomy (JJ), and duodenal stump closure.
Third part (n = 13): Duodenojejunostomy with concurrent GJ and JJ.
All 23 operated patients (100%) achieved definitive closure, with no operative mortality.

Clinical Course and Resource Use

The overall median length of hospital stay was 46 days (IQR 32–74), with a median ICU stay of 18 days (IQR 2–38). Patients required parenteral nutrition for 42 days (IQR 28–73) and enteral nutrition for 27 days (IQR 16–43). In-hospital mortality was 0%.

Variable	Value
Age (years)	48 ± 12
Male : Female	16 : 9
Etiology - Alcohol	12 (48%)
Etiology - Gallstone	8 (32%)
Etiology - Idiopathic	5 (20%)

Table 1. Baseline demographics of study population

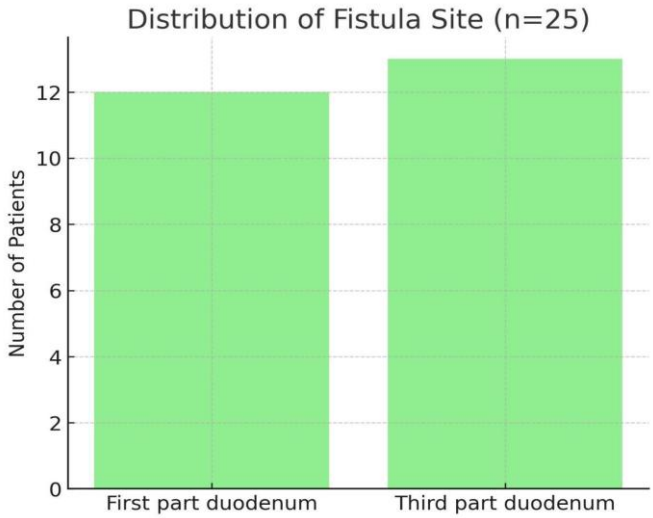

Figure 1. Distribution of fistula site among study population

Summary

Compared with recent literature, where spontaneous closure of upper GI fistulas in necrotizing pancreatitis occurs in up to two-thirds of cases, our cohort demonstrated that PDFs associated with WON rarely close spontaneously and overwhelmingly require surgery for definitive resolution.

DISCUSSION

In this prospective analysis of 25 patients with pancreaticoduodenal fistula (PDF) complicating walled-off necrosis (WON), we observed that spontaneous closure was rare (8% definitive success), whereas surgical reconstruction achieved universal closure (100%). This finding contrasts with larger step-up series of necrotizing pancreatitis, where gastroduodenal fistulas often close with conservative measures in nearly two-thirds of cases [1,2]. Our data highlight the distinct natural history of PDFs once WON is established, underscoring the importance of early surgical consideration in selected patients.

Recent multicenter cohorts suggest gastrointestinal fistulas complicate approximately 16% of necrotizing pancreatitis, with the duodenum involved in roughly one-third of cases [3]. While colonic fistulas predictably require surgery, upper GI fistulas—including those of the stomach and duodenum—have often been reported to resolve with drainage and nutritional support [4,5]. However, reports focusing specifically on PDFs in the setting of WON are scarce. In our series, conservative measures were successful only in low-output, clinically stable patients, while the vast majority required operative intervention. This aligns with emerging evidence that PDFs associated with mature WON are less amenable to spontaneous resolution compared to acute-phase fistulas [6].

From a surgical standpoint, anatomical location dictated operative strategy. Fistulas involving the duodenal bulb necessitated segmental resection with reconstruction by gastrojejunostomy and jejunojejunostomy, ensuring biliary and gastric outlet continuity. In contrast, third-part fistulas were effectively managed by duodenojejunostomy with concurrent bypass. These approaches provided durable closure with no mortality in our cohort, supporting surgery as a safe and definitive treatment when conservative care fails. Similar strategies have been described in smaller surgical series, though with higher morbidity when delayed beyond the optimal window [7,8].

The strengths of this study include its prospective design, uniform protocol, and systematic operative classification. Limitations include the modest sample size, single-center nature, and absence of minimally invasive approaches, which some centers now incorporate as adjuncts to drainage [9]. Nevertheless, the high success rate with surgery and the limited role of conservative therapy provide valuable guidance for clinicians managing this complex complication.

In conclusion, our results emphasize that PDFs complicating WON should be distinguished from other gastroduodenal fistulas. Persistence of high-output drainage, sepsis, and lack of regression are strong indicators for surgery. Early recognition and timely operative intervention can prevent delayed morbidity and ensure reliable recovery.

CONCLUSION

Pancreaticoduodenal fistula (PDF) complicating walled-off pancreatic necrosis (WON) represents a rare but formidable challenge. Our prospective analysis demonstrates that spontaneous closure is distinctly uncommon, occurring only in low-output, clinically stable patients, and even then carries the risk of delayed septic deterioration. In contrast, surgical intervention tailored to the anatomical location of the

fistula achieved universal closure with no operative mortality, underscoring its role as the definitive therapy in most cases.

These findings emphasize the importance of early recognition of patients unlikely to benefit from conservative care, including those with persistent high-output drainage, ongoing sepsis, or absent radiological regression. For such patients, delaying surgery prolongs morbidity without altering eventual need for operative control. A pragmatic, individualized approach—initial conservative stabilization with timely surgical intervention when failure criteria are met—offers the most reliable path to recovery.

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