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CASE REPORTS

High-Flow Nasal Oxygen for ARDS Secondary to Postoperative Pancreatic Fistula After Pancreaticoduodenectomy: A Case Report.

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ABSTRACT

Background: Postoperative pancreatic fistula (POPF) remains one of the most serious complications following pancreaticoduodenectomy and may lead to sepsis, respiratory failure, and acute respiratory distress syndrome (ARDS). Respiratory management in these patients is particularly challenging because positive-pressure ventilation may increase the risk of gastrointestinal anastomotic disruption and worsen postoperative outcomes.
Case Presentation: This report describes a case of moderate ARDS due to POPF in a 68-year-old female following a Whipple procedure for pancreatic head adenocarcinoma. The patient developed progressively worsening hypoxemia, respiratory distress, tachypnea, and hemodynamic instability. Computed tomography revealed bilateral pulmonary infiltrates consistent with ARDS, gastric distention, and intra-abdominal inflammatory changes (due to the presence of POPF). Markedly elevated amylase and lipase levels from drains confirmed the diagnosis of POPF.
Results: Because of the recent gastrointestinal reconstruction and the potential for anastomotic compromise, both continuous positive airway pressure and non-invasive ventilation were not used for this patient. Conservative care included high-flow nasal oxygen (HFNO), broad-spectrum IV antibiotics, gastric decompression, nutritional support, and multidisciplinary care in the intensive care unit. The patient demonstrated continued improvement in respiratory and clinical status without the need for reintubation and or invasive mechanical ventilation. HFNO was progressively weaned; enteral nutrition was reinitiated successfully; and the patient was discharged from the hospital in a clinically stable condition.
Conclusions: This case illustrates that HFNO has the potential to be an effective method of providing respiratory support for ARDS due to POPF after a Whipple procedure, particularly in the patient population at risk of postoperative anastomotic complications from positive-pressure ventilation.
Keywords: ARDS; postoperative pancreatic fistula; Whipple procedure; high-flow nasal oxygen;

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INTRODUCTION

Pancreaticoduodenectomy (Whipple procedure) remains the standard surgical treatment for removable pancreatic head malignancies. Despite advances in surgical techniques, anesthesia, and perioperative critical care, postoperative morbidity remains high, with complication rates reported between 30% and 60%. (1) Among these complications, postoperative pancreatic fistula (POPF) is one of the most clinically significant and may result in intra-abdominal sepsis, hemorrhage, prolonged hospitalization, multiorgan dysfunction, and mortality. (2)

Severe inflammatory response caused by POPF can precipitate acute respiratory distress syndrome (ARDS), a life-threatening condition characterized by diffuse inflammatory lung injury and refractory. (3) Respiratory management in patients who recently underwent upper gastrointestinal surgery is particularly challenging because positive-pressure ventilation may increase intragastric pressure and compromise gastrointestinal anastomoses. (4)

High-flow nasal oxygen (HFNO) has emerged as an alternative respiratory support modality capable of improving oxygenation while avoiding excessive positive airway pressures. (5)

We present a case of successful conservative multidisciplinary management of moderate ARDS secondary to postoperative pancreatic fistula following pancreaticoduodenectomy.

Case Report

A 68-year-old woman with a medical history of hypertension and type 2 diabetes mellitus was evaluated for obstructive jaundice and epigastric discomfort. Diagnostic investigations revealed pancreatic head adenocarcinoma without evidence of vascular invasion or distant metastases. Preoperative assessment classified the patient as ASA II–III with Mallampati II airway status. Laboratory findings showed mild hyperbilirubinemia and mildly elevated liver enzymes, while cardiac evaluation demonstrated preserved left ventricular function with an ejection fraction of 65%.

The patient underwent elective pancreaticoduodenectomy under combined general anesthesia and thoracic epidural anesthesia. General anesthesia was induced with propofol, fentanyl, and rocuronium, while maintenance was achieved using total intravenous anesthesia with propofol and remifentanil. Thoracic epidural analgesia was administered through a catheter placed at the T7–T8 level.

The surgical procedure lasted approximately 12 hours. Estimated blood loss was approximately 1000 mL, requiring transfusion of packed red blood cells, fresh frozen plasma, platelet concentrate, fibrinogen, and prothrombin complex concentrate. Hemodynamic support with low-dose norepinephrine infusion was necessary during surgery. Invasive arterial and central venous monitoring were used throughout the procedure.

Postoperatively, the patient was transferred intubated to the intensive care unit and was successfully extubated after 12 hours. The early postoperative course was favorable, with stable hemodynamics, adequate urine output, preserved neurological status, and gradual vasopressor weaning. After three days in the ICU, the patient was transferred to the surgical ward. On postoperative days 8–9, contrast imaging excluded anastomotic leakage, and oral nutrition was initiated.

On postoperative day 13, the patient developed fever, progressive desaturation, hypotension, and increased fluid requirements. Initial evaluation suggested pneumonia, and broad-spectrum antibiotic therapy was initiated. However, clinical deterioration continued over the next several days, with worsening respiratory distress and hypoxemia requiring ICU readmission.

Thoracoabdominal computed tomography demonstrated bilateral pulmonary infiltrates compatible with ARDS, gastric distension, and intra-abdominal inflammatory changes. Oxygen saturation remained approximately 88% despite oxygen mask therapy at 15 L/min. HFNO therapy was therefore initiated with FiO2 of 80% and flow of 70 L/min.

CPAP and NIV were considered but avoided because of the recent gastrointestinal anastomoses, severe gastric distension, and concern regarding anastomotic disruption from positive-pressure insufflation. Reinsertion of a nasogastric tube drained approximately 800 mL of hemorrhagic and static gastric content.

Laboratory evaluation revealed hemoglobin of 7 g/dL, elevated inflammatory markers, elevated liver enzymes, and markedly increased drain amylase and lipase levels (45,000 U/L and 36,000 U/L, respectively), confirming postoperative pancreatic fistula. Arterial blood gas analysis showed a PaO2/FiO2 ratio of approximately 110, consistent with moderate ARDS.

A multidisciplinary conservative management strategy was adopted, including HFNO respiratory support, broad-spectrum antibiotics, hemodynamic stabilization, parenteral nutrition, suspension of enteral feeding, electrolyte correction, albumin supplementation, venous thromboembolism prophylaxis, serial thoracic imaging, and repeated abdominal ultrasound monitoring. Surgeons elected conservative fistula management with expectation of spontaneous maturation and reduction of fistula output.

Gradual respiratory improvement occurred over the following two weeks, with progressive reduction in oxygen requirements and stabilization of hemodynamic status. Enteral feeding was cautiously restarted after 10 days. Two weeks after ICU readmission, HFNO was discontinued and replaced with low-flow nasal cannula oxygen therapy. The patient later achieved full enteral

nutrition and was transferred back to the surgical ward in stable condition.

The patient was discharged home one week later with an abdominal drain in place. Drain output progressively decreased, and the drain was successfully removed one month after discharge.

DISCUSSION

Pancreaticoduodenectomy continues to be associated with significant postoperative morbidity despite advances in surgical techniques, perioperative anesthesia, and intensive care management. (1) Among postoperative complications, POPF remains one of the most clinically relevant because it may lead to intra-abdominal infection, hemorrhage, prolonged hospitalization, multiorgan dysfunction, and increased mortality. (2) In severe cases, the intense inflammatory response associated with POPF may precipitate systemic inflammatory response syndrome and ARDS (2,3).

In the present case, postoperative deterioration initially mimicked nosocomial pneumonia, a common complication after major abdominal surgery. However, the persistence of hemodynamic instability, progressive respiratory failure, elevated inflammatory markers, and markedly increased drain amylase and lipase levels ultimately confirmed clinically significant POPF with secondary systemic inflammatory response. This highlights the diagnostic difficulty of distinguishing pulmonary infection from intra-abdominal septic complications in the postoperative period, particularly when respiratory manifestations dominate the clinical presentation.

ARDS following abdominal surgery is multifactorial and may involve sepsis-associated endothelial injury, cytokine-mediated inflammatory activation, increased pulmonary vascular permeability, and fluid redistribution. (3)

The patient fulfilled Berlin criteria for moderate ARDS with a PaO2/FiO2 ratio of approximately 110 (6). In addition to the inflammatory burden associated with pancreatic fistula, prolonged surgery, perioperative transfusion requirements, fluid shifts, and postoperative sepsis may also have contributed to the development of respiratory failure.

Previous studies evaluating respiratory failure after pancreatic surgery have primarily focused on invasive mechanical ventilation or conventional non-invasive respiratory support [4,8]. Published literature regarding the use of HFNO specifically in ARDS secondary to POPF after pancreaticoduodenectomy remains limited. Most reported cases of severe postoperative respiratory failure following pancreatic surgery involve escalation to invasive ventilation because of refractory hypoxemia or septic shock. In contrast, the present case demonstrates that carefully selected patients may be successfully managed using HFNO while avoiding both NIV and intubation.

One of the most important challenges in this case involved the selection of respiratory support. Although CPAP and NIV are frequently used to improve oxygenation in acute hypoxemic respiratory failure, their application after upper gastrointestinal surgery remains controversial because positive airway pressure may increase intragastric pressure and potentially compromise fresh gastrointestinal anastomoses (4). In this patient, significant gastric distension further increased concern regarding anastomotic tension and possible dehiscence. Avoidance of positive-pressure ventilation therefore became a critical component of management strategy.

HFNO represented an effective alternative respiratory support modality in this setting. HFNO provides several physiological benefits, including delivery of stable high FiO2, reduction of anatomical dead space, improved secretion clearance, humidification of inspired gases, and generation of low-level positive airway pressure while remaining substantially less invasive than NIV (5,7). Importantly, HFNO was well tolerated and provided sufficient oxygenation support to avoid escalation toward invasive mechanical ventilation.

The favorable outcome observed in this case is consistent with growing evidence supporting HFNO in acute hypoxemic respiratory failure (5,7). However, unlike most studies that evaluate heterogeneous ICU populations, this report specifically highlights the potential role of HFNO in a postoperative pancreatic surgery patient with significant concern for anastomotic complications. This distinction is clinically important because respiratory support decisions in such patients must balance oxygenation goals against the risk of disrupting recent gastrointestinal reconstruction.

Avoiding reintubation was another major therapeutic objective. Invasive mechanical ventilation in postoperative abdominal sepsis is associated with increased morbidity, prolonged ICU stay, ventilator-associated complications, and higher mortality (8). Furthermore, reintubation after pancreatic surgery may complicate hemodynamic management and delay recovery. The successful avoidance of both NIV and invasive ventilation in this patient therefore represents a clinically meaningful outcome.

Nutritional management also played an important role in recovery. Temporary cessation of enteral feeding allowed pancreatic rest and reduction of fistula output, while parenteral nutrition maintained adequate caloric intake during the acute inflammatory phase (9). Careful nutritional optimization likely contributed to both fistula stabilization and respiratory recovery.

Another important aspect of this case was the multidisciplinary approach involving intensivists, anesthesiologists, surgeons, pulmonologists, and nutrition specialists. Successful conservative

management required continuous reassessment of respiratory status, hemodynamic stability, nutritional needs, and fistula progression. Early ICU readmission and prompt recognition of POPF were essential for timely intervention and prevention of further deterioration.

The novelty of this case lies in the successful use of HFNO as the primary respiratory support strategy for moderate ARDS secondary to POPF after pancreaticoduodenectomy, allowing complete avoidance of both NIV and invasive mechanical ventilation in a patient at particularly high risk for anastomotic complications. Reports specifically describing HFNO as the main respiratory modality in this highly complex postoperative setting remain scarce. This case therefore supports consideration of HFNO as a valuable and less invasive alternative in selected postoperative patients where positive-pressure ventilation may carry substantial surgical risk.

CONCLUSION

This case demonstrates that moderate ARDS secondary to postoperative pancreatic fistula after pancreaticoduodenectomy can be successfully managed using a multidisciplinary conservative approach. HFNO represented an effective respiratory support strategy in a patient in whom positive-pressure ventilation carried substantial risk for gastrointestinal anastomotic complications.

Early ICU reassessment, prompt diagnosis of POPF, individualized respiratory management, nutritional optimization, and coordinated surgical and critical care treatment contributed to a favorable clinical outcome. This case highlights the importance of balancing respiratory support requirements with protection of recent gastrointestinal anastomoses in complex postoperative patients.

Editorial Statements

Ethics Approval and Consent to Participate
This study involved the analysis of data from human participants. The research protocol was reviewed and approved by the Institutional Ethics Committee and was conducted in accordance with institutional regulations, the principles of the Declaration of Helsinki, and internationally accepted standards for biomedical research ethics.

Data Availability Statement
The datasets generated and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Author Contributions (CRediT): Conceptualization & Methodology: BA; Data Curation, Investigation and Writing – Original Draft: BA, AC: Formal Analysis: AC: Writing – Review & Editing: AC: Supervision: BA. Both authors have read and approved the final version of the manuscript.

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