

CASE REPORT

Anesthetic Management Of Boerhaave Syndrome: Perioperative Ventilatory And Hemodynamic Concerns – A Case Report

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ABSTRACT

Background: Boerhaave syndrome is a spontaneous transmural rupture of the esophagus commonly associated with forceful vomiting or increased intraluminal pressure. Rapid mediastinal contamination and sepsis make it a life-threatening emergency requiring timely diagnosis and surgical repair. Anesthetic management poses significant challenges due to aspiration risk, hemodynamic instability, and the need for one-lung ventilation during thoracotomy. Maintaining oxygenation, preventing contamination of the healthy lung, and stabilizing cardiovascular parameters remain central goals.

Case Presentation: A 42-year-old male presented with sudden-onset severe retrosternal chest pain, persistent cough with mucoid expectoration, and hypotension following multiple vomiting episodes. Clinical examination showed tachycardia and diminished air entry over the left hemithorax. CT thorax revealed a left-sided spontaneous esophageal rupture with pneumomediastinum and pleural contamination, confirming Boerhaave syndrome. After resuscitation and initiation of vasopressor infusion, invasive arterial and central venous lines were established. Rapid-sequence induction was performed with thiopentone and atracurium, followed by the placement of a 37F left-sided double-lumen tube to facilitate one-lung ventilation. Pressure-controlled ventilation with low tidal volumes and PEEP was employed to reduce barotrauma and maintain oxygenation. Hemodynamic stability was achieved with titrated noradrenaline and guided fluid therapy throughout emergency thoracotomy and surgical repair. Postoperatively, the airway was converted to a single-lumen tube, and the patient underwent elective ventilatory support in the ICU for 72 hours before successful weaning and extubation. Prompt diagnosis, urgent surgical intervention, lung-protective ventilation strategies, and vigilant hemodynamic optimization are essential for improved survival and favorable outcomes in Boerhaave syndrome.

Keywords: Boerhaave syndrome; Esophageal perforation; Emergency thoracotomy; One-lung ventilation; Aspiration prevention; Hemodynamic stabilization; Perioperative anesthesia

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INTRODUCTION

Boerhaave syndrome is a rare but catastrophic clinical entity characterized by spontaneous, full-thickness rupture of the esophageal wall, most frequently resulting from a sudden rise in intraesophageal pressure against a closed glottis, as seen during forceful vomiting or retching

(1). First described by Hermann Boerhaave in 1724, the condition remains associated with high mortality often exceeding 40% particularly when diagnosis and surgical management are delayed. Unlike iatrogenic perforations which are more localized and commonly recognized early, spontaneous esophageal ruptures rapidly lead to

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mediastinal contamination, fulminant sepsis, and multi-organ dysfunction due to leakage of gastric and enteric contents into the thoracic cavity (2).

Clinical presentation is often nonspecific and may mimic more common emergencies such as acute coronary syndrome, pulmonary embolism, or aortic dissection. Classically, the Mackler triad vomiting, chest pain, and subcutaneous emphysema is described; however, it is observed in a minority of patients (3). As a result, delays in recognition are common and significantly worsen outcomes. Cross-sectional imaging, particularly computed tomography (CT), plays a pivotal role in confirming diagnosis, assessing the extent of rupture, and guiding operative planning (4).

Management of Boerhaave syndrome is centered around prompt surgical repair and aggressive supportive care, but the perioperative period presents major anesthetic challenges. Patients typically arrive in a physiologically compromised state with features of hypoxia, hypotension, systemic inflammatory response, and metabolic derangements (5). In addition, mediastinal contamination and pleural spillage predispose to aspiration and respiratory deterioration. During thoracotomy, one-lung ventilation (OLV) is required to provide adequate exposure for esophageal repair, yet this technique may further compromise already impaired gas exchange and precipitate hypoxemia (6).

Therefore, anesthetic goals include maintaining hemodynamic stability through careful titration of fluids and vasopressors, implementing lung-protective ventilation strategies, and preventing further esophageal contamination through meticulous airway control (7). Rapid-sequence induction may be warranted due to the high aspiration risk, but must be executed without causing abrupt fluctuations in intrathoracic pressure that could exacerbate the perforation. Precise positioning, continuous monitoring of oxygenation and perfusion, and anticipation of intraoperative complications are equally essential (8).

Postoperative care is no less critical, as patients remain highly vulnerable to respiratory failure, ongoing sepsis, and nutritional compromise. Planned postoperative ventilation, intensive monitoring, and early detection of anastomotic leaks or recurrent contamination are crucial determinants of outcome (9). A multidisciplinary approach involving anesthesiologists, thoracic surgeons, intensivists, and infection care teams is fundamental in guiding comprehensive management and reducing complications (10).

Given its rarity and high lethality, each case of Boerhaave

syndrome enriches existing evidence regarding its optimal perioperative handling (11). This report highlights key anesthetic considerations in the emergency surgical management of a patient with spontaneous esophageal rupture, emphasizing strategies for securing the airway, providing adequate ventilation during thoracotomy, and supporting hemodynamic status in the setting of sepsis-induced cardiovascular instability.

CASE PRESENTATION

History and Clinical Presentation: A 42-year-old male with no known comorbidities presented to the emergency department with severe retrosternal chest pain that developed abruptly following repeated episodes of forceful vomiting. The pain radiated to the left scapular region and was associated with progressive dyspnea, excessive perspiration, and a sense of impending collapse. There was no history of dysphagia, prior gastrointestinal disease, alcohol abuse, or trauma. On examination, the patient appeared acutely distressed and tachypneic. His pulse rate was 111 beats/min, blood pressure was 122/92 mmHg while receiving noradrenaline infusion initiated previously for hypotensive episodes, respiratory rate was 28 breaths/min, and oxygen saturation was 92% on room air. Auscultation revealed diminished breath sounds over the left lower lung fields without subcutaneous crepitus. No cardiac murmurs or neurological deficits were noted.

Investigations: Laboratory findings demonstrated leukocytosis with neutrophilia and mild metabolic acidosis on venous blood gas analysis, suggestive of evolving sepsis. Chest X-ray showed left-sided pleural effusion with mediastinal widening. Contrast-enhanced computed tomography of the thorax revealed a full-thickness rupture of the distal esophagus with significant pneumomediastinum, left-sided hydropneumothorax, and extravasation of fluid and air into the pleural cavity, confirming the diagnosis of Boerhaave syndrome.

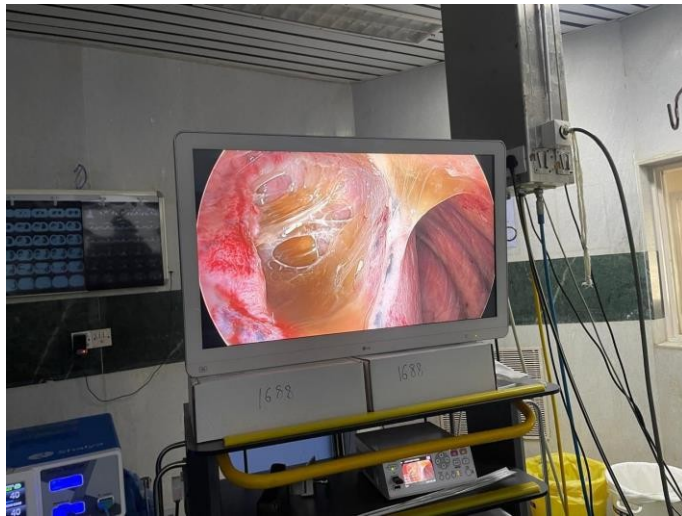
Preoperative Stabilization: The patient was immediately kept nil per oral and started on aggressive intravenous fluid resuscitation and broad-spectrum antibiotic coverage to prevent further septic progression. Due to respiratory compromise and hemodynamic instability, he was categorized as ASA Physical Status IV (E). Urgent surgical intervention via left thoracotomy and primary esophageal repair was planned after multidisciplinary consultation involving anesthesiology, thoracic surgery, and critical care teams.

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ANESTHETIC MANAGEMENT

Pre-induction Considerations: The primary anesthetic goals included rapid airway control to minimize aspiration risk, maintenance of hemodynamic stability in the presence of sepsis-induced vasoplegia, and provision of one-lung ventilation (OLV) to facilitate optimal surgical exposure. Invasive arterial blood pressure monitoring via radial artery cannulation and central venous access through the right internal jugular vein were established before induction for continuous hemodynamic monitoring and vasopressor administration. Peripheral IV access was ensured with two large-bore cannulas.

Airway Management and Induction: Preoxygenation was performed cautiously to avoid excessive intrathoracic



pressure rise. A controlled rapid-sequence induction was executed using thiopentone 3 mg/kg (for hemodynamic stability) and atracurium 0.5 mg/kg to achieve optimal intubating conditions. Cricoid pressure was maintained until airway security was confirmed. A 37-Fr left-sided double lumen endotracheal tube was inserted to enable OLV required for left thoracotomy. Correct placement was confirmed by auscultation and end-tidal CO₂ monitoring.

Figure 1: Intraoperative Positioning and Airway Management (Patient positioned in right lateral decubitus with a left-sided double-lumen endotracheal tube in situ for one-lung ventilation during thoracotomy. Standard monitors, invasive lines, and secure airway taping are evident, along with thoracic surgical preparation)

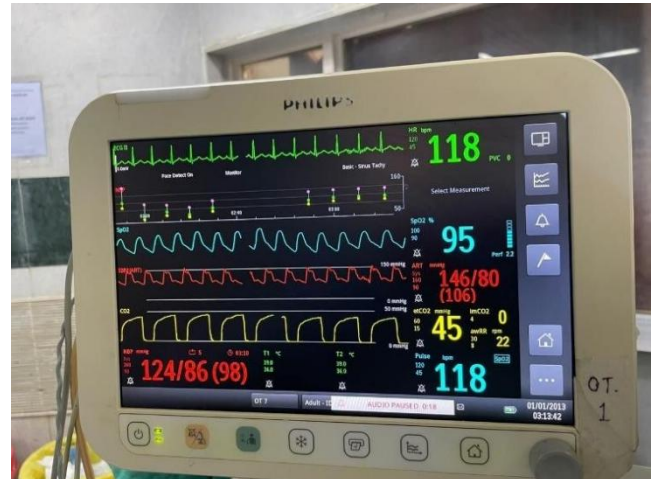


Figure 2: Intraoperative vital signs monitoring during emergency thoracotomy

Figure 3: Intraoperative thoracoscopic visualization of the esophageal rupture (Thoracoscopic image demonstrating contaminant-filled pleural cavity with visible esophageal tear margins and inflamed mediastinal structures during emergency thoracotomy for Boerhaave syndrome)

Ventilation and Intraoperative Management: Pressure-controlled ventilation was administered with low tidal volume strategy (4–6 mL/kg), moderate PEEP to prevent atelectasis, and FiO₂ titration to maintain SpO₂ above 94%. Peak inspiratory pressures were kept below 25 cmH₂O to minimize barotrauma. Hemodynamic stability was maintained through careful fluid therapy guided by blood pressure and central venous pressure trends, along with titrated noradrenaline infusion to maintain MAP \geq 65 mmHg. Temperature was continuously monitored, and forced-air warming devices were used to maintain normothermia. Opioid-based analgesia with incremental fentanyl was provided, combined with local infiltration by the surgical team to optimize postoperative pain control.

Postoperative Care: At the conclusion of surgery, the double-lumen tube was exchanged for a single-lumen tube in anticipation of prolonged ventilatory support in the postoperative period. The patient was shifted intubated to the intensive care unit for elective mechanical ventilation, ongoing vasopressor support, continuous sepsis management, and close cardiopulmonary monitoring. Ventilatory weaning was done cautiously based on arterial blood gas evaluation, pulmonary mechanics, and improved hemodynamics. Successful extubation was

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achieved 72 hours postoperatively with gradual clinical recovery.

DISCUSSION

Boerhaave syndrome represents a true anesthetic emergency due to the rapid evolution of mediastinitis, sepsis, circulatory collapse, and respiratory compromise. The clinical presentation is frequently atypical, leading to delayed diagnosis and heightened mortality, particularly when treatment is initiated beyond 24 hours (11). In the present case, prompt recognition supported early intervention, which remains the most critical prognostic factor in spontaneous esophageal rupture. The anesthetic considerations are complex because anesthesiologists must manage a physiologically unstable patient while simultaneously preventing aspiration, preserving oxygenation, and maintaining hemodynamic integrity during thoracotomy and one-lung ventilation (OLV) (12). Airway management is paramount because these patients typically present after forceful vomiting with significant gastric contamination and intrathoracic fluid accumulation. Rapid-sequence induction is considered beneficial; however, classical cricoid pressure is debated due to risk of worsening esophageal disruption (13). Controlled yet rapid airway securing with preoxygenation, pharmacologic control of sympathetic response, and avoidance of vigorous mask ventilation reduce the risk of aspiration and further mediastinal contamination (14). Placement of a double-lumen endotracheal tube is essential to allow surgical access, prevent soiling of the dependent lung, and improve operative working space. Fiberoptic confirmation of lung isolation is preferred, although auscultation remains acceptable in emergency circumstances (15).

Ventilation must balance multiple priorities: oxygenation of a single lung, avoidance of high airway pressures, and maintenance of carbon dioxide elimination. Pressure-controlled ventilation with low tidal volumes, adequate PEEP, and FiO₂ titration are considered best practices for preventing hypoxia and ventilator-induced lung injury (16). Hemodynamic instability frequently complicates induction and maintenance phases, as many patients present in early septic shock. Vasopressor support, guided fluid therapy, arterial blood gas-based ventilation adjustments, and strict monitoring of perfusion parameters are indispensable (17). Invasive blood pressure monitoring and central venous catheterization are recommended to ensure safe delivery of vasoactive drugs and precise control of intravascular volume (18).

Analgesia also plays a pivotal role due to the extensive thoracic incision and mediastinal instrumentation. Epidural analgesia is beneficial for postoperative pain management; however, sepsis and coagulopathy often contraindicate its use. In this scenario, multimodal systemic analgesia along with local infiltration provided effective pain control while maintaining physiological safety (19).

Postoperative ventilatory support is commonly required because of preoperative respiratory compromise, prolonged surgical duration, and ongoing sepsis. Delayed extubation is frequently planned to avoid immediate deterioration (20). Intensive care monitoring is essential for early detection of complications such as recurrent leaks, pulmonary sepsis, acute respiratory distress syndrome, or multi-organ failure. Nutritional rehabilitation must also be addressed early, typically via jejunostomy, to prevent negative nitrogen balance and impaired healing (21).

The literature underscores the importance of team coordination among anesthesiologists, thoracic surgeons, radiologists, and intensivists to optimize care standards. Several studies emphasize that anesthetic management significantly influences morbidity and survival by modulating oxygenation, hemodynamics, and infection control (22). While advances in imaging and critical care have improved outcomes over recent years, mortality remains substantial, and vigilance at every stage of management is required. Each successfully managed case expands clinical learning because of the condition's rarity, and documenting anesthetic experiences is essential to enhance evidence-based care (23).

In summary, the perioperative course in Boerhaave syndrome demands meticulous airway strategy, lung-protective ventilation, aggressive septic control, and precise hemodynamic management. The anesthesiologist plays a decisive role in stabilizing the patient before, during, and after surgery, ensuring that both surgical conditions and physiological parameters remain within safe thresholds to achieve an optimal recovery trajectory.

CONCLUSION

Boerhaave syndrome remains one of the most life-threatening thoracic emergencies, and successful outcomes depend on early diagnosis, prompt surgical intervention, and vigilant anesthetic management. The presence of sepsis, respiratory compromise, and aspiration risk at presentation complicates airway control and hemodynamic stability, making anesthetic care highly demanding. In this case, structured perioperative strategies

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including rapid airway protection, lung isolation for surgical access, lung-protective ventilation, and titrated vasopressor support were pivotal in preventing deterioration and promoting recovery. Planned postoperative ventilation and intensive monitoring enabled gradual physiological stabilization and timely extubation. This case highlights the critical and influential role of anesthesiologists in managing the complex multisystem derangements associated with spontaneous esophageal rupture. A multidisciplinary approach, constant vigilance, and an individualized plan of care remain the key determinants of a favorable outcome in Boerhaave syndrome.

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