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Anesthetic Management of Traumatic Diaphragmatic Hernia in a 52-Year-Old Female with Emergency Thoracotomy and Hernia Repair: A Case Report

Dr. Bharat Krishna M¹, Dr. Bharathi B^{2*}, Dr. Lakshmi R³

¹Postgraduate, Department of Anesthesiology, Saveetha Medical College, Chennai ²Assistant Professor, Department of Anesthesiology, Saveetha Medical College, Chennai ³Professor and Head, Department of Anesthesiology, Saveetha Medical College, Chennai

*Corresponding author

Dr Bharathi B, Department of Anesthesiology, Saveetha Medical College, Chennai

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KEYWORDS TDH, hernia, thoracotomy	ABSTRACT: Traumatic diap diaphragmatic hernia repair management de specifics, and anesthetic hand year history of breathlessness. right hemidiapl report highligh TDH in this specifics	hragmatic hernia (TDH) is a rare, lindisruption due to blunt or penetrating become imperative to address it emands a comprehensive understand planned surgical intervention. This ling of a 52-year-old female with a TI of systemic hypertension, she press Imaging confirmed liver herniation in magm. The patient underwent emerge ts the perioperative considerations, of ecific clinical context.	fe-threatening condition resulting from g trauma. Emergency thoracotomy and immediate complications. Anesthetic ing of the patient's physiology, trauma s case report outlines the successful DH after a two-wheeler fall. With a five- sented to the emergency room with nto the right hemithorax via a rent in the ncy thoracotomy and hernia repair. This challenges, and outcomes in managing

1. Introduction

Traumatic diaphragmatic hernia (TDH) is an uncommon yet potentially life-threatening condition resulting from the diaphragm's disruption due to blunt or penetrating trauma, with incidence rates ranging between 0.8 and 8%. The associated mortality rate varies from 16.6% to 33.3%.¹ Diagnosing and surgically managing TDH poses considerable challenges. Given that laparotomy is a common procedure post-trauma, it has traditionally been the primary approach for treating TDH.² Nevertheless, thoracotomy has been documented as an alternative treatment method in some published papers.³ The immediate complications linked with TDH often mandate emergency thoracotomy and hernia repair⁴, underscoring the pivotal role of anesthetic management in ensuring optimal patient outcomes. The initial phase of anesthetic management involves a thorough preoperative assessment, encompassing a detailed medical history, evaluation of trauma extent, and an overall appraisal of the patient's physiological status. Vital signs, airway stability, cardiovascular function, and respiratory status are pivotal components of this assessment. Imaging studies, including chest X-rays and computed tomography scans, play a crucial role in diagnosing diaphragmatic hernias and assessing associated injuries.⁵

Securing the airway becomes a critical aspect, demanding careful evaluation and contingency planning by the anesthesiologist. A cautious approach is essential if cervical spine injury is suspected, and rapid sequence induction techniques may be warranted considering the urgency of surgical intervention and the risk of aspiration.

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Traumatic diaphragmatic hernias can introduce hemodynamic instability, requiring vigilant monitoring of blood pressure, heart rate, and central venous pressure for informed fluid resuscitation and vasopressor support.⁶ Respiratory compromise is common, necessitating mechanical ventilation with lung-protective strategies to optimize oxygenation and ventilation. The intraoperative phase demands close collaboration between the anesthesiologist and the surgical team. Coordination is crucial to address potential complications such as inadvertent injuries to major vessels, the heart, or other thoracic structures. Achieving hemostasis, lung re-expansion, and diaphragmatic defect repair are primary surgical goals. Postoperative care entails vigilant monitoring in the intensive care unit, focusing on respiratory function, hemodynamic stability, and effective pain control. Continuous assessment for postoperative complications, including respiratory failure, infections, or cardiac issues, remains paramount.7-9

This case report focuses on a fifty-two-year-old female patient who developed a traumatic diaphragmatic hernia after falling from a two-wheeler. The trip begins with the patient complaining of dyspnea and the identification of a raised right diaphragm on a chest Xray. Subsequent imaging verifies the herniation of the right lobe of the liver, establishing the course of diagnostic and therapeutic procedures.

In the forthcoming sections, we explore the intricacies of preoperative assessment, intraoperative challenges, and postoperative care in managing this unique case of TDH. The multidisciplinary approach, intricate decision-making, and vigilant monitoring throughout the patient's journey form a comprehensive narrative, shedding light on the complexities associated with traumatic diaphragmatic hernias and the successful clinical outcomes achieved through meticulous medical intervention.

Case Presentation

A 52-year-old female patient with a known history of systemic hypertension for the past 5 years. The patient presented following a traumatic event involving a fall from a two-wheeler. This incident prompted a thorough examination and subsequent medical evaluation.

Clinical Course

The patient walked to the emergency department with a primary symptom of shortness of breath. A chest X-ray

revealed an inflated right diaphragm, necessitating further imaging to confirm the diagnosis of traumatic diaphragmatic hernia (TDH). Notably, the right lobe of the liver had ruptured into the right hemithorax. Recognizing the seriousness of the situation, the patient was immediately hospitalized under the care of the cardiothoracic surgery team, who assessed that an emergency thoracotomy and hernia repair were required.

Preoperative Assessment

Upon admission, the patient's vital signs were assessed, revealing a heart rate (HR) of 103/min, blood pressure (BP) at 140/80 mmHg, and oxygen saturation (SpO2) of 89% on 6L oxygen supplementation. Rigorous preoperative evaluations, encompassing ECG, chest X-ray, and CT scans of the thorax and abdomen, were performed and indicated within normal ranges, aside from the diaphragmatic hernia.

Anesthetic Plan

In the operating room, the anesthesia team implemented a comprehensive plan. Two wide-bore IV cannulas were secured for fluid administration, and essential monitors, including ECG, SpO2, and NIBP, were initiated. Preinduction medications, including Inj Midazolam 1mg iv, Inj Glycopyrrolate 0.2mg iv, and Inj Fentanyl 100mcg iv, were administered for sedation and pain control. Anesthesia induction commenced with Inj Etomidate 16mg iv, and neuromuscular blockade was achieved using Inj Succinylcholine 100mg. Direct laryngoscopy was performed with a Macintosh Size 4 blade, facilitating the intubation of the patient's trachea with a 35 French Left-sided Robertshaw double-lumen endotracheal tube. Simultaneously, a right internal jugular vein central line and left radial arterial cannulation were performed for continuous monitoring of central venous pressure (CVP) and invasive blood pressure (IBP), respectively. This meticulous anesthetic strategy laid the groundwork for a safe and controlled environment for the impending emergency thoracotomy and hernia repair, ensuring optimal conditions for the successful management of the traumatic diaphragmatic hernia.

Intraoperative Course

During the intraoperative phase, the patient was carefully positioned in the left lateral position to provide

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for surgical access. Lung isolation was critical, and it was successfully accomplished, allowing for selective ventilation of the left lung by pressure control ventilation. Hernia healing occurred after about an hour of lung isolation, during which Inj Vecuronium was injected to promote muscular relaxation. Following hernia surgery, the double-lumen tube was replaced with a cuffed PVC ET tube (size 7.5). The patient was then admitted to the Cardiothoracic Intensive Care Unit (CT-ICU) for elective postoperative ventilation.

Postoperative Care

In the CT-ICU, vigilant monitoring of the patient's vital signs revealed stability, and chest X-ray (CXR)

exhibited improved lung expansion. Extubation was successfully carried out on postoperative day (POD) -1, reflecting positive progress. Over the subsequent days, the patient demonstrated enhanced saturation levels, and the gradual reduction of oxygen support ensued. With sustained improvement in clinical parameters, the patient achieved a significant recovery milestone and was ultimately discharged on postoperative day (POD)-10. This detailed account highlights the meticulous intraoperative strategies and postoperative care measures that collectively contributed to the successful management and recovery of the patient following emergency thoracotomy and hernia repair for traumatic diaphragmatic hernia.



Figure 2: Demonstrates Post-
Thoracotomy Respiratory
Management: Left Lung
Ventilation With Pressure Control
Ventilation-A Clinical Snapshot

Reveals

on CT Imaging.

Right

Hernia with Hepatic Displacement

Diaphragmatic

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2. Discussion

The presented case of a traumatic diaphragmatic hernia (TDH) following a fall from a two-wheeler underscores the complexity and challenges associated with managing such critical conditions. The successful anesthetic management and subsequent outcomes highlight the multidisciplinary approach and meticulous planning involved in addressing traumatic diaphragmatic hernias.

The patient's initial presentation with breathlessness and an elevated right diaphragm on chest X-ray prompted further imaging, revealing a herniation of the right lobe of the liver into the right hemithorax. This diagnosis necessitated urgent intervention, leading to the decision for emergency thoracotomy and hernia repair. The overall clinical course showcased the efficiency and coordination between emergency room evaluation, imaging, and prompt surgical planning, ensuring timely intervention.

The preoperative examination was critical in defining the patient's baseline physiological condition and directing the following anaesthetic protocol. The patient, who had a five-year history of systemic hypertension, came with vital signs such as a heart rate of 103/min, blood pressure of 140/80 mmHg, and oxygen saturation of 89% while on 6L oxygen supplementation. These data were critical for anaesthetic planning, highlighting the importance of rigorous monitoring and treatment during the perioperative phase.

The anesthetic plan was executed with precision in the operating room, reflecting a comprehensive strategy to address the challenges posed by TDH. Securing two wide-bore IV cannulas, implementing vital sign monitors, and administering premedication were initial steps to ensure stable conditions for induction. The choice of medications, including Inj Midazolam, Inj Glycopyrrolate, Inj Fentanyl, Inj Etomidate, and Inj Succinylcholine, facilitated a smooth induction and intubation process. Notably, direct laryngoscopy with a Macintosh Size 4 blade allowed successful intubation with a 35 French Left-sided Robertshaw double-lumen endotracheal tube.

Intraoperatively, the left lateral positioning of the patient was adopted to facilitate surgical access. Lung isolation, achieved through the selective ventilation of the left lung using pressure control ventilation, enabled the surgical team to initiate hernia repair. The administration of Inj Vecuronium provided adequate muscle relaxation during the procedure. Post-hernia repair, the transition from a double-lumen tube to a cuffed PVC ET tube (size 7.5) marked a crucial step in preparing the patient for the subsequent phase of elective postoperative ventilation in the Cardiothoracic Intensive Care Unit (CT-ICU).

Postoperatively, the patient's care in the CT-ICU was characterized by vigilant monitoring and gradual weaning of oxygen support. Stable vital signs and improved lung expansion on chest X-ray (CXR) indicated successful recovery. The decision to perform extubation on postoperative day (POD) -1 reflected the positive trajectory of the patient's recovery. Over subsequent days, the patient demonstrated consistent improvement in saturation levels, eventually leading to the successful cessation of oxygen support.

Acknowledgment of Potential Complications

Managing TDH repair involves recognizing potential complications despite the overall favorable outcome. Complications may manifest as respiratory distress, postoperative infections, cardiac issues, and those directly related to the surgical repair, such as recurrence or hernia site complications. These possibilities necessitate a proactive approach in managing and mitigating adverse outcomes, emphasizing the importance of thorough patient care.

Contributing Factors to Success

The success seen in this instance is due to a number of circumstances, beginning with a thorough preoperative evaluation. This entails a thorough examination of the patient's medical history, baseline physiological condition, and identification of any risk factors. Such an assessment informs the construction of a personalized anaesthetic and surgical strategy based on the patient's individual needs. Meticulous intraoperative treatment also led to a great result. Lung-protective ventilation methods were used to reduce the risk of ventilator-induced lung damage, which was especially important in patients with reduced respiratory function owing to TDH. Continuous monitoring of hemodynamic parameters permitted real-time evaluation, allowing for early intervention in the case of instability.

Vigilant Postoperative Care

Postoperative care played a pivotal role in maintaining the positive trajectory of the case. Vigilance and prompt intervention in response to any signs of instability or

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complications were integral components of the postoperative care plan. Additionally, the decision to replace the double-lumen tube with a cuffed PVC endotracheal tube post-hernia repair reflected a strategic approach. This shift aimed at optimizing postoperative ventilation and minimizing complications associated with prolonged intubation, emphasizing the importance of meticulous airway management.

Research insight

Research in the realm of diaphragmatic hernias illuminates the challenges associated with their diagnosis, emphasizing the need for customized anesthetic management, particularly in the presence of concurrent pathologies. Studies such as "Anesthesia for Traumatic Diaphragmatic Hernia Associated with Corneal Laceration" shed light on the significance of tailoring management strategies to the unique circumstances of each case. These insights underscore the nuanced nature of anesthetic considerations in the context of diaphragmatic hernias.¹⁰

Similarly, investigations like "Traumatic Diaphragmatic Hernia: Occult Marker of Serious Injury"¹¹ and "Management of Patients with Traumatic Rupture of the Diaphragm" underscore the diagnostic hurdles and the association of diaphragmatic hernias with severe injuries. These studies emphasize the multifaceted nature of trauma-related diaphragmatic conditions, warranting a comprehensive understanding for effective management.¹²

The recognition of diaphragmatic rupture as a predictive factor for severe trauma emerges prominently in research findings. The study "Outcome of Blunt Diaphragmatic Rupture finds that age, related injuries, and clinical state are predictors of death after such injuries. These findings highlight the predictive relevance of diaphragmatic rupture as a measure of the total degree of trauma".¹³

Related research, titled "Traumatic Diaphragmatic Rupture: A Rare Cause of Postoperative Shortness of Breath, emphasises the rarity of delayed traumatic diaphragmatic rupture as a cause of postoperative shortness of breath. The article describes the identification and treatment of a patient with a delayed manifestation of a ruptured right hemidiaphragm after a laparotomy for a pelvic mass".¹⁴

Furthermore, the research titled "Traumatic Diaphragmatic Hernia: Delayed Presentation with Tension Viscerothorax—Lessons to Learn follows a patient's clinical history after experiencing acute abdominal trauma, with the diaphragmatic damage going undiagnosed at first. Two years later, the patient presented with left tension viscerothorax, an uncommon and poorly understood condition. The emergency scenario was effectively treated via nasogastric tube insertion, and the hernia was thereafter fixed in a semi elective setting, providing useful lessons for physicians".¹⁵

Understanding these predictive factors becomes crucial in tailoring interventions and optimizing patient outcomes. In summary, the successful anesthetic management of the presented TDH case underscores the significance of а multidisciplinary approach. among healthcare Collaboration professionals, including anesthesiologists, surgeons, and critical care specialists, was essential. The positive postoperative outcome is indicative of the efficacy of chosen interventions and strategies, tailored to address the unique challenges posed by TDH.

3. Conclusion

The management of the traumatic diaphragmatic hernia (TDH) case exemplifies success through а comprehensive approach. Despite a favorable outcome, acknowledging and addressing potential complications is crucial. Awareness of complications such as respiratory distress, infections, cardiac issues, and those related to surgical repair underscores the need for a proactive stance. The success is attributed to a thorough preoperative assessment, guiding a tailored plan for emergency thoracotomy and hernia repair. Meticulous intraoperative management, including lung-protective ventilation and continuous monitoring, contributed to maintaining stability. Postoperatively, vigilant care and the strategic shift to a cuffed PVC endotracheal tube aimed at optimizing ventilation and minimizing complications. This case underscores the importance of a multidisciplinary approach, showcasing effective teamwork among healthcare professionals. The positive outcome reflects the dynamic nature of perioperative care, encouraging ongoing research and excellence in managing complex clinical scenarios in the evolving field of perioperative medicine.

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