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Awake Fiberoptic Double-Lumen Intubation in Traumatic Diaphragmatic Hernia: A Case Report

Qin Hou[1*]
[1]*Department of Anesthesiology, West China Hospital, Sichuan University, Sichuan, P. R. China*

Corresponding Author: **Qin Hou**
Address: Department of Anesthesiology, West China Hospital, Sichuan University, 37 Guoxue Alley, Wuhou District, Chengdu, Sichuan 610041, P. R. China; Tel: +86 02885423583, +86 18380225770; Email: houqin2021@wchscu.edu.cn
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Abstract

Traumatic diaphragmatic hernia (TDH) poses significant airway management challenges due to risks of visceral herniation and respiratory compromise during positive-pressure ventilation. We present detailed use of awake fiberoptic double-lumen intubation in a 58-year-old male with left-sided TDH following a car accident. Preoperative CT imaging demonstrated a 12 cm diaphragmatic defect with gastric herniation and rightward tracheal deviation (> 15 mm displacement). Given the possible difficult airway and high aspiration risk, we implemented awake fiberoptic double-lumen intubation with topical lidocaine analgesia, maintaining spontaneous breathing without neuromuscular blockade until the hernia sac was controlled. The patient kept oxygen saturation > 95% with stable hemodynamics (BP 135–145/75–88 mmHg, HR 70–85 bpm, RR 16–20 bpm).

Keywords

Traumatic Diaphragmatic Hernia, Airway Management, Awake Fiberoptic Intubation, Double Lumen Tube

Introduction

Diaphragmatic rupture occurs due to blunt or penetrating injury, having either an acute presentation as a part of multi-organ injury or delayed presentation as respiratory distress or gut obstruction [1,2]. Traumatic diaphragmatic hernia (TDH) develops when sudden intra-abdominal pressure surges rupture weak diaphragmatic areas, enabling visceral herniation into the thoracic cavity [2,3]. This displacement compresses cardiopulmonary structures - a risk amplified by positive-pressure ventilation. Without prompt intervention, visceral ischemia and necrosis ensue, mandating urgent surgical repair.

Anesthetic induction in TDH remains contentious, with two predominant approaches documented. Rapid sequence intubation and induction (RSII) using neuromuscular blockers risks exacerbating thoracic compression through diaphragmatic paralysis, while awake fiberoptic intubation preserves spontaneous ventilation but demands technical expertise. RSII may precipitate hemodynamic instability or visceral injury. Awake fiberoptic intubation (AFOI) offers a safer alternative by preserving spontaneous respiration until airway control is achieved.

Case Presentation

A 58-year-old man was transferred to our emergency department with 9 hours of severe left upper quadrant pain and progressive dyspnea after a car accident.

Emergency CT imaging demonstrated localized discontinuity of the left diaphragm with herniation of most of the gastric cavity, segments of intestine, mesentery, partial pancreas, as well as the spleen into the left thoracic cavity. The CT scan also revealed left lung compression, rightward mediastinal shift, left-sided pleural effusion and hemothorax, as well as pulmonary consolidation, atelectasis, and contusion in the left lung (**Fig-1**). One hour later, the patient was transferred to the operating room for urgent repair.

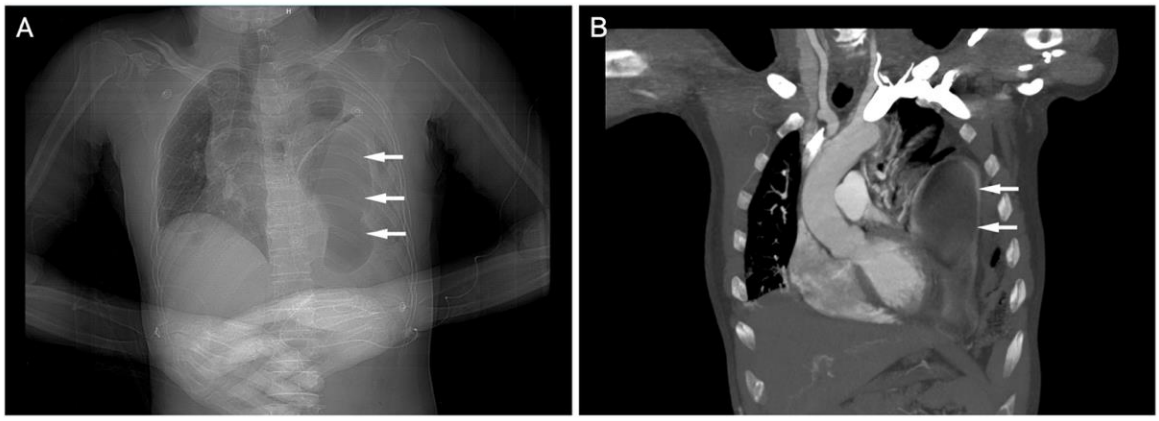

Fig-1:

Supine computed tomography scout film of the chest showing most of the left lung collapse, mediastinal shift and tracheal deviation. Note the presence of air within the left thorax (arrows).

The patient was conscious, exhibited a distressed facial expression, and assumed a sitting position to facilitate breathing. Blood pressure was 130/85 mmHg, pulse was 88/min, respiration was 38/min, temperature was 36.3°C, and oxygen saturation was 94% on 4 L/min O_2 via nasal cannula (82% on room air). Pulmonary examination showed distended and bulging left thorax. Breath sounds were absent on the left side, and the trachea was deviated to the right. Mild wheezing was detected over the right lung field. Cardiovascular examination showed tachycardia. The patient was managed with a nasogastric tube, and 200 ml of gastric fluid had been drained.

Awake Fiberoptic Intubation Preparation

Anesthetics Preparation:

Lidocaine:

Prepare 5 syringes for topical anesthesia by drawing 2 ml of 2% lidocaine into 10 ml syringes filled with some air. Separately, draw 2% lidocaine into a 5 ml syringe for intravenous bolus administration.

Fentanyl:

Dilute to a concentration of 10 μg/ml.

Dexmedetomidine:

Dilute to a concentration of 4 μg/ml for intravenous administration.

Primary Equipment for Bronchial Intubation:

Prepare a fiberoptic bronchoscope (Olympus) with an outer diameter of 3.1 mm for the ability to perform bronchoscopy along with suction and administering local anesthetic spray. Thoroughly lubricate the surface of a 35 Fr double-lumen bronchial tube (Robertshaw™), including the tracheal tube cuff. Ensure that the syringe containing lidocaine retains some air to facilitate aerosolized administration.

Patient Preparation:

Perform invasive arterial and internal jugular vein catheterization under local anesthesia. Explain the necessity and specific procedures for patient cooperation during the operation and provide adequate psychological support.

Surgeon Standby:

To avoid respiratory or circulatory collapse, the surgeon was on standby to perform thoracotomy or laparotomy at any time and to reposition the contents of the hernia sac back into the abdominal cavity.

Awake Fiberoptic Intubation Procedure

Under fiberoptic bronchoscope guidance, topical anesthesia was sequentially applied using 2% lidocaine (2 ml) to the oropharynx, supraglottic region, subglottic region, carina, and left bronchus. The entire topical anesthesia procedure was performed with the patient in a semi-recumbent position (40°–50° inclination). Dexmedetomidine (0.5 μg/kg) was administered as an intravenous infusion over 10 minutes during oropharyngeal anesthesia. Thereafter, fentanyl (1 μg/kg) was separately administered intravenously during the supraglottic and subglottic topical anesthesia. A 35-French left-sided double-lumen endotracheal tube was subsequently positioned under fiberoptic bronchoscope guidance, preceded by intravenous administration of 2% lidocaine (0.5 mg/kg) (**Table-1**). Anesthetic maintenance was achieved with 1% sevoflurane, continuous remifentanil infusion (0.05 μg/kg/min), and dexmedetomidine infusion (0.4 μg/kg/h), while preserving spontaneous breathing throughout the procedure.

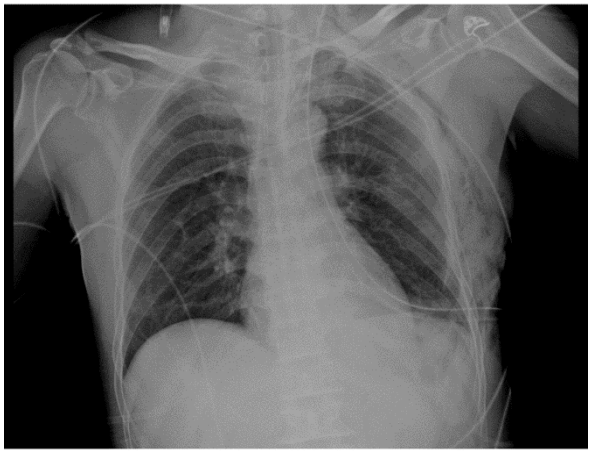

Fig-2:

Posteroanterior chest radiography confirms midline positioning of the mediastinal structures with complete restoration of bilateral lungs.

After the surgeon successfully controlled the hernia sac, the neuromuscular blockade was administered. During the operation, it was discovered that the rupture of the diaphragm was approximately 10 cm, and the repair was successfully completed. After the surgery, the patient was transferred to the ICU with a single-lumen tracheal tube. On the second day after the surgery, a chest X-ray was performed, showing complete lung re-expansion (**Fig-2**). On the fourth day after the surgery, the tracheal tube was removed, and the discharge criteria were met on the 13th day after the surgery.

Discussion

Anesthetic management of traumatic diaphragmatic hernia (TDH) is challenging due to risks of visceral herniation and respiratory compromise during induction, particularly before hernia sac control. This case emphasizes avoiding positive-pressure ventilation and neuromuscular blockade use until surgical intervention and advocates awake fiberoptic double-lumen endotracheal intubation (DLT), which mitigates gastric insufflation risks while preserving spontaneous ventilation. DLT facilitates surgical exposure and protects the non-dependent lung from gastric contamination. However, awake DLT placement requires meticulous airway topicalization and operator expertise to ensure patient tolerance and procedural success.

Rapid sequence induction and intubation (RSII), commonly employed in patients with full stomach and pulmonary aspiration concerns, poses significant hazards in TDH. However, RSII is associated with an increased risk of difficulty in airway management, such as failed intubation. The identified failed intubation occurs in 1 in 2,000 in elective cases and increases to 1 in 300 with RSII. The incidence of failed intubation is

Table-1: Timeline of the Awake Fiberoptic Intubation Procedure

Timeline	Primary Event	Anesthetics	Intravenous sedation
22:20	Continuous oxygen therapy	-	-
22:40	Oropharyngeal topical anesthesia	2% lidocaine	Dexmedetomidine
22:50	Supraglottic topical anesthesia	2% lidocaine	Fentanyl
22:53	Subglottic topical anesthesia	2% lidocaine	Fentanyl
22:56	Carina and left bronchus topical anesthesia	2% lidocaine	-
23:00	DLT intubated	None	2% lidocaine

even higher (1 in 50–100) with RSII in emergency cases, critical care, or obstetric patients [4,5]. Furthermore, neuromuscular blockade may result in diaphragmatic relaxation and enlargement of the defect, subsequently increasing herniation volume, which exerts compressive effects on the thorax and mediastinum. While RSII remains appropriate for select trauma scenarios, its application in TDH requires careful risk-benefit analysis.

Awake fiberoptic intubation is widely recognized as the gold standard for airway management in patients with anticipated difficult airways [6-8]. In this case, preoperative CT imaging revealed significant rightward tracheal deviation, indicating a heightened risk of airway difficulty. Given these anatomical concerns and the operator's prior experience with this technique, awake fiberoptic intubation was selected for this patient with TDH. Adequate local anesthesia combined with complementary sedation preserves spontaneous ventilation and minimizes airway manipulation-induced stress. However, this technique demands meticulous preparation (premedication, local anesthesia, sedation) and operator expertise to ensure patient cooperation and procedural success [7].

This case underscores three key considerations. Firstly, preoperative CT imaging was crucial for assessing hernia severity and guiding airway strategy. Secondly, adequate topical anesthesia and light sedation optimized patient comfort without respiratory depression. Lastly, neuromuscular blockade should be withheld until the diaphragmatic hernia is effectively controlled, to mitigate the risk of airway and circulatory collapse induced by positive-pressure ventilation.

Conclusion

Anesthesiologists must balance aspiration risks against the dangers of positive-pressure ventilation when encountering urgent TDH. This case illustrates that awake fiberoptic bronchoscopy-guided double-lumen endotracheal intubation represents a safe and effective anesthetic strategy. This approach preserves spontaneous breathing, minimizes the risk of visceral displacement associated with neuromuscular blockade and positive-pressure ventilation, and facilitates surgical procedures. The successful management of this high-risk scenario underscores the importance of individualized airway planning to enhance perioperative safety.

Consent for Publication

Written informed consent was obtained from the patient for the publication of this case report and related images.

Ethics Approval and Consent to Participate

This study was approved by the Ethics Committee of West China Hospital of Sichuan University. Written informed consent was obtained from the patient for the publication of any potentially identifiable images or data included in this article.

Data Availability Statement

The original contributions presented in this study are included in the article. Further inquiries can be directed to the corresponding authors.

Conflict of Interest

The author has read and approved the final version of the manuscript. The author declares no conflicts of interest.

Funding

No funding was received for this study.

Informed Consent

Written consent was obtained from the patient for publication.

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