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Case Report

Inability to re-inflate a deflated lung due to double-lumen tube malposition during one-lung ventilation: A unique case

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Abstract

Accurate positioning of a double-lumen tube (DLT) is critical for effective one-lung ventilation (OLV) in thoracic anaesthesia. We report the case of a 53-year-old male who underwent thoracotomy and chest wall reconstruction following a severe road traffic accident. After initial successful OLV, difficulty in re-inflating the non-dependent lung led to desaturation. Immediate corrective measures revealed DLT malposition with the bronchial cuff obstructing the right bronchus. Fiberoptic bronchoscopy (FOB) was used to reposition the DLT, restoring adequate ventilation. This case highlights the risks of DLT displacement during surgical repositioning and emphasizes the importance of continuous vigilance, routine FOB use for placement confirmation, and prompt corrective action when complications arise. The inability to re-inflate a deflated lung, as observed here, is a rare complication, emphasizing the need for heightened awareness and well-established protocols for managing such events.

Keywords: One-lung ventilation, Double-lumen tube, Fiberoptic bronchoscopy, Malposition.

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1. Introduction

Lung isolation and one-lung ventilation (OLV) are crucial aspects of thoracic anaesthesia, facilitating optimal surgical exposure while safeguarding the non-operative lung. The double-lumen tube (DLT) remains the most widely used device for achieving lung isolation, offering distinct advantages in controlling ventilation to each lung independently. However, the success of DLT placement heavily relies on precise positioning, as even slight malpositioning can lead to significant complications such as hypoxemia, atelectasis, and inadequate lung isolation.[1,2]

The incidence of DLT malposition is reported to be as high as 37%, particularly during patient repositioning or when surgical manipulation disrupts the tube's placement.[3] Although most malpositions result in issues such as hypoxemia or failure to achieve complete lung isolation, there are rare and complex situations that can arise. In this case, we describe an unusual occurrence where successful lung deflation was achieved, but the ability to re-inflate the lung intraoperatively was compromised. This rare complication emphasizes the necessity of maintaining strict vigilance throughout the procedure, employing fiberoptic bronchoscopy (FOB) as a reliable tool for confirming DLT placement, and establishing clear, effective management protocols to address potential complications promptly. These measures are essential to ensuring optimal outcomes and patient safety during thoracic surgeries.

2. Case Report

A 53-year-old male presented to the emergency department following a severe road traffic accident. He was conscious, oriented, and hemodynamically stable. High-resolution CT of the thorax showed bilateral subcutaneous emphysema, multiple bilateral rib fractures, bilateral clavicle fractures, bilateral lower lobe contusions, right-sided pneumothorax, and pneumomediastinum. He was planned for thoracotomy, rib fixation, decortication, and chest wall reconstruction.

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Given the complexity, the anaesthetic plan included general anaesthesia with OLV via a left-sided DLT and thoracic epidural analgesia. In the supine position, a single-lumen endotracheal tube (ETT) was initially placed during bilateral clavicle fixation. Following this, a 39-Fr left-sided DLT was placed and confirmed by auscultation for lung isolation. The patient was then repositioned into the left lateral decubitus position, and a thoracic epidural catheter was inserted at T6-T7 for continuous analgesia.

During thoracotomy, OLV was successfully initiated to facilitate surgical exposure. However, on the second attempt to re-inflate the non-dependent lung, it failed to expand, and the patient began to desaturate. Immediate corrective actions, including 100% oxygen, suctioning, and manual ventilation, were performed, and a fiberoptic bronchoscope (FOB) was urgently arranged.

FOB revealed slight displacement of the DLT, with the bronchial cuff partially obstructing the right bronchus, causing ventilation failure (**Figure 1**). The DLT was repositioned under FOB guidance, resolving the issue (**Figure 2**). The remainder of the surgery proceeded uneventfully, and the patient was successfully extubated in the operating room, followed by an uneventful recovery.

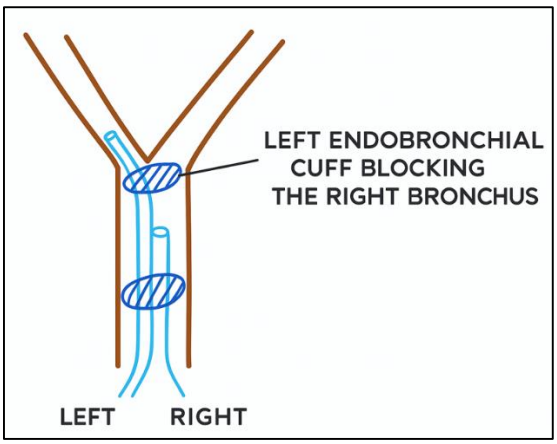

Figure 1: Left endobronchial cuff occluding the right bronchus as seen in our case

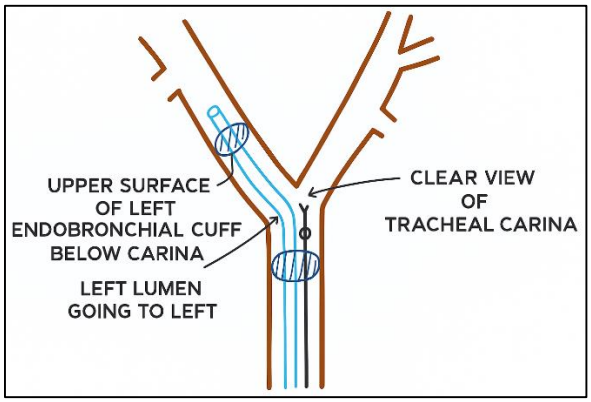

Figure 2: Correct position of left sided DLT

3. Discussion

Lung isolation and one-lung ventilation (OLV) play a pivotal role in thoracic anaesthesia, ensuring optimal surgical conditions while safeguarding the contralateral lung. The double-lumen tube (DLT) has become the primary device for achieving lung isolation, largely due to its proven efficacy in this regard. Nevertheless, precise positioning of the DLT is essential, as malposition can lead to a range of complications, including hypoxemia, atelectasis, and inadequate lung isolation, which can significantly affect surgical outcomes.[1,2]

Campos et al. established clear criteria for DLT malposition, which includes: (1) bronchial cuff herniating into the carina, indicating that the tube is too far out; (2) the bronchial cuff obstructing a secondary bronchus, suggesting the tube is too far in; (3) placement in the opposite bronchus, and (4) failure to properly identify the tracheobronchial anatomy.[3] These criteria serve as a useful guide for clinicians in preventing and identifying potential misplacements.

The incidence of DLT malposition has been reported to range from 26% to 37%, with the risk of malposition being particularly high during certain procedures, such as patient repositioning, surgical manipulation, or movements of the head and neck.[4,5] In our case, the displacement of the DLT was most likely attributed to the lateral decubitus position or the surgical traction applied at the pulmonary hilum. This highlights the dynamic nature of thoracic surgery, where factors such as patient positioning and surgical interventions can contribute to changes in tube placement.

Fiberoptic bronchoscopy (FOB) remains the gold standard for confirming the position of the DLT, offering a level of accuracy that far surpasses auscultation alone.[6] Campos et al. demonstrated that the routine use of FOB significantly reduces the rate of malposition.[3] Despite the efficacy of FOB, the need for continuous vigilance is paramount, as displacements can still occur intraoperatively, particularly under conditions of rapid change, such as during surgery or with shifting patient positions.

The incidence of malposition varies depending on factors such as the study population and the specific definition of malposition, but it is relatively common. Malposition can lead to complications such as poor lung isolation, hypoxemia, and increased airway pressure.[7,8] Our case presented a unique challenge of the inability to re-inflate the isolated lung, despite successful deflation and isolation. This complication is not commonly highlighted in the existing literature, making it a rare and noteworthy occurrence in the context of thoracic anaesthesia.

To decrease the risks associated with DLT malposition, we recommend a series of strategies that can enhance both the safety and efficacy of lung isolation procedures. These include: (1) the routine use of fiberoptic bronchoscopy to verify DLT placement both before and after patient repositioning; (2) the establishment of clear protocols for

troubleshooting ventilation difficulties during the procedure; and (3) regular training and simulation sessions for anaesthesia providers on both DLT placement and FOB use. Such strategies are essential to minimizing complications and ensuring optimal patient outcomes during complex thoracic surgeries. The need for precise and cautious management of DLT positioning cannot be overstated, particularly in high-risk surgeries where the balance of ventilation and lung isolation is crucial.

4. Conclusion

This case emphasizes the critical importance of maintaining vigilance and routinely using fiberoptic bronchoscopy (FOB) to confirm double-lumen tube (DLT) placement. It highlights the need for heightened awareness of potential complications, particularly during patient repositioning, which can affect tube placement. Additionally, implementing clear management protocols is essential for addressing issues promptly and ensuring optimal outcomes in thoracic anaesthesia. By following these practices, anaesthesia providers can minimize risks and enhance patient safety during thoracic surgeries.

5. Source of Funding

None.

6. Conflict of Interest

None.

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