

Independent lung ventilation in the management of pneumothorax

Muna Beg, Pantea Mahtosh, Sudhir Rajan, Hekmat Nasiri, Vincent Liu

ABSTRACT

Introduction: Independent lung ventilation (ILV) with double lumen endotracheal tube (DLT) or endobronchial blockade has a known role in managing pneumothorax or by isolating the diseased lung. We report a case in which ILV was used along with a bronchial blocker for treatment of severe persistent pneumothorax (PTX). **Case Report:** We report a 66-year-old female admitted with septic shock and respiratory failure from right lobar pneumonia who developed a right-sided pneumothorax. Despite the placement of two chest tubes, the patient had persistent acidosis and air leak. She required independent lung ventilation with a double lumen endotracheal tube and a bronchial blocker. This isolated the right lower lobe airleak and provided lung protective concordant positive pressure ventilation to the right middle and upper lobes. **Conclusion:** Persistent air leaks in an intubated patient can be challenging. Our case highlights the concept of anatomical lung separation. With this clinicians can to allow provide isolation of the diseased lung, while using other subsegments to maintain adequate gas exchange.

Keywords: Double lumen endotracheal tube, Endobronchial blockade, Independent lung ventilation, Pneumothorax

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INTRODUCTION

Independent lung ventilation (ILV) with double-lumen endotracheal tube (DLT) or endobronchial blockade has a known role in managing pneumothorax or pulmonary hemorrhage by isolating the diseased lung [1]. Pneumothorax can result in cardiovascular collapse and ILV can be used in this situation to achieve adequate gas exchange and promote lung healing [2]. Few prior reports describe the use of ILV to treat concomitant respiratory failure and pneumothorax. We report a case in which ILV was used along with a bronchial blocker for treatment of severe persistent pneumothorax (PTX).

CASE REPORT

A 66-year-old female was admitted to the ICU with septic shock and respiratory failure from right lobar pneumonia. After intubation she developed a right-sided pneumothorax and significant subcutaneous emphysema (Figure 1). Despite placement of two chest tubes, a large

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air leak persisted (Figure 2). Thus, ILV was performed using a DLT to focus ventilation on the left lung. She did well initially, however, as pneumonia developed in the left lung, gas exchange remained a challenge. As a result a right lower lobe bronchial blocker was added to isolate the RLL air leak while allowing for lung protective concordant positive pressure ventilation of the right upper and middle lobes and the left lung with two different ventilators. As seen in Figure 3, there was improved aeration of the RML and RUL subsegments with this technique. Lower pressures were maintained on the right side to promote healing of the bronchopleural fistula (Table 1). This combination achieved marked improvements in oxygenation and ventilation, and correction of her acidosis (Table 2). On hospital day-4 the RLL bronchial blocker was deflated and the air leak had resolved. She had a prolonged hospital course, including tracheostomy, but was decannulated prior to discharge home.

DISCUSSION

Persistent air leaks in the setting of pneumothorax in an intubated patient can be challenging to manage. Anatomical lung separation allows isolation of the diseased parts of lung from the non-diseased parts [1]. ILV allows the practitioner to prescribe ventilator settings select for each lung [3]. Usually, the ventilator can be set to achieve majority of gas exchange with the non-diseased lung, while allowing the diseased lung to heal. Our case

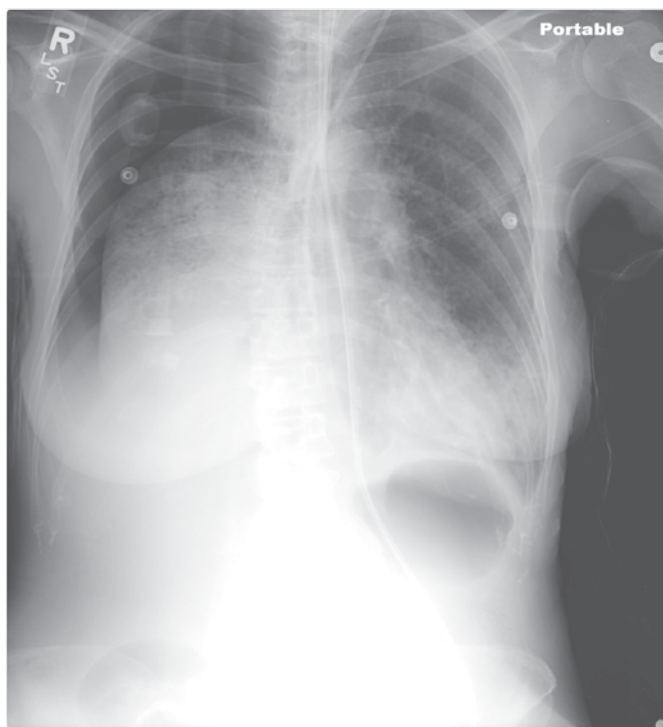


Figure 1: Portable chest X-ray with a right-sided pneumothorax and significant subcutaneous emphysema.

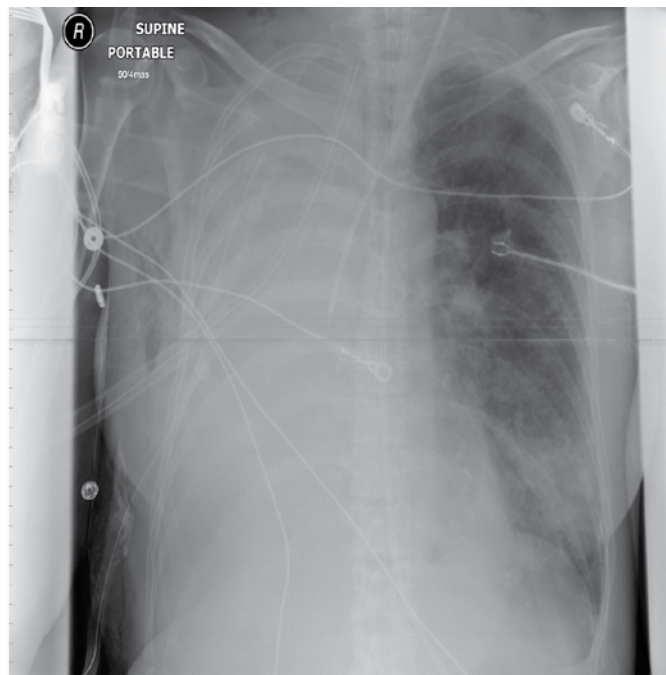


Figure 2: Portable supine chest X-ray after the placement of two right-sided chest tubes. Also seen is a large right-sided pleural effusion and subcutaneous emphysema.

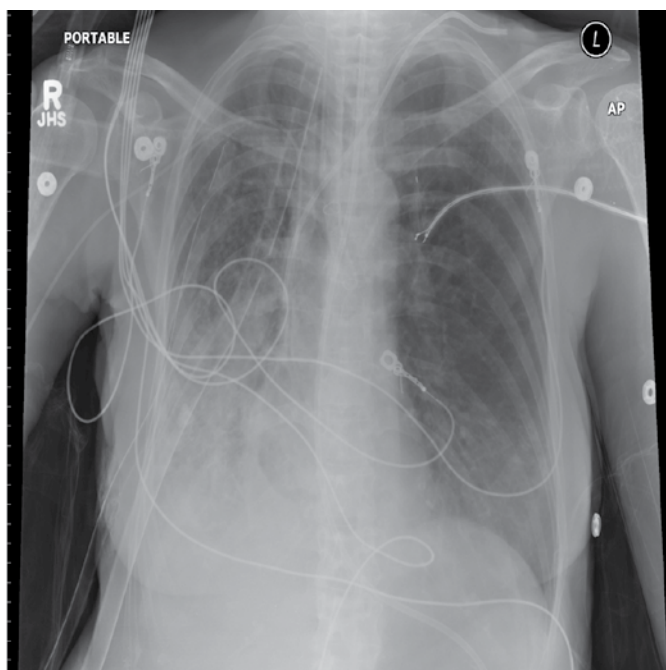


Figure 3: Portable chest X-ray showing improved aeration of the right upper lobe and right middle lobe.

provided a unique challenge where the pneumothorax was in the lung without pneumonia (diseased lung) and additional modalities to isolate the pneumothorax were required.

Review of literature comparing the two modalities, shows that use of a double lumen tube (DLT) is preferred to a bronchial blocker alone, DLT is quicker to place, less

Table 1: Ventilator settings before and after the bronchial blocker

	Mode	Pressure (cm H ₂ O)	PEEP (cm H ₂ O)	FiO ₂ (%)
Right Lung	AC/PC	8	6	70
Left Lung	AC/PC	25	9	90

Abbreviations: AC: Assist-Control
PC: Pressure-Control
PEEP: Positive end-expiratory pressure
FiO₂: Fraction of inspired oxygen

Table 2: Arterial blood gas results before and after the bronchial blocker

	pH	PCO ₂ (mmHg)	PO ₂ (mmHg)
Initial	7.24	74	64
After Bronchial Blocker	7.40	46	78

Abbreviations: PCO₂: Partial pressure of carbon dioxide
PO₂: Partial pressure of oxygen

likely to become malpositioned and preserves access to facilitate bronchoscopy and suctioning [4].

The use of DLT and RLL endobronchial balloon blocker allowed for the air leak to heal, whereas ILV with low tidal volume ventilation to the RML and RUL allowed for improved gas exchange. This method can be useful for clinicians managing a patient with respiratory failure and pneumothorax where less invasive methods do not result in adequate gas exchange.

CONCLUSION

Persistent air leaks in an intubated patient can be challenging. Anatomical lung separation allows isolation of the diseased parts of lung from the non-diseased parts. Our case was unique as the left lung, though initially without pathology, developed worsening consolidation. Thus additional modalities were required to isolate the persistent air leak and RLL pneumothorax. When using a single lung is not enough for oxygenation and ventilation, DLT and a bronchial blocker can provide isolation of the diseased lung, while using other subsegments to maintain adequate gas exchange.

Author Contributions

Muna Beg – Substantial contributions to conception and design, Acquisition of data, Analysis and interpretation of data, Drafting the article, Revising it critically for

important intellectual content, Final approval of the version to be published

Pantea Mahtosh – Analysis and interpretation of data, Revising it critically for important intellectual content, Final approval of the version to be published

Sudhir Rajan – Analysis and interpretation of data, Revising it critically for important intellectual content, Final approval of the version to be published

Hekmat Nasiri – Analysis and interpretation of data, Revising it critically for important intellectual content, Final approval of the version to be published

Vincent Liu – Analysis and interpretation of data, Revising it critically for important intellectual content, Final approval of the version to be published

Guarantor

The corresponding author is the guarantor of submission.

Conflict of Interest

Authors declare no conflict of interest.

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