

Contralateral Tension Pneumothorax During Video-Assisted Thoracic Surgery: A Case Report of A Rare Complication

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ABSTRACT

Spontaneous pneumothorax during one lung ventilation is a life-threatening emergency. We report a case of 60-year-old woman with undergoing video-assisted thoracoscopic surgery (VATS) left upper division segmentectomy for left upper lobe adenocarcinoma. During the operation, the patient developed sudden hypotension and desaturation with increase in airway pressure. Fiberoptic bronchoscopy revealed compressed right-sided bronchus. Intraoperative chest X-ray confirmed the diagnosis of right tension pneumothorax and chest drain was inserted. This case shows the importance of maintaining high level of suspicion to detect and manage such condition.

Keywords: Thoracoscopic surgery; Pneumothorax; Lung

INTRODUCTION

Pneumothorax during one lung ventilation (OLV) is a rare but life-threatening complication.

The incidence is 0.16% among the general population according to one case series.^[1] It can be presented as gradual desaturation or acute haemodynamic collapse if not detected and managed promptly.^[2] Here we present a case of contralateral tension pneumothorax during video-assisted thoracoscopic surgery (VATS) with OLV. We describe the intraoperative management and discuss the importance for early recognition.

CASE PRESENTATION

A 60-year-old non-smoker woman with weight of 60 kg and height of 160 cm was scheduled for an elective left VATS upper division segmentectomy for left upper lobe adenocarcinoma. She has previously diagnosed with right upper lobe lung tumour. She underwent VATS right upper lobectomy in 2023, pathology was papillary adenocarcinoma without lymphovascular invasion or metastasis (pT1aN0). From a follow up computed tomography (CT) of thorax, a subsolid ground glass opacity (GGO) of 15 mm was found at left upper lobe. Fine needle aspiration (FNA) biopsy of left upper lobe GGO showed adenocarcinoma with lepidic pattern. Subsequent positron emission tomography (PET) scan in 10/2024 found fluorodeoxyglucose (FDG) avid left

lung apex ground-glass opacity which was consistent with biopsy proven underlying adenocarcinoma. No suspicious hypermetabolic enlarged mediastinal or hilar lymphadenopathy was noted. Her preoperative lung function test was as follows: forced vital capacity (FVC) 2.51 L (108% predicted), forced expiratory volume in one second (FEV1) 1.96 L (107% predicted) and diffusion capacity for carbon dioxide (DLCO) 19.16 ml/min/mmHg (83% predicted). She had no other significant comorbidities.

In the operating theatre, the patient was put on standard monitoring including pulse oximetry (SpO₂), non-invasive blood pressure (NIBP) and 5-lead electrocardiogram (ECG). A 18G intravenous (IV) cannula was set. Anaesthesia was induced with propofol target-controlled infusion (TCI) at 3 mcg/ml, remifentanyl infusion at 0.1 mcg/kg/min and cisatracurium 14 mg after pre-oxygenation. A 35-French (Fr) left-sided double lumen tube (DLT) (Bronchocath, Mallinckrodt Medical Ltd., Athlone, Ireland) was inserted. After fiberoptic bronchoscope (FOB) assessment, the DLT was fixed at 27 cm at incisors. Anaesthesia was maintained with propofol TCI and remifentanyl infusion. OLV was commenced with pressure-regulated volume-controlled ventilation with a tidal volume (TV) of 300 ml and positive end-expiratory pressure (PEEP) of 3 cmH₂O. Peak inspiratory pressure (P_{peak}) was approximately 20 cmH₂O. The patient was placed on right flexed lateral decubitus position for surgery using 2-port VATS technique.

About 40 minutes after skin incision, gradual tachycardia and increase in airway pressure was noted. Suctioning of DLT was performed which yielded not much sputum or secretion. DLT position was verified with FOB assessment. However, a life-threatening condition suddenly developed with a systolic blood pressure (SBP) of 40 mmHg and a drop in SpO₂ to 60%. Immediate measures to stabilize haemodynamics were initiated including fluid resuscitation and phenylephrine boluses. Two-lung ventilation was resumed with 100% inspired oxygen. No tracheal deviation or dilated neck veins were noted. No end-tidal carbon dioxide (etCO₂) was detected during trial of OLV to right lung, indicating the pathology was likely from the non-operating dependent right lung. Further FOB assessment found collapsed bronchus on the right side and intact right upper lobe stump. Right-sided pneumothorax was suspected. The patient was repositioned to supine position. Chest X-ray (CXR) was performed which confirmed right tension pneumothorax [Figure 1]. A 24 Fr chest drain tube was inserted by surgeon to the right side. Repeated CXR showed re-expanded right lung [Figure 2]. Haemodynamics and SpO₂ of the patient was stable and surgery was resumed. The patient was extubated inside the operating theatre after surgery. Postoperatively both lungs were fully expanded and there was no air leak from chest drains bilaterally [Figure 3]. The right-sided chest drain was removed on postoperative day 2 and the left-sided chest drain was removed on day 3. The patient was discharged on day 5 after surgery.

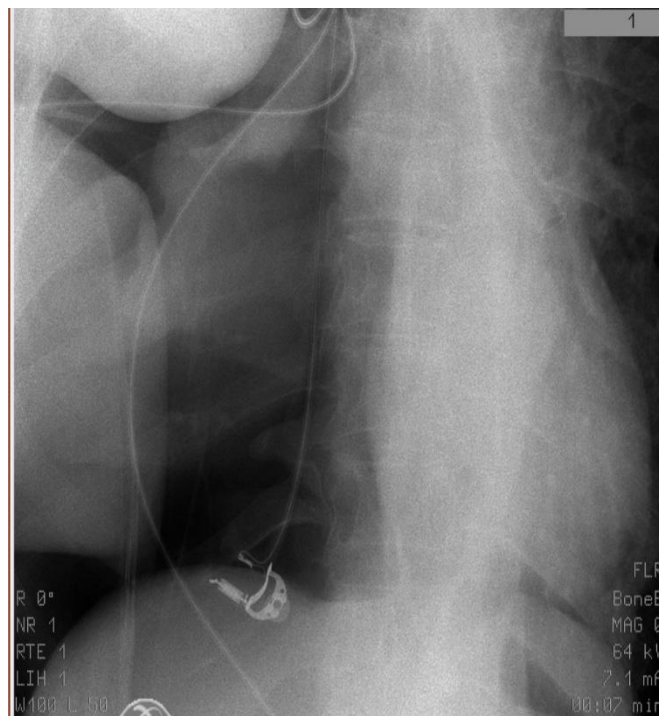


Figure 1: Tension pneumothorax over the right lung with mediastinal shift. (Intraoperative fluoroscopy, limited view only)

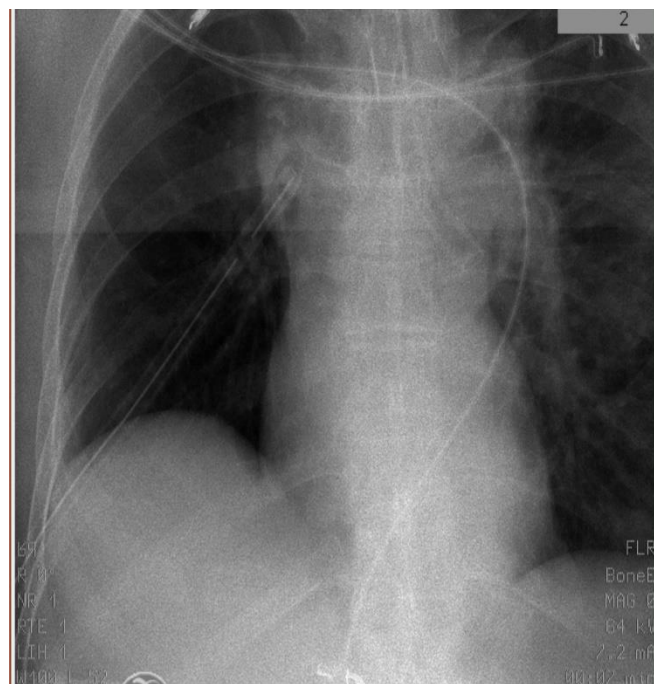


Figure 2: Right lung re-expanded after chest drain insertion. (Intraoperative fluoroscopy, limited view only)



Figure 3: Postoperative day 1 CXR showed both lungs were well expanded and bilateral chest drains were in situ.

DISCUSSION

Pneumothorax is defined as the accumulation of air in the pleural space between the visceral and parietal pleura.^[3] Causes of intraoperative pneumothorax include rupture of emphysematous bullae or blebs, iatrogenic trauma during intubation, central venous catheter or thoracic epidural insertion, and surgical procedures.^[4,5] In the context of OLV, inappropriate size and depth of the DLT can lead to contralateral pneumothorax.^[6,7] If a one-way valve mechanism is present, of which air is allowed to enter the pleural space but egress of air is obstructed, tension pneumothorax can develop and result in haemodynamic compromise. Lee et al.^[8] reported a case of sudden cardiac arrest caused by contralateral tension pneumothorax during right upper lobectomy with OLV and required extra-corporeal membrane oxygenation (ECMO) support.

In our case, 35 Fr DLT is appropriate to the patient's body build and bronchus diameter as measured in CT. DLT position was reconfirmed by FOB. Preoperative CT thorax did not show any emphysematous changes in the right lung. Ppeak was maintained at around 20 cmH₂O with driving pressure (Ppeak - PEEP) of around 17 cmH₂O. It is suggested a Ppeak of >50 cmH₂O is indicative of barotrauma risk during positive pressure ventilation.^[2,5] Even a lower plateau airway pressure of 35 cmH₂O have been associated with an elevated risk of barotrauma in intensive care unit patients.^[12] There was no dehiscence of prior right upper lobe stump.

Detection of pneumothorax during OLV is challenging. Signs, including hypoxaemia, increased airway pressure and hypotension, and non-specific and frequently occur during OLV.^[9] Other differential diagnoses for abrupt severe hypoxaemia include major hemorrhage, malposition of DLT/endobronchial blocker, gas embolism or pulmonary thromboembolism and acute right heart failure.^[10] Systemic approaches for simultaneously diagnosing and managing hypoxaemia during OLV have been proposed.^[5,10] To improve oxygenation, give 100% inspired O₂ and consider switching to manual ventilation. PEEP optimization and recruitment maneuvers

can also facilitate oxygen delivery. Ventilator malfunction or circuit kinking/disconnection should be excluded. FOB can help verify DLT position, assess for bronchospasm and suction out any secretions. Intravenous fluid and vasopressor boluses should be given as appropriate. Lung ultrasound (USG) is reported to be valuable in diagnosing intraoperative pneumothorax with high accuracy.^[2,5,9] Absence of lung sliding, barcode sign and presence of lung point are signs of pneumothorax on USG. Continuous positive airway pressure (CPAP) or oxygen insufflation to operative lung can be considered if no other cause of desaturation can be identified. Total intravenous anaesthesia technique can also relieve hypoxaemia by preserving hypoxic pulmonary vasoconstriction and maintaining ventilation-perfusion matching. Above all, anaesthesiologist should maintain early and effective communication with surgeon.

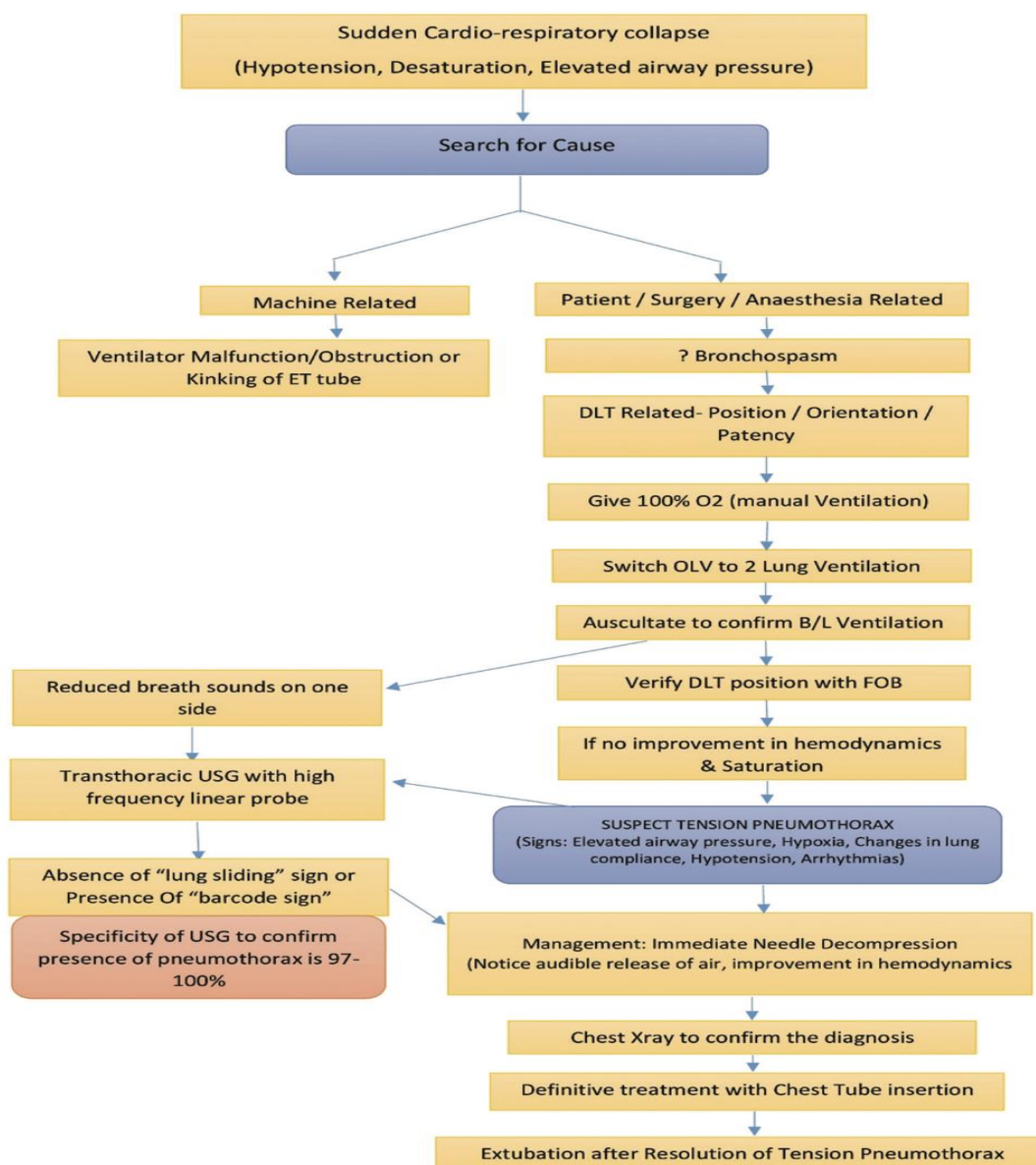


Figure 4: Flow chart for management of hypoxaemia during OLV. **Source:** Prasad N, Gaiwal SS. A Case of Life-Threatening Contralateral Tension Pneumothorax during Video-Assisted Thoracic Surgery in a Patient with Retrosternal Goiter. Ann Card Anaesth. 2025;28(1):72-75.

In our case, no trachea deviation was detected upon palpation. It could be explained by the balance of pressure between the pneumothorax in the right pleural cavity and the iatrogenic capnothorax of the operative left lung. Moreover, the surgical drapes covering the patient and the lateral decubitus positioning made recognition of dilated veins difficult.

Gold standard for relieving tension pneumothorax is decompression with a 14G needle at the 5th intercostal space, anterior to mid-axillary line.^[11] For our patient, the blood pressure and SpO₂ was stabilized when the suspicion of pneumothorax was made, and cardiothoracic surgeon was immediately available for prompt chest drain insertion. Therefore, needle decompression was not performed.

CONCLUSION

Tension pneumothorax during OLV in VATS is potentially fatal and requires prompt action. Anaesthesiologists should maintain constant vigilance and prepare to manage such complication in close coordination with thoracic surgeons.

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