



## Case report

## Anaesthetic management of intraoperative tracheo-bronchial injury

Shivinder Singh, MBBS, MD<sup>\*</sup>, Anurag Garg, Navdeep Lamba, Vishal

Department of Anesthesia &amp; Intensive Care, Command Hospital, Chandimandir, 134107, India



## ARTICLE INFO

## Keywords:

Airway injury  
Tracheo bronchial rupture  
One lung ventilation  
Tracheal repair

## ABSTRACT

Intraoperative tracheobronchial injury (TBI) may manifest clinically as pneumothorax, pneumomediastinum, subcutaneous emphysema, cyanosis, and respiratory insufficiency and has serious implications if it remains undetected or is managed improperly. The outcome of such injuries is affected by the extent of the lesion, pulmonary status & the surgical reconstruction undertaken. The recommended airway management of an intraoperative tracheal tear is to bypass the injured side by intubating the healthy bronchus with a single lumen endotracheal tube (ETT) and the use of a bronchial blocker or double lumen endotracheal tube (DLT) and becomes a very challenging situation.

We report successful anaesthetic management of an accidental traumatic rupture of the left main bronchus during surgical dissection in an elderly lady of Carcinoma Oesophagus who underwent a Video Assisted Thoracoscopic surgery (VATS), and was managed by one lung ventilation of the contralateral (right) side manipulating the same DLT and lung protective ventilation.

## 1. Introduction

Intraoperative tracheobronchial rupture is a rare but a serious complication which results either due to dissection during chest surgery or during endotracheal (ET) intubation. It is a potentially a fatal injury and manifested by difficulty in breathing, inadequate oxygenation, bloody sputum, discomfort behind the sternum and subcutaneous emphysema [12], (see Fig. 1)

Most of TBI occurs within 2.5 cm of the carina, and require a fibroptic Bronchoscopy to diagnose a tracheal tear and determine its severity and extent. Management of such cases is a challenging situation as it requires a right-sided thoracotomy with One-lung ventilation [1–3]. It is essential to maintain spontaneous ventilation until a definitive airway is established as positive pressure ventilation may further enhance the extent of the tracheal dissection.

## 2. Case report

A 60 year old female patient, with no known comorbidities, a case of Ca Oesophagus (adenocarcinoma) was posted for Transthoracic Esophagectomy under laparoscopic guidance (Video Assisted Thoracic Surgery -VATS). She was accepted in ASA grade-II for surgery under General anaesthesia with one lung ventilation (OLV).

Standard protocol for General anaesthesia was followed and a left

sided double lumen tube (DLT) was placed under fibroptic guidance. Anaesthesia was maintained using O<sub>2</sub> air and Sevoflurane at 1–2% concentration with the FiO<sub>2</sub> & PEEP being delivered to maintain oxygen saturation in excess of 92%. Arterial blood-gas (ABG) analysis, at the start of surgery, with a FiO<sub>2</sub> of 0.8 was, PaO<sub>2</sub> (322 mmHg), pH (7.44), PaCO<sub>2</sub> (31 mmHg).

Video Assisted (Laparoscopic) right thoracoscopy was performed to approach the carina and the oesophagus, with the patient in prone position. After around 2 hours of surgery, once the surgeon was dissecting the tracheal Lymph nodes near the carina, there was sudden fall in Tidal volume delivered to the patient along with fall in patient's oxygen saturation to 60%. We checked the circuit for leaks, but found nothing. On further investigation, the blue bronchial cuff of the DLT was visualized on video monitor and a diagnosis of accidental rent in the Left main bronchus was made. Arterial blood gas (ABG) analysis, confirmed hypoxic status of the patient PaO<sub>2</sub> (54 mmHg), pH (7.08), PaCO<sub>2</sub> (80 mmHg).

The surgery was immediately stopped and it was decided to repair the rent before proceeding further. In order to avoid the loss of airway control by taking out the DLT and using a new Right sided DLT, we decided to manipulate the same Left sided DLT into the right main stem bronchus. The position of the DLT was verified with a fiber-optic bronchoscope and the repair of tracheal tear was carried out by right sided single lung ventilation. The right upper lobe was collapsed with a lung

<sup>\*</sup> Corresponding author.

E-mail addresses: [sshivinder@hotmail.com](mailto:sshivinder@hotmail.com) (S. Singh), [anu6779x@gmail.com](mailto:anu6779x@gmail.com) (A. Garg).

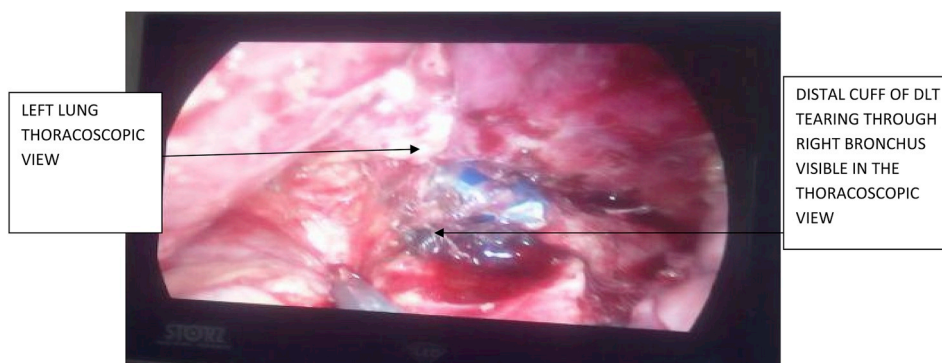


Fig. 1. Intraoperative view of tracheal rent & distal cuff of DLT.

retractor prior to inflation of the cuff of the Lt DLT as the surgeon wanted a better approach to the trachea, and the remaining right lung (middle & lower lobe) was ventilated with a peak inspiratory pressure of less than 27 cm H<sub>2</sub>O to avoid ventilator induced lung injury (VILI).

In order to have better ventilation control and to avoid ventilator induced lung injury (VILI), we shifted the patient from the Anaesthesia work station to an ICU ventilator (Galileo<sup>R</sup>), with the ventilator settings of LUNG PROTECTIVE ventilation in pressure regulated volume control mode (PRVC) with: FiO<sub>2</sub>0.5, tidal volume 6mlKg<sup>-1</sup>, PEEP of 8 cmH<sub>2</sub>O ensuring a peak pressure of less than 28 cm H<sub>2</sub>O and a respiratory rate, of 28 min<sup>-1</sup>. The inhalationals were stopped and anaesthesia managed with total intravenous anaesthetics- Inj Ketamine iv 1mgKg<sup>-1</sup> bolus and then 1mg kg<sup>-1</sup>Hr<sup>-1</sup> as continuous infusion, Inj Dexmedetomidine iv 50mcg bolus and then 10 mcg/Hr as continuous infusion, Inj Propofol iv intermittent boluses as and when required and Inj Atracurium iv 25mg bolus and then 15mg Hr<sup>-1</sup> as continuous infusion. A right thoracotomy was performed to repair the defect in the left main bronchus.

After the repair of the defect, the primary repair for excision of oesophagus with gastric pull up continued and then the DLT was changed to a single lumen ET. The patient remained stable throughout the surgery.

In view of the intraoperative complication and airway surgery, the patient was ventilated overnight in ICU on PRVC mode and extubated the next day after a spontaneous breathing trial.

Adequate post-operative pain relief was ensured by giving an epidural bolus of 3mg Morphine dissolved in 10 ml of normal saline and a continuous infusion 0.125% bupivacaine at 5 ml per hour using an elastomeric mechanical pump. This was supplemented with injection Acetamenophen 1000mg iv and Fentanyl intermittently.

### 3. Discussion

The essentials of the anaesthetic management, in a case of Tracheobronchial rupture is ensuring adequate ventilation and protection of the airway. This becomes challenging in view of the obvious inadequacy of gas exchange, unstable hemodynamics and anatomical difficulty in repair of the lesion that are encountered in this situation. Conventional ventilation with an endotracheal tube and intermittent positive pressure ventilation will result in an air leak causing inadequate ventilation or a total loss of tidal volume including anaesthetic gases through the ruptured airway. The concern therefore, remains to isolate the injured airway/lung with a DLT, or a bronchial blocker. Isolation and ventilation using a DLT is preferable as in addition to facilitating the ease of the surgical repair, it also ensures adequate ventilation without high-pressure on the suture lines [4-6].

The goals of ventilation should be to maintain Etco<sub>2</sub> in a range to keep pH more than 7.30, target peak pressures less than 27 cm H<sub>2</sub>O and PEEP to be adjusted to achieve SpO<sub>2</sub> greater than 92% at all times. To decrease the likelihood of hypoxaemia and atelectasis, the ventilation methods adopted during OLV are either (i) a high tidal volume (Vt)

(10–12 ml kg<sup>-1</sup>) without PEEP or (ii) a moderate tidal volume (6–8ml kg<sup>-1</sup>) with PEEP [7,8], but a high tidal volume strategy may result in over distension of alveoli leading to acute lung injury and higher levels of cytokines [9]. Pressure controlled ventilation (PCV), with the decelerating flow pattern, has been shown to provide better arterial oxygenation.

In this case isolation of the left lung was the only option since the left main bronchus was perforated and a left sided tube could not be placed. The right upper lobe was collapsed using gentle retraction to approach the oesophagus and the Lt Main bronchus. Except for mild hypoxaemia and hypercarbia the patient remained stable during the procedure. Early diagnosis and accurate clinical assessment were crucial in the successful outcome of our case.

### 4. Conclusion

To summarize, in the setting of a catastrophic airway injury, ensuring adequate gas exchange should be the foremost priority followed by provision of best possible conditions to the surgeon to achieve a robust repair of the injured airway.

The highlights of the anaesthetic management, in this case were.

- The same DLT was used by guiding the tip into the uninjured right main bronchus with FOB guidance to avoid loss of airway and avoid unnecessary tissue handling since the collapse of the Rt Upper lobe was required for the surgeon to be able approach the Lt main Bronchus.
- Use of Lung protective ventilation in PRVC mode while the patient was undergoing surgery.

To conclude, early diagnosis and aggressive ventilatory management are the keys for good functional recovery in a case of intraoperative airway injury.

### Consent

Written informed consent was obtained from the NOK of patient for publication of this manuscript and accompanying images. A copy of the written consent is available.

### Declaration of competing interest

The authors declare that they have no conflict of interest.

### Acknowledgments

We thank our patient's NOK who gave written permission to publish his case.

No external funding was obtained.

**References**

- [1] F.A.M. Herbella, A.F.C. Machado, D.M. Cardoso, Subcutaneous emphysema due to airway rupture after chronic endotracheal intubation, *Clin. Intensive Care* 15 (2/3) (2004) 109–110.
- [2] E.H. Chen, Z.M. Logman, P.S.A. Glass, T.V. Bilfinger, A case of tracheal injury after emergent endotracheal intubation: a review of the literature and causalities, *Anesth. Analg.* 93 (5) (2001) 1270–1271.
- [3] M. Beiderlinden, M. Adamzic, J. Peters, Conservative treatment of tracheal injuries, *Anesth. Analg.* 100 (1) (2005) 210–214.
- [4] H.S. Hofmann, G. Rettig, J. Radke, H. Neef, R.E. Silber, Iatrogenic ruptures of the tracheobronchial tree, *Eur. J. Cardiothorac. Surg.* 21 (2002) 649–652.
- [5] C.P. Chu, P.P. Chen, Tracheobronchial injury secondary to blunt chest trauma: diagnosis and management, *Anaesth. Intensive Care* 30 (2002) 145–152.
- [6] H. Wulf, R.J. Elfeldt, A. Hückstädt, Diagnosis and therapy of tracheal rupture after blunt thoracic trauma, *Anesthesiol. Intensivmed. Notfallmed. Schmerzther* 32 (1997) 258–262.
- [7] P. Michelet, X.B. D'Journo, A. Roch, et al., Protective ventilation influences systemic inflammation after esophagectomy: a randomized controlled study, *Anesthesiology* 105 (2006) 911–919.
- [8] P. Slinger, Pro: low tidal volume is indicated during one-lung ventilation, *Anesth. Analg.* 103 (2006) 268–270.
- [9] J. Lohser, One-lung ventilation calls for one-lung recruitment, *Anesth. Analg.* 104 (2007) 220–221.