

Prebronchoplasty ventilation maneuver: Steering the outcome in the management of bronchial injuries!

ABSTRACT

Bronchial injuries are infrequently seen following blunt chest trauma and mostly have subtle clinical presentation. Its diagnosis is challenging and may be delayed resulting in myriad complications such as secondary infection, bronchiectasis, atelectasis, collapse, and fibrosis. We discuss the anesthetic management of a case of complete right principle bronchus transection with distal lung collapse, posted for surgical repair and highlight the unique intraoperative ventilation maneuver to identify the functional lung segment. This unique yet less recognized ventilation maneuver of the collapsed lung segment was performed just before bronchoplasty. The aforesaid maneuver may act as a pointer for further surgical course and a useful diagnostic and therapeutic modality in ensuring the eventual outcome in this subset of patients.

Key words: Bronchus; chest trauma; cross-field; lung; maneuver; ventilation

Introduction

Bronchial injuries are infrequently seen following blunt chest trauma with varied clinical presentation, ranging from subtle to life-threatening, depending on the site of injury.^[1-7] Right main bronchus (RMB) is one of the most common sites involved in intrathoracic tracheobronchial injuries.^[2] Due to covert presentation, its diagnosis is challenging and may be delayed resulting in complications such as secondary infection, bronchiectasis, atelectasis, collapse, and fibrosis.^[2,4] We discuss the anesthetic management of case of complete right principle bronchus transection with distal lung collapse, posted for surgical repair and stress upon the unique intraoperative ventilation maneuver to identify the functional lung segment. This distinctive maneuver may act as a pointer for further surgical course and may eventually affect the outcome in this subset of patients.


Case Report

A 20-year-old male with history of blunt trauma chest was presented in emergency room with a diagnosis of right hemopneumothorax, for which thoracostomy tube was immediately inserted and kept on intravenous (IV) analgesics and empirical antibiotics. During his hospital stay, he subsequently developed high-grade fever, dry cough, and deterioration of vital parameters. Contrast-enhanced computed tomography (CECT) chest manifested right pyopneumothorax with underlying lung collapse and RMB “cutoff” sign just below the tracheal bifurcation with no evidence of any endobronchial lesion or extrinsic compression [Figure 1]. Flexible bronchoscopy revealed normal trachea and bifurcation but with completely occluded RMB around 2 cm from the carina and a large bronchopleural fistula communicating with the RMB and fluid collection

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in pleural cavity. A diagnosis of RMB tear was made, and immediate exploration with possible bronchial resection or further reconstruction was planned.

After taking written informed consent, the patient was shifted to operating room, standard monitors were applied, and IV access attained. An epidural catheter (18 gauge) was threaded in epidural space at T₇₋₈ thoracic level, and ultrasound-guided central venous pressure catheter was inserted in the right internal jugular vein. After ensuring proper working of chest drain and subsequent drainage of pleural fluid, the patient was positioned in slight head-up with 30° right lateral-tilt, with aim to isolate the left lung of contamination from possible spillage of purulent secretion from right lung, during induction of anesthesia.^[8] General anesthesia was instituted (induction: fentanyl [200 µg IV], propofol [100 mg IV]; muscle relaxation: vecuronium bromide [10 mg IV]; maintenance: 40:60 oxygen-nitrous oxide mixture and isoflurane [1%–2%]) in the aforesaid position. The patient trachea was intubated with flexible fiberoptic bronchoscope-guided, left-sided, double-lumen tube (37 French gauge) to avoid accidental malpositioning of the tube in RMB and was subsequently kept on pressure control mode of ventilation.

Surgeons planned for right posterolateral thoracotomy. The unhealthy pleura and overlying organized membrane was decorticated, and both transected bronchus segments openings were identified. Surgeons planned for bronchoplasty of affected bronchial segment but were doubtful of reexpansion of collapsed distal lung. They have a strong apprehension that in case of irreversible collapse of distal lung segment they might have to plan later for segmental lobectomy or even pneumonectomy.

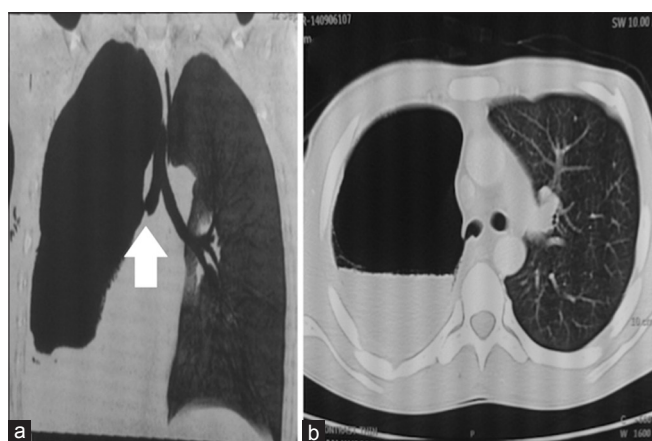


Figure 1: Contrast-enhanced computed tomography chest. (a) White arrow showing right main bronchus “cutoff” sign. (b) Computed tomography slice showing right pyopneumothorax with underlying lung collapse

After discussion with surgeons, we planned for a unique ventilation maneuver to establish the functionality of the affected lung segment. We planned for insertion of an endotracheal tube (ETT) in the distal transected bronchus and subsequent intermittent ventilation (with 50% air in oxygen) with a separate anesthesia circuit and machine (pressure control ventilation mode, peak airway pressures ≤ 14 mmHg) for checking the lung expansion in the affected area [Figure 2]. As the average diameter of RMB is approximately between 14 and 18 mm,^[9,10] a sterile uncuffed polyvinyl chloride ETT of 5 mm internal diameter with outer diameter of 6.7 mm (Teleflex®, Teleflex Medical Sdn Bld, Malaysia) was selected for uninhibited insertion [Figure 2]. We observed a slow but definite reexpansion of the collapsed segment after 15 min of ventilation. Subsequently, bronchoplasty (end-to-end anastomosis of transected segments of RMB with interrupted sutures of 5-0 vicryl) was performed and further plan for segmental lobectomy of collapsed segment was deferred. Rest of the surgery and postoperative period remain uneventful. In due course, the patient’s chest X-ray and CECT chest showed optimum expansion with effort tolerance and was subsequently discharged without any further complications.

Discussion

Patients presenting with blunt trauma to the chest with subtle bronchial injuries have nonspecific symptoms. Most of these injuries may be sealed by peribronchial tissues with minimum air leak.^[4] Ventilation may continue through the torn area and delay the diagnosis. However, due to incomplete obstruction, there is possibility of inadequate removal of secretion leading to underlying lung atelectasis and infection.^[4] Surgical repair of bronchus in such situation is advocated; nevertheless, the

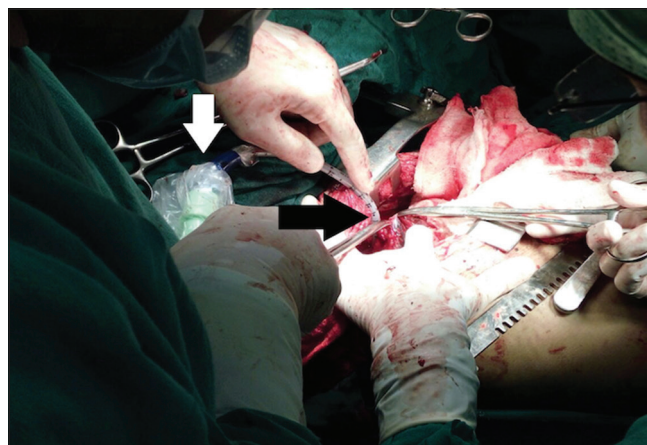


Figure 2: Black arrow showing endotracheal tube insertion in right main bronchus and white arrow showing attachment of additional anesthesia circuit with universal connector of endotracheal tube

long-term prognosis depends on the time interval between diagnosis and treatment, condition of distal transected lung, and associated vessel injury.^[11]

In the present case, the diagnosis of complete RMB transection was made by CECT chest and bronchoscopy. Radiographic abrupt “cutoff” of bronchus and lung-drop below the level of carina also called “fallen lung sign” may assist in confirmation.^[4,5] The definitive diagnosis is made on the basis of bronchoscopy, to delineate the exact location and possible nature of lesion.^[4,7] In addition, radionuclide perfusion scans, if available, may also be used as a diagnostic modality to assess the vascularity of collapsed segment.^[4]

A unique yet less recognized ventilation maneuver of the atelectatic lung segment, rarely mentioned in literature,^[4] was performed just before bronchoplasty. The aforesaid maneuver falls in the bracket of “cross-field” ventilation, conventionally employed during tracheal reconstruction, particularly with defects around carina.^[12] This maneuver proved to be efficacious in the evaluation of functional lung segment. With this maneuver, regular lung expansion and deflation can be achieved and therefore may provide the information of the compliance and elasticity of the collapsed lung.^[4] This maneuver may also benefit the affected functional lung by regaining lung growth in postoperative period.^[4] Further, it may also provide supplementary mode of oxygenation to decrease the shunt fraction. In addition, it may furnish useful information regarding the reversibility of collapsed segment, which may direct the course of surgical management. In conditions of irreversible lung segment, the option of lobectomy or pneumonectomy may be considered. Opting for the aforesaid surgical intervention may directly influence the overall morbidity in this subset of patients.

Conclusion

Bronchial injuries are a challenge from detection to subsequent management. A comprehensive plan should be

formulated to deal with the complex nature of the injury. The above-mentioned differential ventilation strategy may act as a useful diagnostic and therapeutic modality in ensuring the eventual outcome in this subset of patients.

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Conflicts of interest

There are no conflicts of interest.

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