

Complete bronchial transaction due to severe blunt trauma and chest; treatment and outcomes : A distinct entity

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Abstract

An 18-year-old male patient came to the emergency department with history of severe blunt trauma. He was having respiratory distress and diagnosed as bronchial injury on the right side. A chest tube was put immediately and there was continuous air leak in the form of air bubbles in the intercostal chest tube bag with each inspiratory effort. Chest injury can be a life-threatening condition, if not managed timely and properly. Bronchoscopy showed injury over the right main bronchus. The features of this uncommon entity are discussed, with special emphasis on early diagnosis and surgical management.

Keywords: Air-leak, asphyxia, traumatic, broncho-pulmonary, fistula, surgery

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Introduction

The first case of traumatic ruptured bronchus was reported by Webb in 1848 observed following post-mortem examination, in a man, who was run over by a cart. Primary successful repair was done by Scannell in 1951.^[1] Tracheobronchial injuries are rare and occur in less than 1% of patients following blunt chest trauma.^[2] Delay in diagnosis is the single most important factor influencing the outcome. Early bronchoscopic examination and chest X-ray are the important part of investigations in emergency. Intercostal chest tube drainage (ICTD) is the first line of treatment to relieve respiratory distress in the chest trauma cases. We encountered a case of complete transaction of the right bronchus which was managed successfully surgically. A repair of the

disrupted right main bronchus was performed with a complete preservation of the right lung.

Case Report

An 18-year-old young male was brought to the emergency in Government Medical College and Hospital tertiary care center, with complaint of trauma. The patient had a history of being buried under the falling wreckage of an old building. He was irritable and disoriented. His pulse was 110/min, blood pressure 130/90 mm Hg, and respiratory rate 60/min with central type of cyanosis. There was bilateral extensive subcutaneous surgical emphysema over the chest and abdomen. On auscultation, distinctive crunching sounds were present with each respiration predominantly on the right side. Abdominal examination was normal. He was put on oxygen at the flow rate of 4–6 l/min with venti-mask. But his Po₂ and cyanosis did not improve.

Intercostal chest tube (ICT) was put in 5th intercostal space, in midaxillary line on the right side which was followed by continuous and massive air leak, corresponding to massive bronchopulmonary fistula (BPF) grade III. Even after chest intubation his respiratory parameters were same.

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On chest X-ray, right-sided pneumothorax with complete collapse of the right lung was found. There was no evidence of fractured ribs. The patient's dyspnea worsened over a couple of hours and with gradual decrease in oxygen saturation. Arterial blood gas (ABG) analysis showed respiratory acidosis.

At this point of time intermittent positive pressure ventilation (IPPV) was considered and the patient was intubated in emergency. Then patient was shifted to the operation theater for bronchoscopy. Alarmed by the mounting respiratory distress, urgent bronchoscopy was done which showed pooled blood in the right main bronchus which was also trickling into the left main bronchus and trachea. Bronchoscope could not be negotiated further into the right main bronchus due to loss of continuity of the bronchial tube; hence the patient was diagnosed to have traumatic complete right main bronchus disruption.

After proper resuscitation, right lateral thoracotomy was done through the fifth inter-costal space and part of the fourth, fifth rib removed to improve the access. The right lung was completely collapsed with intact pulmonary hilum. There was approximately 500 ml of blood pooled in the pleural cavity. The right main bronchus was completely transected 1 cm distal to carin.

We tried to procure a double-lumen tube, but it was not available in hospital. An attempt was made to redirect the endo-tracheal tube into the left main bronchus to improve ventilation but failed. Occlusion of the disrupted right main bronchus was achieved during operation by means of finger insertion in the proximal bronchial stump to improve oxygenation intermittently while the repair was done. Reconstruction of the bronchus was done with 3-0 Vicryl interrupted sutures and the anastomosis was reinforced with pleural patch. Thorax was closed over the two ICTD placed in apico-anterior and postero-basal location of the rib cage at the sixth intercostal space.

Postoperatively, the patient was put in IPPV mode with the following settings: rate 14 breaths per minute. His ventilator breaths were set at a VT (Tidal Volume) of 350 ml with and FiO_2 of 40 %. Airway pressures were kept up to 19 cm H_2O . CPAP or PEEP was avoided for fear of provoking an anastomotic leak. As his condition improved over the next couple of days, he was put in SIMV mode with a pressure support of 10 cm H_2O , while decreasing the ventilator delivered breath rate to 8 breaths per minute, maintaining an FiO_2 of 50 % and keeping the airway pressure up to 19 cm H_2O . He was able to generate 10-12 breaths of his own with

a VT (tidal volume) of 75-200 ml. Minute ventilation was less than 8 l/min.

On the fourth day, his pressure support was decreased to 6 cm H_2O while maintaining the same tidal volume. After 4 hours, a trial of weaning was given, and based on stable spontaneous parameters, ABG and clinical conditions, he was removed from the ventilator and put on a "T-piece" breathing 50% oxygen for 4 hours. A postoperative chest X-ray showed no pneumothorax with chest tubes *in situ* [Figure 1].

The patient was extubated on the 4th postoperative day but he continued to have features of upper respiratory tract obstruction due to laryngeal edema. To further ease the patient's respiration, formal tracheostomy was done on the 5th day. A repeat chest X-ray on the 8th day showed complete resolution of surgical emphysema bilaterally [Figure 2]. He was put on broad spectrum antibiotics, analgesics, and chest physiotherapy. The patient was discharged in satisfactory condition with tracheostomy tube removed on the 16th postoperative day [Figure 3]. The patient is on regular follow-up and doing well.

Discussion

Tracheobronchial injuries (TBI) can be associated with blunt trauma. Patients with TBI present with acute signs and symptoms in the form of severe dyspnea, cyanosis, major air leak, surgical emphysema, and a Hamman's crunch with pneumothorax.^[3] Louis Hamman described distinctive chest noise and emphasized their association with pneumo-mediastinum and pneumothorax in 1937.^[3]

In a collective review of 256 patients with TBI, motor vehicle accidents were the most frequent (59%) cause of injury.^[1,4] Bronchial injuries occur in 0.4-1.5% cases of blunt

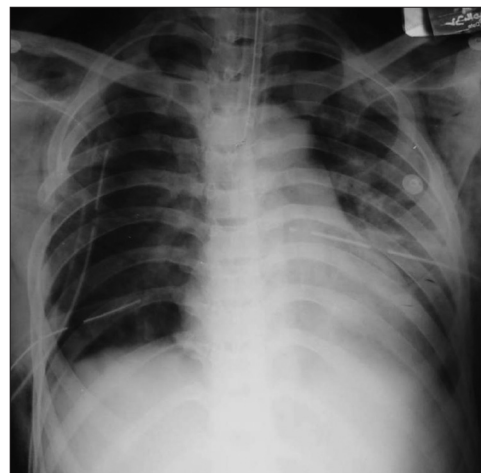


Figure 1: Postoperative chest X-ray showing resected ribs on the right side and intercostal drainage tubes on both sides of the chest



Figure 2: Repeat check X-ray showed complete resolution of surgical emphysema bilaterally. A tracheostomy tube seen and chest tube *in situ* on the right side

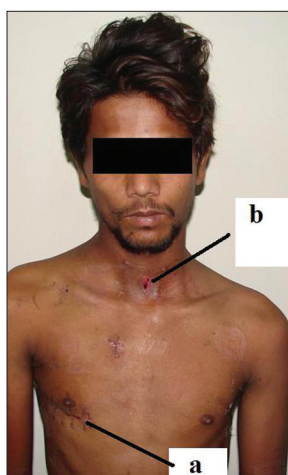


Figure 3: Photograph of the patient (a) healed scar mark on the right side; (b) healed tracheostomy side

trauma chest. The overall mortality has declined from 36% before 1950 to 9% since 1970. The injury occurred within 2 cm of carina in 76% of patients, whereas 43% patients had injuries within first 2 cm of the right main bronchus.^[1,4] Injuries on the right side were detected and treated sooner but were associated with a higher mortality than the left side injuries.^[1] The pathophysiology of the bronchial rupture includes - a decrease in the anteroposterior diameter of the thorax and sudden increase in intrabronchial pressure with a closed glottis.^[5] If continuous air leak will present in an airway injury, then there may be chances of increased subcutaneous emphysema, but the absence of emphysema does not rule out an airway tear.^[6]

However, if the trachea or proximal left main bronchus is involved the air will commonly dissect centrally producing mediastinal and cervical emphysema.^[7] Failure to re-expand the lung with a chest tube under suction should increase the suspicion of a persistent leak from an airway injury.

It is necessary to preserve the pulmonary parenchymal function in the case of severe chest trauma as emergency pneumonectomy is associated with high mortality.^[8]

Bronchoscopy is necessary in the operation room with preparation for surgery.^[9] Occasionally an abnormal course of mainstem bronchus or a “fallen lung” sign featuring a collapsed lung in dependent position, hanging on the hilum only by its vascular attachments may allow computed tomography diagnosis of a blunt traumatic bronchial injury.^[2] Those patients who have minimal sign and symptoms should be treated conservatively, while those patients presented with respiratory distress, continuous air-leak on ICTD require emergency surgery.

Summary

- High index of suspicion is required in trauma and respiratory distress.
- Delay in diagnosis is the single most important factor influencing the outcome.
- Accurate pre-intra-postoperative management.
- First rib # associated with aortic injury 20%, bronchial # 80%, mortality 20%.
- Patients with chest wall instability require longer ventilatory support.
- Meticulous surgical technique.
- Optimal functional pulmonary parenchymal preservation is desirable as pneumonectomy is associated with high mortality.

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