

Left Main Bronchus Rupture due to Blunt Trauma Necessitating Pneumonectomy in a 6-year-old Boy: A Case Report

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ABSTRACT

Tracheobronchial injuries following blunt chest trauma are uncommon in children and usually present with acute signs and symptoms in the form of severe dyspnea, cyanosis, major air leak and surgical emphysema. In the present case report, a 6-year-old boy with left main bronchial rupture and complete collapse of the left lung following blunt chest trauma and unresolved left-sided pneumothorax 5 days

after tube thoracostomy is introduced. Bronchoscopic examination showed severe injuries to the left main bronchus. Left posterolateral thoracotomy was performed. During the operation, we found a complete non-repairable T-shaped rupture in the left main bronchus at the proximal side associated with separation of the distal side. Due to post-bronchorrhaphy stenosis, pneumonectomy was performed.

Keywords: Bronchial T-shaped rupture; Blunt trauma; Pneumonectomy

INTRODUCTION

Tracheobronchial ruptures following blunt thoracic trauma are rare in children. This type of injury is usually associated with major trauma and associated injuries such as ribs fractures, pulmonary contusion, heart damage and damage to the great vessels. Early diagnosis and appropriate medical interventions can reduce the incidence of morbidity and mortality due to the chronic bronchopleural fistula, empyema, and mediastinitis [1]. We report a case of a 6-year-old boy with complete non-repairable T-shaped rupture in the left main bronchus after blunt chest trauma who was treated by pneumonectomy due to post-bronchorrhaphy stenosis.

CASE REPORT

On 14th April 2013, a 6-year-old boy who fell down from a pickup truck was admitted to the emergency department of the Ali-Ebn-Abitaleb Hospital in Rafsanjan. On arrival, the patient was very agitated, briefly cyanotic and had severe respiratory distress. He had a Glasgow Coma Scale score of 13 and his vital signs were as follows: pulse rate 120/min, blood pressure 105/65 mm Hg, respiratory rate 40/min and oxygen saturation was 79-80% by oxygen mask.

On physical examination, positive findings were as follows: decreased excursion of the left hemithorax, ipsilateral diminished breath sounds, right tracheal deviation, and severe thoracic subcutaneous emphysema. A diagnosis of tension pneumothorax was made and tube thoracostomy was performed. Continuous and massive air leak was observed after thoracostomy. Respiratory distress subsided after tube thoracostomy and oxygen saturation level increased up to 98%. The initial chest X-ray and thorax computed tomography (CT) scan demonstrated a left pneumothorax and complete collapse of the left lung [Figure 1]. The patient was admitted to the intensive care unit (ICU). On the second day of admission, tube thoracostomy was connected to the negative pressure due to failure of pulmonary re-expansion. Although the air leak stopped after four days, the involved lung failed to expand and accordingly other pathologic conditions including severe bronchial injuries or bronchial foreign body were suspected. Bronchoscopy was performed for further evaluation. A piece of bronchial tissue was observed at the distal left main bronchus. Bronchial cartilage at the proximal end was exposed after removal of the ablated piece of bronchus which was suggestive of bronchial rupture. A left posterolateral thoracotomy was undertaken through the fifth

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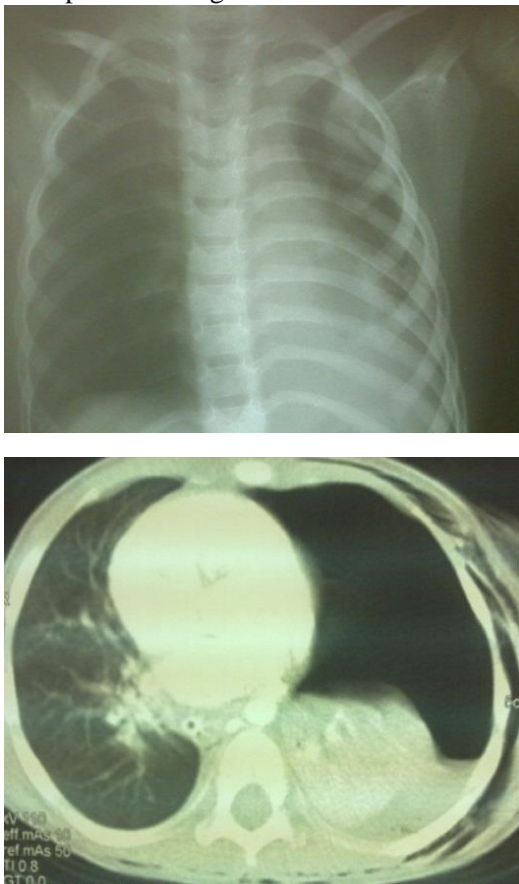
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intercostal space. Little amount of serosanguinous secretions and some fibrin clots were observed within the pleural cavity. The left lung was completely collapsed without any ventilation and apparent tissue injuries. The left main bronchus was completely transected and separated 1.5 cm distal to the carina. There was a 1 cm gap between the two bronchial ends. There was also a longitudinal tear in the proximal end of the transected left main bronchus. The longitudinal rupture was repaired by the sutures of 5/0 prolene; however, the diameter of lumen decreased up to 50%. Since the bronchial stenosis could result in many complications such as recurrent pneumonia, bronchiectasis and atelectasis, and finally growth disorder in children, therefore, pneumonectomy was preferred. After ligation of the pulmonary hilum vessels, pneumonectomy was performed and tube thoracostomy was inserted. The patient was extubated 24 hours after surgery and discharged from the hospital 6 days after operation.

Figure 1: Chest X-ray [A] and thorax computed tomography [CT] scan [B] showing left-sided pneumothorax and collapsed left lung



DISCUSSION

Injuries to the major airways are uncommon in children. Nearly all are caused by blunt trauma. The most common specific lesions are partial or complete transection of one of the main bronchi and tears of the membranous trachea. Airway injuries usually occur within 2 to 3 cm of the carina and may be rapidly fatal if not recognized and treated promptly [2]. The incidence of tracheobronchial injury in blunt pediatric trauma ranges from 0.7% to 2.8% [3], a figure much higher than in the adult population because of the elasticity of the immature thoracic cage [4]. In two thirds of survivors, the diagnosis is delayed, occasionally for many years, resulting in complications such as airway stenosis, atelectasis, pneumonia, mediastinitis, sepsis, and decreased pulmonary capacity [5]. Many cases have been reported in which bronchial disruption was not diagnosed at the time of injury because the air leak had ceased secondary to bronchial occlusion by blood clot and subsequent fibrous occlusion [6]. A continued voluminous air leak with persistent pneumothorax and failure of the lung to re-expand following adequate intercostal catheter drainage suggest the diagnosis [6]. Patients with tracheobronchial injuries present with acute signs and symptoms in the form of severe dyspnea, cyanosis, major air leak and a surgical emphysema with pneumothorax [3]. There are two principal mechanisms of tracheobronchial injury in blunt trauma. A crush injury presents a sudden, forceful compression of the AP diameter in contrast to the widened transverse diameter and results in distraction of the immobile airways. Additionally, compression of the pliable chest against a closed glottis rapidly increases airway pressure resulting in a blowout of the airway in accordance with the law of La Place [7]. This mechanism would explain the complete transection of the left main bronchus in our case. The second and more common mechanism is described in acceleration/deceleration injuries. Rapid changes in inertia cause shear force at the regions of varying density and mobility. As the larger airways are more dense and fixed at bifurcations, they are susceptible to these shear injuries [7]. In one study examining blunt tracheobronchial injuries reported between 1873 and 1996, right-sided bronchial injuries occurred most frequently (47% of the 259 patients), whereas injury to the trachea and left main bronchus occurred less frequently [8]. The higher incidence of right bronchial injuries may be from the shorter length of the

right main bronchus compared with the left. However, the right bronchus is encircled by the aorta and other mediastinal tissues [8]. Injuries on the right side were detected and treated sooner but were associated with higher mortality than the left-sided injuries [8]. Bronchial rupture may be transverse between the bronchial rings, longitudinal or complex; in our case, it was complex rupture. Complex lesions are rarely seen, comprising 8% of all ruptures [9]. Athanassiadi et al presented a case with complete transection of the left main bronchus in a 23-year-old man after blunt chest trauma without any vascular injury but with rib fractures, pleural effusion and pneumomediastinum which was treated by thoracotomy and an end-to-end anastomosis [10]. Zarama et al presented a case with complete transection of the right main bronchus in a 30-year-old man after blunt chest trauma with no additional injuries. A right pneumonectomy was performed, and the patient was transferred to the ICU. The patient died 3 days later, with respiratory insufficiency associated with the right pneumonectomy and pulmonary contusion of the left lung [11]. Our patient was a child and had isolated bronchus rupture without any concomitant injuries such as rib fracture or pleural effusion. Suspicion of tracheobronchial injury is based on the history and physical examination, chest radiographs, and chest CT scan in a stable patient. Bronchoscopy provides definitive diagnosis and should be performed when tracheobronchial injury is suspected. In an unstable patient, thoracotomy is indicated. At bronchoscopy, a defect in the wall of the airway may be visible. Other bronchoscopic signs of injury include mucosal disruption or exposed cartilage [2]. Indications for non-operative treatment are minimal lesions characterized by a wound with less than one-third of bronchial circumference or longitudinal laceration, no respiratory distress or hemodynamic trouble and sufficient thoracic drainage [12]. Spontaneous healing is the rule for small lacerations in the membranous trachea and some partial bronchial tears involving up to one-third of the circumference. These may be treated non-operatively. For larger laceration of the trachea or bronchi, primary surgical repair through a posterolateral thoracotomy is the best way to ensure good long-term results. Distal injuries to a lobar or segmental bronchus may be treated by lung resection rather than direct repair. The right side of the chest allows best exposure of the trachea, carina and the right main bronchus; the left side gives better exposure

for injuries to the distal left main bronchus. In the presence of a massive air leak, it may be necessary to clamp the hilum before attempting to repair the airway advancing the endotracheal tube or passing sterile tube across the surgical field in to the distal airway may also be helpful during the repair. Simple interrupted sutures after debridement of the margins work best. Although lobectomy or pulmonary segmentectomy may be necessary, pulmonary resection is done only as a last resort in unstable patients or when the lung is extensively damaged. The late functional results of pulmonary resection or bronchial repair are usually excellent [2]. Our patient had a T-shaped rupture in the left main bronchus. Since repairing of the rupture caused significant bronchial luminal stenosis, therefore, the best management was pneumonectomy [Figure 2].

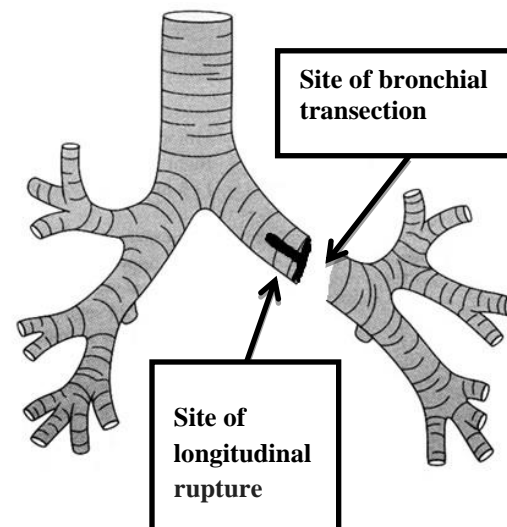
CONCLUSION

Injuries to the major airways are uncommon in children. Nearly all are caused by blunt trauma. Bronchoscopy is indicated for failure of re-expansion of a pneumothorax in patients with blunt chest trauma. In patients with bronchial rupture and when repair is associated with stenosis, pneumonectomy, especially in children, can be considered.

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Figure 2: The site of bronchial transection and longitudinal rupture in a schematic drawing



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Involvement of adjacent articular surface	3 (3.9%)
Severe perisoteal reaction	2 (2.6%)