Acute Nonpenetrating Tracheobronchial Injuries: What Is Important in the Mortality?

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Abstract

Background: Nonpenetrating tracheobronchial disruption are rare and potentially life threatening and associated with blunt thoracic trauma. Sometimes diagnosis is missed.

Methods: 2340 traumatic patients were admitted to the trauma center of Tabriz University Hospital, Iran. Only twelve patients of them had ruptured tracheobronchial airways following blunt chest trauma. In this retrospective study of twelve patients, we aim to document and evaluate causes, presentation, and diagnosis and treatment modalities over fourteen years (1993-2006).

Results: All the cases admitted to our referral hospital from six hours to 72 hours, underwent surgical interventions. There were two deaths; one in the operating room because of massive bleeding of pulmonary vascular disruptions coexisted with trachobronchial injuries and in other due to severity of disruption of carina, right and left bronchus five days after repair. Diagnosis was missed in one patient and he repaired after six month. Stricture formation of anastomotic site and localized empyema with bronchopleural fistula were the complications of two patients.

Conclusion: A high-level of suspicion in blunt thoracic trauma and use of bronchoscopy confirm the diagnosis of tracheobronchial disruption. Early diagnosis of tracheobronchial disruption is important, but severity of disruptions predisposes mortality.


Keywords: Chest Trauma ● Tracheobronchial Rupture ● Blunt Trauma

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Introduction

Tracheobrochial disruption because of blunt thoracic trauma is a rare entity which can be life threatening and need prompt recognition and treatment\(^1\). The true incidence of tracheobronchial injuries in blunt trauma is difficult to prove because many patients suffering trauma severe enough to cause such injuries die before reaching the hospital\(^2\). The diagnosis of tracheobronchial transections secondary to nonpenetrating trauma is not always straightforward and initially can be missed in patients with multiple injuries. Although early diagnosis and treatment is important\(^3\) but our retrospective study shows us severity of tracheobronchial injuries is important in mortality. Our retrospective review with some complex airway injuries led us to review in twelve patients and identify with tracheobronchial injuries to find out the clinical signs and symptoms, methods of diagnosis, surgical management and define risk factors of mortality.

Methods

Twelve patients of acute nonpenetrating injuries of trachea and major bronchi were managed at our thoracic department in Imam Khomeini Hospital affiliated to Tabriz University of Medical Sciences since 1993 to 2006. Out of these patients, ten were male (83.3%) and two were female (16.6%). Age of patients ranged from 9 to 49 years. As well as their chest injuries five had evidence of substantial trauma in other locations, two of them had liver or splenic rupture and two of other patients had clavicle, femur or humerus fractures. Each of patients had chest films on admission and during hospitalization; CT scans of the thorax were available in three of them. The chest x ray and CT scans were evaluated for tracheobronchial transections or lacerations signs; subcutaneous emphysema, pneumothorax, pneumomediastinum, rib fractures on the site of the injury, atelectasis and fallen lung sign. The mean time between accident and admission was 17 hours (range 7-72 hours). Ten patients present with a history of deceleration as the mechanism of injury which was caused by car or motor crash (n= 7) and a fall from 4 to ten meter height (n= 4). In one patient the mechanism was compression factor. On arrival all patients had mild to severe respiratory distress and in two of them severe hemorrhagic shock with a systolic blood pressure less than 80 mm Hg. The diagnosis of tracheobronchial disruption was proved by bronchoscopy in eleven patients and corroborated by surgery in one. Surgical treatment consisted by debridment and reanastomosis of the transected trachea or bronchus (7 patients). Primary repair of the laceration did in two patients. Simple or sleeve left upper lobe lobectomy because of coexisted upper lobe bronchus transection that could not be repaired (two patient), or pneumonectomy in (one patient). In one patient diagnosis was missed and diagnosis and treatment had been performed six month later. All patients were monitored clinically with repeated flexible bronchosity and chest films.

Results

The predominant clinical signs were cough, hemoptysis, pneumothorax and subcutaneous emphysema. Pneumothorax was presented on the initial chest films in ten and was bilateral in on patient who had a carina, right and left disruption. In one patient we had not seen pneumothorax. In the two patients, the pneumothorax was not obvious until the third day after admission. Tension pneumothorax was occurred in one patient. In chest X-Ray of the other two patients there were changes consistent with fallen lung sign. All patients had rib fractures and four of them had involved clavicles, sternum (two patients). In three patients, the first three ribs were fractured and in the other six, bilateral two rib fractures and in the three other patients a single rib fracture were occurred. Immediately after admission, closed chest tube thoracostomy was performed in all patients. There were not any endotracheal abnormalities in our series, and tracheostomy was not needed in our patients. Flail chest did not seen in our patients. The diagnosis was established after a mean of (70 min to 6 month). Two patients of our series died, one because of concomitant pulmonary vessels disruption with right main stem bronchus disruption...
and severe massive hemoptysis. And in other patient because of severity of disruption of carina, right main stem bronchial disruption concomitant with 4 cm tearing of left main stem bronchus. All patients brought to operating room for surgery. In two patients, the abdomen is operated first due to internal bleeding and in (n=9) patients repair was possible with or without debridment. Right main stem bronchus stricture were present as a complication in one patient after three month of repairing, which was corrected with sleeve lobectomy of right upper lobe. Sepsis and localized empyema with right bronchopleural fistula in one patient was occurred after two weeks after repair that treated with ceftriaxone and metronidazol and closed tube followed open tube drainage ten days later. Treatment was achieved after 45 days without any problem. One year follow up of 10 patients were good.

**Discussion**

30% of blunt thoracic trauma leads to bronchial ruptures2,4. In blunt trauma lesions of the main bronchus are common. In all patients of our series, lesions were located at the main bronchus solely or concomitant with carina or lower tracheal rupture5. Lynn and Lyengar reported that more than 80% of tracheobronchial injuries due to blunt trauma are located within 2.5 cm of the carina5,6. The mechanism of disruption were at the level of carina or bronchi with deceleration type in ten patients and only two types of thoracic decompression type led to the bronchial rupture. Cervical and thoracic emphysema, respiratory distress, cough, hoarseness, hemoptysis and even cyanosis are the most consistent clinical findings in tracheal injury caused by nonpenetrating blunt trauma; subcutaneous emphysema is the result of decompression of pneumomediastinum. This sign is nonspecific finding and is more commonly found in acute traumatized patients after difficult intubations, multiple rib fractures and penetrating chest wounds1. If the deep cervical and thoracic subcutaneous emphysema does not increase in amount and the source is unknown in investigation, it has little clinical significance. In the presence of tracheobronchial laceration it increases and air scattered in the fascia planes. We found this sign in only ten of the twelve patients. Pneumomediastinum is a precursor of subcutaneous emphysema and early sign7. Absence of pneumomediastinum in the presence of tracheobronchial disruption has been attributed to presentation of the integrity of the paratracheal or peribronchial connective tissue sheet, or temporary occlusion of the tear by fibrin, fractured cartilages, and clot and sometimes by endotracheal balloon cuff. In four of our patients it may prevented by unexplained reasons. Pneumothorax is the main clinical sign of tracheobronchial disruption, is the result of rupture of mediastinal pleura and injury of right or left bronchus, allowing air to enter the pleural spaces. If pleura is intact pneumothorax does not occur, but pneumomediastinum and subcutaneous emphysema can occur. Our reports support this; in the two patients without pneumothorax, the tears were confined trachea, carina or when pleuritis and pleural adhesions were present. The radio logic sign of fallen lung sign is a specific sign of bronchial injury but not seen in all of patients8. Thoracic fractures especially in upper ribs with pneumothorax are an important diagnostic clue to tracheobronchial disruptions and their frequency vary from 40% to 90%. Rib fractures occur with all of thoracic trauma, and more often in the absence of airway injuries9. Because of elasticity of the thoracic cage it is uncommon in children and young adults. In our series rib fractures occurred in only ten and in two of six young adult patients there had not rib fractures. Treatment of associated life threatening injuries was given priority over bronchial rupture repair and after stabilization of vital signs tracheobronchial tears should be repaired9. Stricture formation is one of the complications of tracheobronchial injury that occurred with or without repair10. Bronchoscopy is the most reliable means of establishing the site, nature, and extent of major airway disruption6. All of our patients diagnosed with bronchoscopy. Missing and delay in diagnosis was occurred in one patient that managed previously by nonthoracic...
surgeon in other center. Delayed repair after six month is associated with a well outcome. There are several surgical options for the treatment of a ruptured bronchus. Small and moderate lesions can be treated with simple suture whereas in larger tears a lobectomy might be necessary. Pneumonectomy is not recommended because it has high mortality of 75-100%.\textsuperscript{11,12} One patient of our series that have concomitant main pulmonary vasculature disruption undergoing pneumonectomy He died intraoperatively because of severe and uncontrolled bleeding. In cases of delayed diagnosis stenting is an alternative treatment to surgical repair\textsuperscript{13}. In all of our patients after thoracotomy and diagnosis of tearing site, the tip of endotracheal tube guided and positioned in left main stem bronchus and then repair was performed. Compared the mortality of 8.5 to 25% reported in the literature in severe thoracic or multiple injury patients with clinical signs of subcutaneous emphysema, persistent air leakage and pneumothorax despite closed tube drainage, tracheobronchial injury must be suspected. The outcome in our series with a mortality of 16.6% was good\textsuperscript{14}. Severity of tracheobronchial trauma in two patients of our series was responsible to mortality. In Casseda series; early diagnosis of tracheobronchial injuries is important,\textsuperscript{3} but in our series the severity of disruption and accompanying disruption of pulmonary vessels determine the occurrence of the mortality.

Conflicts of interest

The authors had no conflicts of interest to declare in relation to this article.

References