

Pneumomediastinum Due to Indirect Blunt Chest Trauma, Diagnostic Challenge and Understanding of Pathophysiology

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Abstract

Pneumomediastinum, also known as mediastinal emphysema, refers to collection of air in the mediastinum. Pneumomediastinum is reported in up to 10% of patients with severe blunt chest trauma (1,8). Although injury to the tracheobronchial tree is assumed to be the commonest aetiology, it has been reported in only less than 10% of patients (2). In most cases, the cause of pneumomediastinum after blunt trauma remains obscure. A recent paper attributed the cause to what is known as the Macklin effect (2). Although CT scanning remains the gold standard to identify the

aetiology and the extent of the injury, bronchoscopy and upper gastrointestinal endoscopy may be needed to rule out other injuries. We report a case of mediastinal emphysema due to blunt trauma in which we discuss the possible aetiology, investigations, differential diagnosis and management.

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Case Report

A 54-year-old male, smoker, fell from three meters height, landed on his buttock, resulting in few bruises. He did not seek medical advice at the time of injury. He presented to his local A&E department, only 24 hours later, when he noticed massive facial and neck swelling. On initial assessment, the patient was stable with normal oxygen saturation on air and normal vital signs. Massive swelling of the face and neck and tenderness on the back of his chest were noted. A chest X-ray confirmed presence of mediastinal emphysema with no evidence of rib fractures or pneumothorax. CT scan showed pneumomediastinum and mild left pneumothorax (Figure 1A). The radiologist raised the suspicion of possible tracheal injury (Figure 2). The patient was then referred to our hospital as a tertiary referral. Bronchoscopy was performed and showed a normal tracheal mucosa with no signs of tracheal rupture such as sub-mucosal bleeding or mucosal tear. The patient was kept under observation for four days during which the emphysema resolved completely and the patient was discharged home on day 4. The patient remains well at the end of the sixth week follow up.

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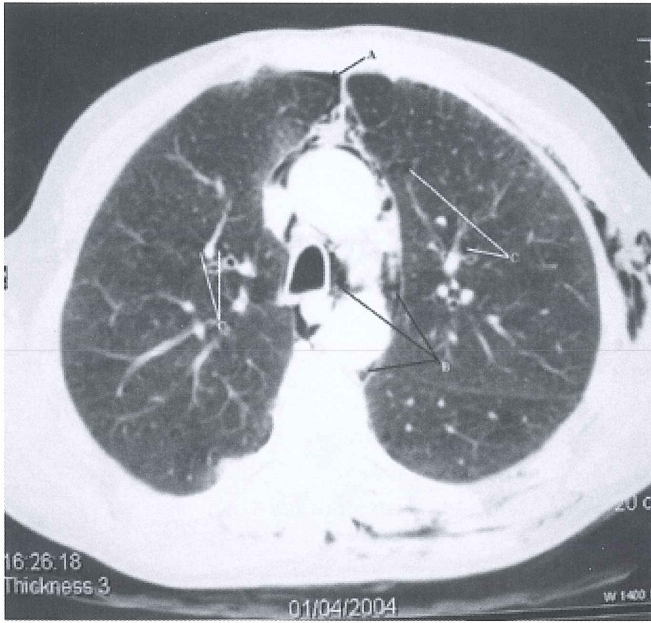


Figure 1. A- Pneumothorax, B- Pneumomediastinum, C- Air escaping along the broncho-alveolar sheaths

Discussion

Pneumomediastinum relates to collection of air within the mediastinum. The source of air could be a tracheobronchial or oesophageal tear. Subcutaneous emphysema following rib fracture, with or without pneumothorax, may progress along the fascial sheaths and extend into the mediastinum. First described by Macklin in 1939 (2,6), the Macklin effect is thought to be the aetiology in the majority of cases where pneumomediastinum develops following indirect blunt trauma. It involves alveolar rupture, air dissection along the bronchoalveolar sheaths (Figure 1B), and the spreading of this air to the mediastinum (Figure 1C). A study on 51 patients with mediastinal emphysema following blunt trauma conducted over a five years period (1995-2000) has shown the incidence of tracheobronchial injury to be 10% compared to 39% due to Macklin effect (2,7). Macklin effect was also detected in conditions such as neonatal respiratory distress syndrome, asthma crisis and during positive pressure ventilation (3).

Diagnosis of associated mediastinal emphysema is clinically evident and it usually appears within few hours from the onset of injury though it may appear as late as 24 hours as discussed in our case. Respiratory distress may not be present and it is an important determinant in the course of management. Tracheobronchial injury must be excluded in all cases. In stable patients, CT scan is very useful to diagnose pneumomediastinum and exclude other injuries, however is might be not specific in detecting tracheal injury. Bronchoscopy may be necessary if there is a suspicion of tracheal injury (the signs are submucosal bleed, mucosal tear or irregularity). Oesophageal injury can be ruled out by a water-soluble contrast study. Macklin effect can be diagnosed on

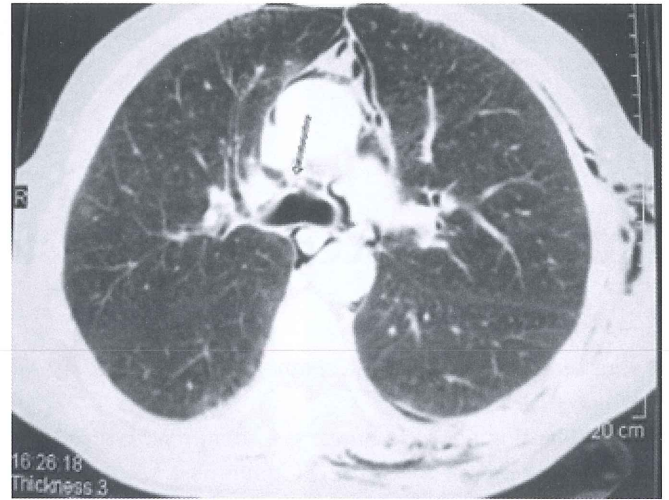


Figure 2. Suspected tracheal injury, which was excluded by bronchoscopy

high resolution CT scan. It is important to appreciate that the presence of Macklin effect does not rule out tracheal injury. In about 5-10% of cases, aetiology may not be evident despite all investigations.

Conclusion

Management of pneumomediastinum depends on the aetiology and the patient's condition. Drainage of the pneumothorax if significant and close respiratory and haemodynamic monitoring is sufficient in most cases. Operative procedures may be required in unstable patients with tracheal injury. The above mentioned case highlights an under diagnosed entity, "the Macklin effect", as an important cause of pneumomediastinum and explains a possible mechanism through which the alveolar air travels, under pressure generated from blunt trauma against the closed epiglottis, along the bronchovascular sheath to the mediastinum (6,7). In these cases conservative management is the treatment of choice after excluding other associated injuries.

References

1. Triaridis S, Konstantinidis I. A diagnostic challenge: investigating suspected tracheobronchial and pharyngoesophageal tears. Are there gold standards? *Acta Oto-Rhino-Laryngologica Belgica* 2002;56(3):331-4.
2. Wintermark M, Schnyder P. The Macklin effect. A frequent etiology for pneumomediastinum in severe blunt chest trauma. *Chest* 2001;120(2):543-7.
3. Poli-Merol ML, Belouadah M, Parvy F. Tracheobronchial injury. *European J Paediatric Surgery* 2003;13:398-402.
4. Hagan W. Pharyngoesophageal perforation after blunt trauma to the neck. *Otolaryngeal. Head Neck Surgery* 1983;91:620-6.
5. Polsky S, Kerstein M. Pharyngoesophageal perforation due to blunt trauma. *American Surgery Journal* 1995;61:994-6.
6. Macklin C. C. Transport of air along sheaths of pulmonic blood vessels from alveoli to mediastinum: clinical implications. *Arch Internal Medicine* 1939;64:913-26.
7. Merchand P. The anatomy and applied anatomy of the mediastinal fascia. *Thorax* 1951;6:359-68.
8. Cyrlak D, Milne E, Imray T. J. Pneumomediastinum: a diagnostic problem. *Critical review of diagnostic imaging* 1984;23:75-117.