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Case report

Fallen lung sign in a traumatic partial bronchial tear: A case report

Khairil Amir Sayuti^{a,d}, Wan Aireene Wan Ahmed^{a,d,*}, Zuhanis Abdul Hamid^b,
Mohd Zulfakar Mazlan^{c,d}

^a Department of Radiology, School of Medical Sciences, Universiti Sains Malaysia, 16150 Kubang Kerian, Kelantan, Malaysia

^b Department of Radiology, Institut Kanser Negara No. 4, Jalan P7, Presint 7, 62250, W.P. Putrajaya, Malaysia

^c Department of Anaesthesiology & Intensive Care, School of Medical Sciences, Universiti Sains Malaysia, 16150 Kubang Kerian, Kelantan, Malaysia

^d Hospital Universiti Sains Malaysia, Health Campus, Universiti Sains Malaysia, 16150 Kubang Kerian, Kelantan, Malaysia

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ABSTRACT

The fallen lung sign describes the lung collapse at the dependent region away from the hilum. It is usually a specific sign for complete bronchial tear. We present a case of a young patient post mechanical ventilation for a traumatic head injury with unexpected CT thorax findings of fallen lung secondary to a partial bronchial tear. The patient was managed conservatively with specific ventilator strategy and successfully discharged home. Partial bronchial tear with fallen sign is a very rare cases reported.

1. Introduction

Bronchial tear implies a mucosal tear either complete or partial. The causes of tear are trauma and non-trauma related. The post-traumatic bronchial tear is not uncommon, particularly in blunt chest injury. The incidence of blunt injury to the tracheobronchial tree is less than 1% and usually associated with subcutaneous emphysema, pneumomediastinum and pneumothorax [1]. It commonly occurs at approximately 2 cm from the carina and more likely to involve the right main bronchus [2]. It can be a severe and life-threatening injury. The fatality rate is as high as 70% for incomplete tear and 100% for complete tear [3]. The incidence of complete tear is less than 1% [3]. The clinical history of blunt bronchial injury varies depending on the severity of injuries. The most common symptoms are dyspnea, dysphonia, hemoptysis and subcutaneous emphysema. However, many of these clinical signs may not be detected during the initial examination. Therefore, recognising specific radiological signs is essential in reaching an accurate diagnosis so that appropriate treatment for this potentially lethal injury can be given in timely manner.

2. Case presentation

A 21-year-old motorcyclist was found alone and unconscious by the roadside following a road traffic accident. On arrival at the hospital, his Glasgow Coma Scale was 3/15 requiring intubation and mechanical ventilation. Urgent computed tomography (CT) brain showed acute subdural haemorrhage. Chest radiograph (CXR) post-intubation revealed a well marginated opacity at right lower zone associated with ipsilateral mediastinal shift, overinflation of the left lung and left first rib fracture (Fig. 1). Unenhanced CT thorax demonstrated right lower lobe collapse with the displacement of the collapsed lung toward the dependent area suggestive of the fallen lung sign (Fig. 2). There was also a small wall defect of the right lower lobe bronchus that represents partial tear. The right lower lobe

* Corresponding author. Department of Radiology, School of Medical Sciences and Hospital USM, Universiti Sains Malaysia, 16150 Kubang Kerian, Kelantan, Malaysia.

E-mail address: waireene@usm.my (W.A. Wan Ahmed).

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bronchus was also posteriorly displaced associated with right pneumothorax and bilateral pulmonary interstitial emphysema (Fig. 3). He was admitted to Intensive Care Unit with conservative management. Serial CXRs in the next few days showed resolution of pneumothorax and pneumomediastinum. The patient was subsequently extubated and discharged without the need for any surgical intervention.

3. Discussion

The fallen lung sign was first identified by Oh et al., in 1969. It describes the portion of the lung ‘falling’ away from the hilum rather than the usual central collapse towards the mediastinum [1]. The intact hilar pulmonary vessels are unable to sustain the portion of the lung distal to the bronchial tear [2]. It will cause the partially detached lung to collapse and move towards the dependant position, which is posterior in supine or inferior on erect.

When reporting CT thorax of patients suspected of partial bronchial tears, it is recommended that the region be systematically analysed. The key findings include bronchial wall discontinuity with surrounding air leakage, subcutaneous and neck emphysema, unresolved pneumothorax and pneumomediastinum, focal narrowing and abnormal orientation of the affected bronchus [3–5]. The evidence of air leak adjacent to the main bronchi, even when there is no direct evidence of bronchial discontinuity or tear should also raise the suspicion [6]. Our case agrees with the previous study, whereby the majority of the mediastinal air collection were seen closely surrounding the bronchial tear.

This sign is rarely observed, particularly in partial tears because of a few possible reasons. First is the rarity of collapse of the entire lobe. Second, pneumothorax secondary to bronchial tears may spontaneously resolve due to lung re-expansion within 24 hours; as seen in our patient [3].

Our case demonstrates the abnormal displacement of right lower lobe bronchus posteriorly. According to Tack et al., 2000 and Wintermark et al., 2001, the CT fallen lung sign sometime only requires the identification of the bronchial tree orientation, either in normal aerated or consolidated lung. In cases of abnormal orientation of bronchi associated with pneumothorax or pneumomediastinum, we need to scrutinize the mainstem bronchus in order to demonstrate the possibility of bronchial tear.

The gold standard approach to diagnose bronchial rupture is either multiplanar reconstructed CT images or bronchoscopy. However, when the typical fallen lung sign is present, a bronchial tear can be confidently diagnosed in CT scan alone without the need for additional invasive investigations [4]. In our patient, the decision for bronchoscopy was cancelled since the subsequent chest radiograph showed improvement. Nevertheless, if CT patterns suggest a complete or near-complete bronchial tear, immediate bronchoscopy should be carried out [3].

Our CT images showed evidence of bilateral pulmonary interstitial emphysema (PIE). PIE and pneumomediastinum have been reported infrequently, associated with the Macklin effect, commonly seen in blunt chest trauma. Macklin first described its pathophysiology in 1939 as a result of alveolar ruptures, with leaking air dissecting along peribronchovascular sheaths and extending into the mediastinum. They were also associated with other causes such as positive-pressure mechanical ventilation, neonate respiratory distress syndromes, severe asthma, Valsalva manoeuvres and Boerhaave’s syndrome [7].

4. Conclusion

Bronchial tear in the blunt chest trauma is not uncommon. The definite diagnosis can be challenging, particularly in suspected partial bronchial tear. The role of CT scan is vital and recognising specific sign on CT plays an essential role. When the typical fallen

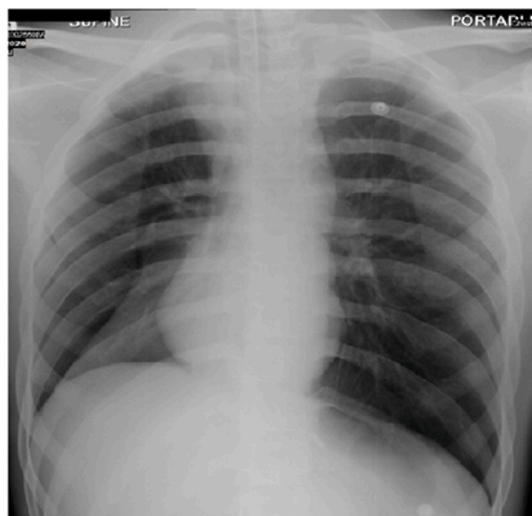


Fig. 1. Portable chest radiograph post-intubation showed a well marginated opacity at right lower zone with ipsilateral mediastinal shift and overinflation of left lung. Left 1st rib fracture is also seen.

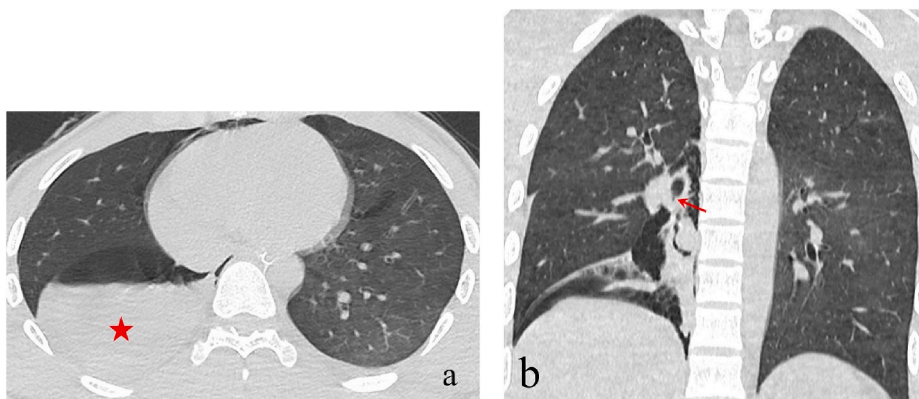


Fig. 2. Axial CT thorax in lung window (a) demonstrates right lower lobe collapse with the collapsed lung portion displaced toward the dependent position (red star) suggestive of the fallen lung sign. Coronal view (b) shows a small wall defect of right lower lobe bronchus (red arrow).

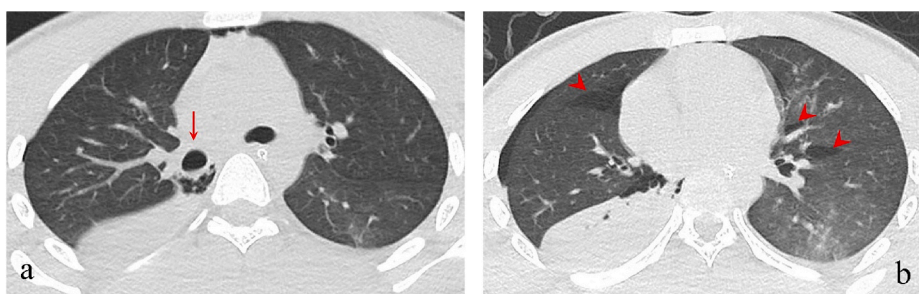


Fig. 3. Axial view in lung window (a, b) demonstrates the right lower lobe bronchus (red arrow) displaced posteriorly. This is associated with right pneumothorax, pneumomediastinum and bilateral interstitial emphysema (red arrowheads).

lung sign is present together with other supportive findings such as bronchial wall defect, surrounding air leakage and pneumomediastinum, the diagnosis of bronchial tear can be established. Early definitive treatment is required since it may potentially reduce the possibility of lethal complications.

Authorship

All authors have made substantive contributions to the study, and all authors endorse the data and conclusions. Each of the authors confirms that this case study has not been previously published and is not currently under consideration by any other journals.

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Availability of data and materials

This case report has no restrictions on the availability of data and materials.

Declaration of conflicting interests

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Not applicable.

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