An Unusual Presentation of Bronchial Rupture

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Persistent hydropneumothorax was diagnosed in a 62-year-old female with a history of blunt trauma, although she was treated with chest tube and closed underwater seal drainage. Computed tomography and fiberoptic bronchoscopy findings were consistent with "fallen lung" syndrome. Fiberoptic bronchoscopy also found a cavitary lesion at the right tracheobronchial angle. Forceps biopsy of the cavitary lesion indicated bronchogenic carcinoma. Our final diagnosis was tracheobronchial complete rupture and fallen lung syndrome secondary to malignancy. *Key words: fallen lung; blunt chest trauma; bronchial rupture.* [Respir Care 2011;56(6):858–860. © 2011 Daedalus Enterprises]

Introduction

Bronchial rupture is usually due to blunt or penetrating trauma or is iatrogenic. Bronchial rupture secondary to a malignant lesion is rare. We saw a patient with a history of trauma and hydropneumothorax. Although, she had been treated with chest tube and closed underwater seal drainage, there was a massive air leak and the hydropneumothorax persisted, so we thought the hydropneumothorax may have been from a bronchial rupture.

Case Report

A 62-year-old, female, retired teacher was seen in an out-patient clinic with persistent cough and yellow sputum that had begun 3 months prior. She also reported dyspnea for the last 2 days. She was referred to our emergency service after chest radiograph and computed tomogram (CT). She had a history of 30 pack-years of smoking and long-term passive exposure. She also described a chest trauma from a dog dragging 5 months prior, from which she had gotten some small bruises on her back and the right side of her chest, but she did not have any respiratory symptoms until 3 months ago.

Her physical examination revealed minimal pre-tibial edema and inspiratory crackles in the left hemithorax, but no respiratory sounds in the right hemithorax. Laboratory findings included moderate leukocytosis, thrombocytosis, anemia, high alanine transaminase, and low sodium. Chest radiograph showed a right hydropneumothorax (Fig. 1). CT also showed a cavitary lesion whose wall integrity seemed destructed over the anterolateral part, at the right tracheobronchial angle (Fig. 2). A chest tube was inserted into the right pleural space, but there was massive air leak as soon as the intercostal tube was inserted. Follow-up imaging showed persistent hydropneumothorax. In addition, the chest drain continued bubbling when the patient coughed. Suction was not applied because we suspected bronchopleural air leak. Control CT revealed the right hydropneumothorax and the collapsed lung in the posterior thorax, and a necrotizing cavity. With these clinical and radiological findings, we suspected "fallen lung" syndrome with complete bronchial rupture secondary to trauma, so we conducted fiberoptic bronchoscopy immediately. During the fiberoptic bronchoscopy we found mucosal irregularity and infiltration in the last 1 cm of the trachea. The main carina seemed to be damaged and deformed. There was a necrotic cavity filled with purulent secretions just

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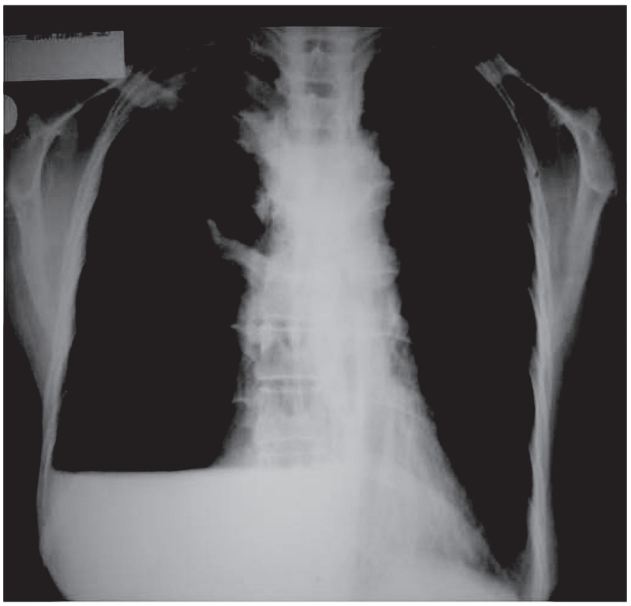

Fig. 1. Chest radiograph shows a right hydropneumothorax.

above the carina, on the right, and we obtained a forceps biopsy from the inner wall of the cavity (Fig. 3). It was not possible to clarify the tracheobronchial rupture because the mucosa was extremely damaged and viscous secretions obstructed the view. However, the CT led us to believe the rupture was on the anterolateral wall. The left main bronchus also seemed to be infiltrated. The pathology report on the biopsy specimen indicated poorly differentiated adenocarcinoma. With all these findings taken together, our diagnosis was "fallen lung" syndrome, on the basis of trachea-cavitary complete rupture secondary to malignancy. Both the right and left main bronchi and lower third of the trachea were infiltrated, so we ruled out surgery (eg, tracheal sleeve lobectomy). Her Eastern Cooperative Oncology Group performance status (ECOG; http://ecog.dfci.harvard.edu/general/perf_stat.html) was 4, and the tumor/node/metastasis (TNM) staging was T3N2Mx, so tracheal stent and chemotherapy were also ruled out. She received palliative care, and died within a month of the cancer diagnosis.

Discussion

The first fallen lung case was reported by Weisel and Jake in 1953.[1] Fallen lung syndrome is radiologically characterized by the displacement of the collapsed lung toward a peripheral localization, and the attachment of the lungs to the hilum with only vascular structures.[2] This syndrome is observed in adults 10 times more often than in children. The presence of rib fracture has been reported to be more than 90% in adults, and less than 24% in children with fallen lung syndrome.[3]

Probable causes of fallen lung syndrome include: strong compressions that decrease the anteroposterior diameter and increase the lateral diameter of the thorax; compression of the thorax and the tracheobronchial tree against a closed glottis, especially during an instant increase of airway pressure in the trachea and main bronchus; and pleural dislocation of the fixed carina from sudden deceleration, such as in a motor-vehicle accident.[4,5] Fallen lung can develop from a complete or incomplete bronchial rupture. Bronchial rupture is generally iatrogenic (eg, error during intubation, over-inflation of the endotracheal tube cuff, dislocation of the endotracheal tube) or from blunt trauma (motor-vehicle accident, falling from a high place) or penetrating trauma (stab or gun-shot).[4] Kiser and colleagues identified 265 cases reported between 1873 and 1996. They found that tracheobronchial injury was mostly due to motor-vehicle accident.[6] Our patient had blunt trauma 5 months prior, and strong compression of the thorax probably caused the rupture. Incomplete initial rupture might have progressed to complete rupture and subsequent invasion of the malignant tissue. Therefore, we finally concluded that our patient had a tracheobronchial complete rupture and fallen lung syndrome secondary to malignancy. Fallen lung syndrome due to bronchocavitary cutaneous fistula from a large-cell lung cancer has been reported.[7] However, no fallen lung cases secondary to malignancy such as in our patient have been previously reported.

In fallen lung syndrome, although the most relevant clinical symptom is dyspnea, hemoptysis, cyanosis, and chest pain may also be present. Pneumothorax, pneumomediastinum, and subcutaneous emphysema are common findings.[3] Persistence of a pneumothorax despite chest tube insertion is another sign of tracheobronchial rupture. Our patient had cough, purulent sputum, dyspnea, and persistent hydropneumothorax, but not pneumomediastinum or subcutaneous emphysema.

Diagnostic procedures in the fallen lung syndrome include chest radiograph, CT, and bronchoscopy.[3] Chest radiograph may be sufficient for diagnosis, and surgery can be planned based on chest radiograph. Fallen lung is localized laterally or posteriorly in the supine position, or inferiorly in the upright patient.[2] Bronchoscopy is useful in the differential diagnosis, and can show the localization and the distribution of the rupture. However, in the case of a rapidly developing clinical situation, surgery can be performed without bronchoscopy. Diagnosis is difficult in ruptures secondary to trauma, because of blood and mucus.[3]

In our patient, fallen lung syndrome was identified via CT, and the collapsed lung segment was in the posterior thorax. Bronchoscopy revealed the malignant invasion, and we believe the rupture was secondary to the lung carcinoma.

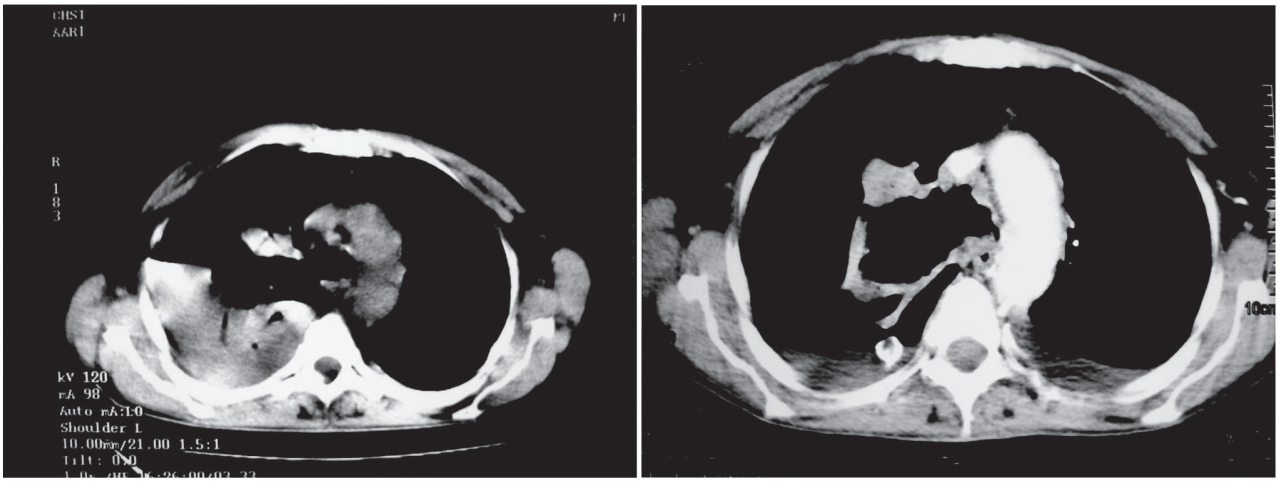

Fig. 2. Left: Computed tomogram shows a cavitary lesion on the right tracheobronchial angle. Right: The hydropneumothorax has been drained with a chest tube.

Fig. 3. Fiberoptic bronchoscopy shows the damaged main carina.

Tracheal or main bronchus rupture requires urgent surgical intervention, after determining the etiology. Tcherveniakov and colleagues performed emergency surgery within 6–12 hours after the accidents in their patients, and recommended preserving optimal functional lung parenchyma after the surgery.[8] The surgery performed depends on the rupture's features, and may even include pneumonectomy. Petrov and colleagues operated on 29 patients (88%) in a series of 33 patients with traumatic tracheobronchial lesions. They carried out simple repair in 19 patients (58%), left pneumonectomy in 2 patients (6%), tracheal resection and end-to-end anastomosis in 2 patients (6%), tracheotomy in one patient (3%), thoracentesis and drainage in 3 patients (9%), and cervical mediastinotomy in 2 patients (6%). Surgical mortality was 9%, and was associated with brain and spinal-cord injury.[4] In our patient we ruled out surgery because the tumor had invaded the main carina and right and left main bronchi. Since her ECOG performance status was not favorable for stent placement, she received palliative care.

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