Malpositioning of the chest tube across the anterior mediastinum is risky in chronic obstructive pulmonary disease patients with pneumothorax

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Abstract

Malpositioning is one of the most common complications of chest tube insertion and is associated with increased morbidity and mortality. We present two cases of patients with chronic obstructive pulmonary disorder (COPD) in whom malpositioned chest tubes penetrated through the anterior mediastinum to the contralateral pleural cavity, and were later removed without complications. Both patients had a relatively wide retrosternal airspace and received blunt dissection with a trocar for percutaneous chest tube insertion, which may have increased the risk of chest tube penetration through the anterior mediastinum during tube thoracostomy. Further, the precise location of the malpositioned chest tubes could not be confirmed by single-view anteroposterior portable chest radiography, and computed tomography (CT)-scan was more helpful in the diagnosis and management of the cases reported herein.

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1. Introduction

Malpositioning is one of the most common and problematic complications of chest tube insertion [1, 2]. However, only 14% of the cases of malpositioning are caused by mediastinal placement [3, 4]. Here, we report two cases in which the inserted chest tubes penetrated through the anterior mediastinum to the contralateral pleural cavity and were later removed without complications.

1.1. Case 1

An 84-year-old male with a history of heavy smoking, chronic obstructive pulmonary disorder (COPD), and scalp angiosarcoma presented to our emergency department with sudden-onset dyspnea. Physical and radiographic examinations yielded the following findings: low blood pressure; normal body temperature; high respiratory rate; high heart rate; crackles over both lower lung fields; breath sounds on the left field less audible than those on the right; bilateral pneumothorax; and multiple patch lesions.

After admission, chest tubes were inserted bilaterally, and the patient underwent intubation for the treatment of hypoxic respiratory failure. Because of persistent right pneumothorax and poor chest tube drainage, a new 28-F chest tube was inserted in the right chest by using a trocar. However, follow-up chest radiography revealed that the chest tube had penetrated the left lung (Fig. 1a, white arrows). At this point, the patient’s condition was stable with no evidence of bleeding. Chest ultrasound could not detect the malpositioned chest tube. Follow-up chest computed tomography (CT)-scan revealed that the right chest tube had penetrated the costomediastinal recess of the left pleural cavity (Fig. 1b, white arrows) without causing visceral organ damage or new pleural effusion development. Multiple nodular and cavitory lesions in the lung fields and multiple metastatic hepatic lesions were also seen. A diagnosis of scalp angiosarcoma with lung and liver metastasis was favored. All chest tubes were removed gradually without complications, and the patient was discharged two weeks later.

1.2. Case 2

A 58-year-old male with a history of smoking and COPD visited our emergency department with progressive dyspnea and intermittently increasing body temperature. Chest radiography showed diffuse pulmonary infiltrates over both lung fields, and atypical pneumonia was highly suspected.
After admission, the patient showed progressive dyspnea and hypoxic respiratory failure in spite of receiving moxifloxacin and oseltamivir phosphate (Tamiflu). He received elective intubation and was transferred to our intensive care unit (ICU), wherein chest radiography showed rapid progression of bilateral lung infiltration with $\text{PaO}_2/\text{FiO}_2 < 100$ and high positive end-expiratory pressure demand. Acute respiratory distress syndrome (ARDS) was diagnosed.

Because of the patient's poor oxygenation status, venovenous extracorporeal membrane oxygenation (V-V ECMO) support was initiated for rescue therapy. After 10 days of V-V ECMO support, the patient's oxygenation status improved, and he was weaned off V-V ECMO.

Three weeks later, tracheostomy was performed, and the patient underwent further weaning. However, right pneumothorax developed during the course of weaning, and right thoracostomy with apical insertion of a 28-F chest tube was performed using a trocar. Follow-up chest radiography showed malpositioning of the right chest tube (Fig. 2, white arrows). The malpositioned chest tube penetrating the anterior mediastinum was detected by bedside chest ultrasound. The patient's condition was stable with no evidence of bleeding. The malpositioned chest tube was withdrawn slowly with the tube tip within the right pleural cavity, which restored good drainage function. Follow-up chest radiography showed no evidence of the left pneumothorax. The patient was eventually weaned off the ventilator, and he is currently undergoing pulmonary rehabilitation.

2. Discussion

Although the complications of mediastinal chest tube placement have been described in some reports [4—7], to the best of our knowledge, these are the first reported cases in which a chest tube passed through the anterior mediastinum and lodged in the contralateral pleural space.
without major complications. In our two cases, the malpositioned chest tubes were withdrawn within 24 hours without pneumothorax development on the contralateral side. Therefore, we hypothesized that the communicating hole between the pleural cavities was sealed by fibrin formation, and the resultant pleural-pleural fistula can be avoided by prompt withdrawal of the chest tubes.

Precise localization of the malpositioned tubes is essential for their management. However, in our cases, chest radiography could not detect the precise location of the malpositioned chest tubes. Although a pilot study [8] showed that bedside chest ultrasound can reveal the location of malpositioned chest tubes, ultrasonic verification is likely to be considerably more difficult in obese patients and in those with subcutaneous emphysema. In our report, bedside ultrasound was only useful in Case 2; in Case 1, the small amount of pneumothorax around the chest tube may have rendered ultrasonographic detection ineffective. Thus, while bedside ultrasound may exclude the possibility of an extrathoracic malpositioned chest tube, it cannot identify the location of a complicated intrathoracic malpositioned chest tube. Because of the shortcomings of the other methods, CT-scanning should be preferred in these patients.

Patients with anatomic alterations of the thoracic cage have a risk of malpositioning and even injury to vital organs [5]. The chest CT-scan images of our patients showed that both had large lung volumes with the width of the retrosternal airspace increasing to more than 2.5 cm [9], which may have increased the risk of malpositioning. In addition, in these two cases, the physicians employed a lateral approach with blunt dissection by using a trocar for percutaneous chest tube insertion, which may have also increased the risk of malpositioned chest tube insertion [10]. Therefore, we suggest that chest tube insertion for patients with pulmonary disease and alterations of thoracic cage anatomy should be performed carefully by an experienced physician without using a trocar.

In conclusion, chest tube malpositioning after mediastinal placement is a rare occurrence. However, COPD patients who receive tube thoracostomy may have a higher risk of this complication because they have wide retrosternal airspace. For patients with complicated pulmonary disease and alterations of thoracic cage anatomy, the risk of malpositioning can be reduced if the procedure is performed by an experienced thoracic surgeon without using a trocar. While bedside ultrasound was useful to exclude the possibility of extrathoracic malpositioned chest tube, CT-scan may be the best tool for diagnosing the condition and obtaining information on its management.

References