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Case Report

Management of acquired bronchopleural fistula due to chemical pneumonia

Reddy Ravikanth[a]*, *Sunil Mathew*[b], *Denver Steven Pinto*[a]

[a]Department of Radiology, St. John's Medical College, Bengaluru, Karnataka, India,
[b]Department of Anatomy, St. John's Medical College, Bengaluru, Karnataka, India

Abstract

Bronchopleural fistula (BPF) is a sinus tract between the bronchus and the pleural space that may result from a necrotizing pneumonia/empyema (anaerobic, pyogenic, tuberculous, or fungal), lung neoplasms, and blunt and penetrating lung injuries or may occur as a complication of procedures such as lung biopsy, chest tube drainage, thoracocentesis, or radiation therapy. The diagnosis and management of BPF remain a major therapeutic challenge for clinicians, and the lesion is associated with significant morbidity and mortality. Here, we present a 70-year-old male with acquired BPF due to chemical pneumonitis caused by aspiration of kerosene who presented with the symptoms of fever, cough with expectoration, breathlessness and signs of tachycardia, tachypnea, diminished breath sounds, and crepitations. After a 3-week course of culture-sensitive antibiotics with β-lactam and β-lactamase inhibitors, open drainage of the empyema was done following which the patient showed symptomatic improvement and was discharged.

Keywords: *Acute respiratory distress syndrome, Bronchopleural fistula, Contrast-enhanced computed tomography, Chemical pneumonia, Pleurocutaneous tract*

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Introduction

Bronchopleural fistula (BPF) refers to a communication between the pleural space and the bronchial tree. It is a rare complication of empyema; other common causes include postoperative complications after pulmonary resection or persistent pneumothorax. In developing countries, tuberculosis remains a very important cause of BPF. A characteristic feature on chest radiography is hydropneumothorax. BPF generally manifests 7 to 15 days following a lung resection; although more delayed presentations have been reported. Among several proposed classifications, Varoli *et al*. [1] used time of onset after an operation to classify fistulas as early (1–7 days), intermediate (8–30 days), or late (more than 30 days). These lesions almost always occur within 3 months after surgery [2]. BPF developing as a complication of pleuropulmonary infections can occur at any point during illness. Here, we present a case of acquired BPF due to chemical pneumonitis and its management.

Case report

A 70-year-old male with a history of kerosene aspiration 15 days previously presented with the complaints of fever, cough with expectoration, and breathlessness in the emergency department. The patient also had comorbidities-diabetes mellitus and cirrhosis of the liver. On clinical examination, he had tachycardia and tachypnea with diminished breath sounds and crepitations in the right axillary, infra-axillary, interscapular, and right infrascapular regions. The white blood cell count was 11.0×10^9 (neutrophils, 80%), the erythrocyte sedimentation rate was 120 mm/h, and the C-reactive protein level was 215 mg/dL. A frontal chest radiograph showed volume loss with an air-fluid level in the retrocardiac region on the right side. There was also right costophrenic angle blunting with thickening of the right minor fissure [Figure 1]. A bronchogram obtained by instilling contrast material into the airway revealed a fistulous track between the right lower bronchus and the pleural cavity with contrast pooling [Figure 2].

Multiplanar reformatted images on contrast-enhanced computed tomography (CT) scan of the chest showed a pleural collection along the right posterior chest wall with an air-fluid level [Figure 3a] and the posterior basal subsegmental bronchus leading into the collection [Figure 3b]. There was surrounding subsegmental regional consolidation with a mild contralateral mediastinal shift. A diagnosis of BPF with empyema due to chemical pneumonitis was made. The air-fluid level resolved and fever ceased after a 3-week course of culture-sensitive antibiotics with β-lactam, β-lactamase inhibitors (amoxicillin-clavulanate 250–500 mg PO Q 8 h or 875 mg PO Q12 h). Open drainage resulted in symptomatic improvement, and

*Address for correspondence:
Dr. Reddy Ravikanth,
Department of Radiology, St. John's Medical College, Bengaluru, Karnataka, India.
E-mail: ravikanthreddy06@gmail.com

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the patient was symptom-free on discharge. 8 weeks after discharge, fluoroscopy performed after injection of contrast material into the airway through a bronchoscope showed no extravasation of contrast material in the pleural space, suggesting obliteration of the BPF [Figure 4]. The cavity resolved only over a period of 6 months, and the tube was gradually withdrawn.

Discussion

Aspiration of hydrocarbons such as kerosene cause pulmonary toxicity and provoke symptoms of pulmonary irritation such as a cough and dyspnea. Kerosene aspiration may lead to inflammation and loss of surfactant, secondarily causing the development of a BPF. Imaging localizes the site of the fistula and helps in surgical planning/bronchoscopic closure.

BPF is direct communication between the pleural space and the bronchial tree or the lung parenchyma. It is a rare pulmonary complication associated with high mortality and morbidity. Contrast-enhanced CT scan is an important diagnostic tool in the diagnosis of bronchopulmonary fistulas and provides crucial information that cannot be provided by invasive diagnostic procedures such as bronchoscopies [3]. Aspiration pneumonia with subsequent adult respiratory distress syndrome is a common cause of death associated with BPF s [4]. Pneumonectomy, prolonged pneumothorax, aspiration pneumonia, empyema, radiation therapy, and infective conditions such as tuberculosis are associated with BPF formation [5].

Hydrocarbon aspiration (kerosene) can cause significant pulmonary disease by inducing an inflammatory response, hemorrhagic exudative alveolitis, and the loss of surfactant function, intraalveolar hemorrhage and edema, hyperemia, bronchial necrosis, and vascular necrosis. Secondary effects in the lungs include pneumothorax, pneumatocele, or BPF. The hemorrhagic alveolitis and bronchial and vascular necrosis can result in a hemorrhagic pleural effusion. Lower viscosity promotes penetration into more distal airways and lower surface tension increases spread over a larger area of lung tissue. CT is considered the imaging technique of choice for visualizing and characterizing BPF [6]. Radiological indicators of BPF include (a) a persistent air leak, even though chest tubes have been placed; (b) reappearance of air in a postpneumonectomy space which was earlier opaque; and (c) a fall in the fluid level of at least 1.5 cm and an increase in the air level. The above

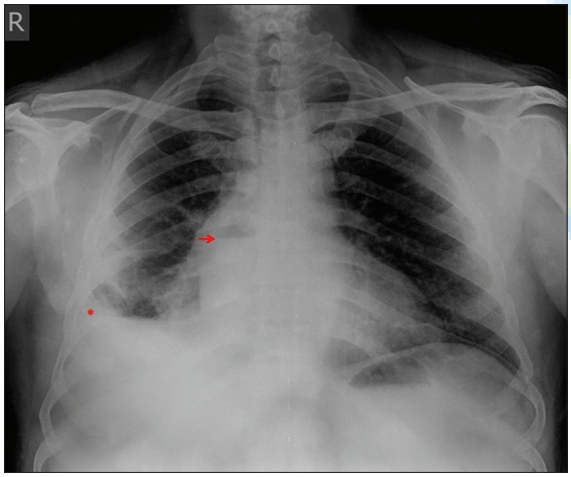

Figure 1: Frontal chest radiograph shows volume loss with an air fluid level in the right retrocardiac region (arrow). There is also right costophrenic angle blunting (asterisk) with thickening of the right minor fissure

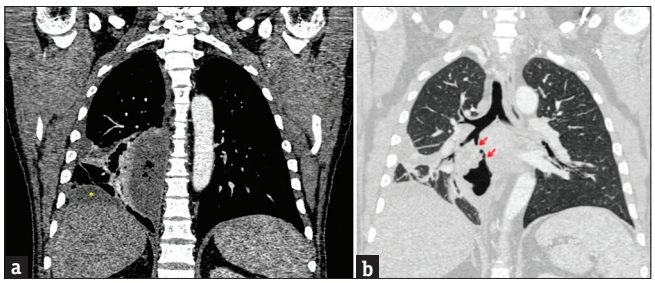

Figure 3: (a) Coronal contrast-enhanced computed tomography section of the chest showing an encysted pleural collection with right-sided pleural effusion (asterisk). (b) Coronal contrast-enhanced computed tomography section of the chest in the lung window showing the posterior basal subsegmental bronchus leading into the collection (arrows)

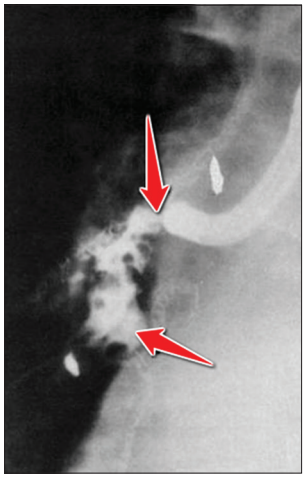

Figure 2: Bronchogram demonstrating a bronchopleural fistula (top arrow) between the right lower bronchus and pleura with contrast pooling in the pleural cavity (bottom arrow)

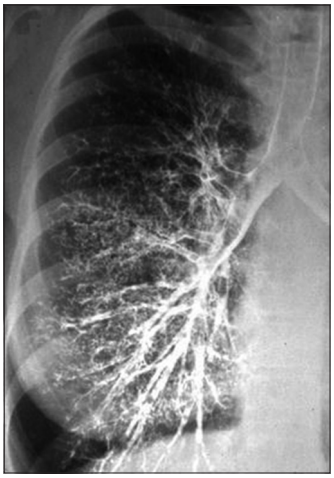

Figure 4: 8 weeks after discharge, fluoroscopy performed after injection of contrast material into the airway via bronchoscope shows no extravasation of contrast material in the pleural space, suggesting obliteration of the bronchopleural fistula

indicators are the same for a BPF due to kerosene-related pneumonitis or that from surgical complications. Another process of identifying BPF is by observing the color of sputum after injecting methylene blue into the pleural space. Chronic drainage and long-term antibiotic administration are the cornerstones of treatment. Bronchoscopic approaches with endobronchial valves and sealing compounds are newer modalities available for treatment [7]. Limited data exist on independent lung ventilation, high-frequency jet ventilation, and application of positive end-expiratory pressure to chest tubes in the management of BPF. In a surgical approach, suture closure of a BPF is buttressed by a vascularized pedicle of omentum or muscle. If the suppurative infection is present, closure of a BPF is likely to fail as is instillation of the antibiotic solution and chest closure [8].

A variety of operations have been employed to stop air flow across BPFs. These include direct closure, decortication, thoracoplasty, omental or muscle transposition, and completion pneumonectomy [9]. Localization and size of the fistula may be the decisive factors in choosing between surgical and endoscopic procedures. Of particular interest is the use of bronchoscopy with different glues, coils and sealants, which provides a safe, quick, cost-effective and relatively noninvasive and successful mode of treatment in a select group of patients. Nonoperative factors include diabetes mellitus, hypoalbuminemia, cirrhosis, and steroid administration. When the patient is severely debilitated or life expectancy is limited, palliation can sometimes be provided by a surgically created pleurocutaneous tract to vent the pleural space on a permanent or temporary basis [10]. In the present case, due to his comorbidities-diabetes mellitus, and cirrhosis of the liver and to avoid the morbidity of major operations, conservative management was employed for fistula control. Studies have proved that conservative treatment is both effective and safe for empyema-complicated post-lobectomy BPF [11]. Reported techniques include the application of liquid sealants, instillation of irritants to cause local tissue inflammation, and placement of endobronchial blockers [12].

Conclusion

Traumatic and iatrogenic causes of BPF include blunt and penetrating lung injuries, complications from pneumonectomy and thoracocentesis and chemical pneumonia due to hydrocarbon aspiration. Multidetector CT is the imaging modality of choice to determine the presence, size and location of the BPF tract and to demonstrate the underlying cause of this rare occurrence. BPF has significant morbidity and mortality rates. Surgical management is used for immediate postoperative fistulas and large BPFs, while a bronchoscopic closure can be attempted for smaller fistulas. Minimally invasive procedures for closure of a BPF include the application of liquid sealants, instillation of irritants and placement of endobronchial blockers. Thoracic surgeons should be familiar with the concepts of palliative care, and consideration should be given to concepts of palliative care, which should be considered in some cases.

Declaration of patient consent

The authors certify that the patient has obtained appropriate patient consent form. In the form, the patient has given his consent for his images and other clinical information to be reported in the journal. The patient understands that his name and initial will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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