SPONTANEOUS PNEUMOTHORAX FOLLOWING BRONCHOPLEURAL FISTULA IN GERIATRIC PATIENT: A CASE REPORT AND EMERGENCY MANAGEMENT

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ABSTRACT

Introduction: Bronchopleural fistula (BPF) is a pathological connection between the bronchial tree and the pleural space. Clinical manifestation of BPF may be classified as acute, subacute, and delayed or chronic forms. Acute BPF can be a life-threatening condition due to tension pneumothorax or asphyxiation from pulmonary flooding.

Purpose: To report the patient survival from the upper lobe of the right lung bronchopleural fistula wedge resection and to use staplers as upper lobe pulmonary wound closure.

Case Report: 72-year-old male referred from pulmonologist with a chief complaint of progressive shortness of breath and nonproductive cough for four days. The patient had a history of tuberculosis and COPD and a heavy smoker for the last 50 years. Chest radiography showed a decreased opacity of the right hemithorax, with 40% collapsed of the lung parenchyma. Chest tube insertion performed on the right hemithorax, then the patient got immediate relief. On the seventh day, the patient complained of worsening dyspnea. A chest x-ray showed lung collapsed on the right hemithorax. Multislice CT-scan (MSCT) of the chest showed right-sided pneumothorax with bronchopleural fistula. Wedge resection for the 3 cm in diameter fistula was performed. On the seventh day postoperative, the patient was fully recovered then discharged from the hospital.

Conclusion: Seven days postoperatively of wedge resection, the patient discharge from the hospital without any complication and stable hemodynamic. The patient went to the outpatient department for follow up one week after.

Keyword: Bronchopleural fistula, spontaneous pneumothorax, chest tube insertion, wedge resection.

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INTRODUCTION

Bronchopleural fistula (BPF) is a pathological connection between the bronchial tree and the pleural space. It is associated with significant morbidity and prolonged stay in the hospital[1]. BPF fist described by Franz and Murphy in 1955 after eighteen patients under operation that leading to fistula formation[2]. The causes of BPF can be nonsurgical conditions like trauma, necrotizing pneumonia, empyema, radiotherapy, bulla, or cyst rupture, but the common cause is the surgical condition like lung resection[3]. BPF usually manifests seven to fifteen days after lung resection, though more delayed presentation has been reported[4]. Some authors have divided postoperative BPF into three groups according to the rime onset after the operation: early (1 to 7 days), intermediate (8 to 30 days), and late fistulas (more than 30 days)[3–5].

Batihan *et al.* divided BPF risk factors into three groups: patient-related factors, surgeon-related factors, and anatomic factors. Age (>60 years), gender (male), neoadjuvant radiation therapy, diabetes mellitus, malnutrition, smoking, chronic steroid/ immunosuppressive usage, and need for postoperative mechanic ventilation can be classified as a patient-related risk factor[3]. Whereas other authors included chronic obstructive pulmonary disease (COPD), tuberculosis (TB), and alcohol abuse[6,7]. Surgeon-related risk factors usually related to technical failure during surgery, and the most common causes of this condition are poorly secured knots, stapler misfiring, and high anastomotic tension. Several anatomic disadvantages were defined for right-sided pneumonectomy: the presence of two left-sided and one right-sided bronchial artery supply, no coverage on the right bronchial stump, and the right main bronchus is wider and more vertical than the left main bronchus which facilitates more secretion retention.

Clinical manifestation of BPF may be classified as acute, subacute, and delayed or chronic forms. Acute BPF can be a life-threatening condition due to tension pneumothorax or asphyxiation from pulmonary flooding. Patients present with the sudden appearance of dyspnea, hypotension, subcutaneous emphysema, cough with expectoration of purulent fluid, tracheal or mediastinal shift, persistent air leak, and a reduction or disappearance of pleural effusion on the chest radiograph. The subacute presentation is more insidious and is characterized by wasting, malaise, and fever. The chronic form is associated with an infectious process and fibrosis of the pleural space[1,6].

Chest radiograph features that are suggestive of the presence of a BPF include an increase in intrapleural air

space, a new air-fluid level, changes in an already present air-fluid level, development of tension pneumothorax, and a drop in the air-fluid level exceeding two cm[4,8]. Chest computed tomography (CT) demonstrate the continuation of a bronchus or lung parenchyma to the pleural space. Seo et al. reported that chest CT succeeds to demonstrate signs of central BPF as 86%, and 100% of the patients with peripheral BPF[3,9,10]. Bronchoscopy usually performed in the presence of clinical or radiological suspicion of BPF to localize/confirm BPF. The presence of pleural fluid leakage or/and air bubbling in the bronchial stump is pathognomonic[3,4,11].

First-line therapy should address any immediate, life-threatening conditions, for example, endobronchial contamination, pulmonary flooding, respiratory failure, and tension pneumothorax. The chest tube should be applied to drainage of air and fluid from the pleural cavity and allow for lung re-expansion. Other treatment options of BPF include surgical procedures, the use of bronchoscopy and different glues, coils, and sealants[1,5,6,12].

CASE REPORT

A 72-year-old male was referred from pulmonologist to a cardiothoracic surgeon with a chief complaint of progressive shortness of breath and nonproductive cough for four days throughout the day. There was no history of fever, trauma, or chest pain. The patient had a history of pulmonary TB and had completed the medication 40 years ago, and COPD since 11 years ago. He is a heavy smoker with two packs per day for the last 50 years. The patient was conscious, with a heart rate of 100 beats per minute, blood pressure of 140/90 mmHg, respiratory rate of 26 breaths per minute, body temperature was 36,9 ^{o}C, and peripheral saturation oxygen was 94% at room air.

On physical examination, he had flared nostrils and excessive use of accessory muscles. Chest examination revealed asymmetry in chest expansion, hyper resonance to percussion over right hemithorax, decreased breath sounds on the right lung. The rest of the examination was unremarkable. Chest radiography showed a decreased opacity of the right hemithorax, with 40% collapsed of the lung parenchyma (Figure 1). The patient was treated with oxygen supplementation 3 L/min via nasal cannula and chest tube insertion performed on the right hemithorax; then, the patient got immediate relief. We use a large-bore (24 F) tube through the fifth intercostal space in the midaxillary line. A chest radiograph one hour after the procedure noted partial right chest expansion. A serial chest x-ray

performed on days 2 and 3 showed full chest expansion. Then, we decided to attempt pleurodesis to stick the pleura together by using 20 ml of 1% lidocaine diluted in 30 ml sterile normal saline was instilled, followed by 4 g of sterile talc (Steritalc®) suspended in 100 ml of sterile normal saline infused through the chest tube. The patient's position is shifted from side to side to distribute the sclerosant.

On the seventh day, the patient complained of worsening dyspnea. A chest x-ray showed lung collapsed on the right hemithorax (Figure 2A). A chest tube with a water seal has applied again, but there was no improvement. Multislice CT-scan (MSCT) of the chest showed right-sided pneumothorax with a bronchopleural fistula on the posterior segment of the right upper lobe (RUL) (Figure 2B). An immediate right-sided wedge resection, via posterolateral thoracotomy, was performed. The patient was positioned laterally after intubation, using a double-lumen tube. A bronchopleural fistula, 3 cm in diameter at the RUL, was identified (Figure 3A), and then the stapler is fired proximally from the fistula. A wedge resection for the fistula was performed (Figure 3B). The patient was stable throughout the operation and was sent to the recovery room. Postoperatively, the patient continued to improve, with a remarkable decrease in air leak, the chest tube was removed in about day seven postoperatively, and the patient was discharged home with fully recovered.

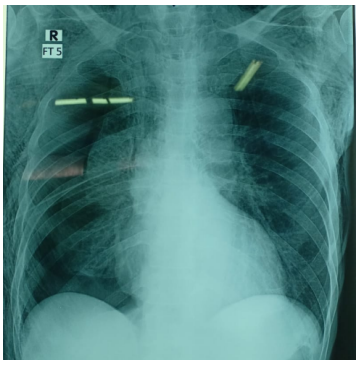

Figure 1. Chest x-ray showing pneumothorax complicated by right lung collapse

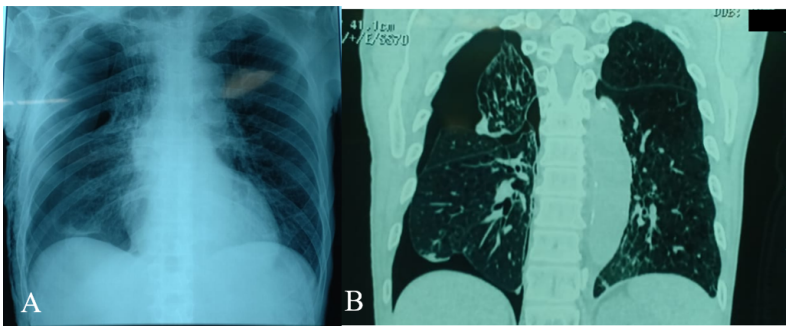

Figure 2. Patient's chest radiography on the seventh day. (A) chest x-ray showing lung collapse on the right hemithorax, (B) chest CT-scan showing right-sided pneumothorax with a bronchopleural fistula

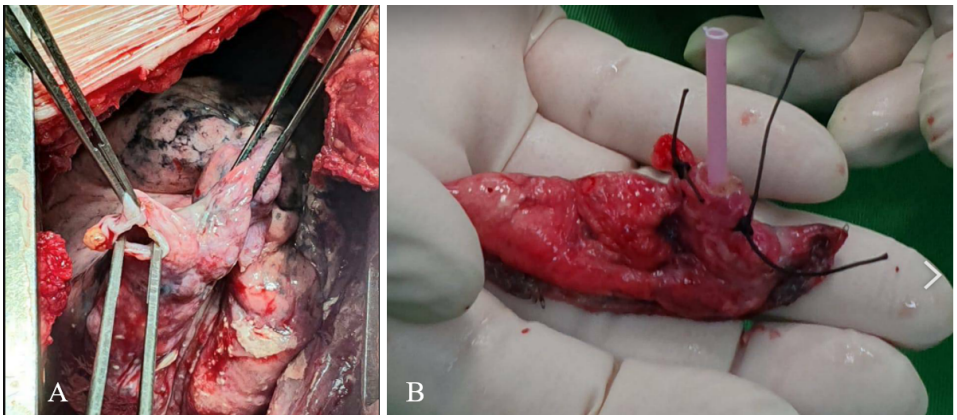

Figure 3. Intraoperative procedure (A) showing bronchopleural fistula, (B) wedge resection procedure was performed

DISCUSSION

The most common cause of BPF is a postsurgical procedure with right pneumonectomy, and right lower lobectomy is the highest incidence. However, some nonsurgical risk factors have been associated with BPF[1,3,6]. Several risk factors in our patients include geriatric patients, smoking, history of pulmonary TB, and COPD. Furthermore, a history of pulmonary TB is a risk factor and has an important role in the morbidity of COPD, as well as smoking. In the mid-1950s to early 1960s, the majority of BPFs were secondary to pulmonary tuberculosis. Improved drug therapy for tuberculosis results decreased to this complication[13]. It may be related to pulmonary scarring tissue and peribronchial or pleural fibrosis as a consequence of pulmonary TB[14,15].

BPF mortality rate ranges from 18 to 71%, and the most common cause of death is aspiration pneumonia, acute respiratory distress syndrome, or development of tension pneumothorax[4]. BPF resulting pneumothorax generally managed with oxygen therapy, chest tube insertion, and medical treatment for fistula

closure[5,6]. Chest tube insertion should be performed to drainage of air and fluid from the pleural space to avoid respiratory dysfunction and subsequent complications[6,16]. The chest tube can also be used to promote pleurodesis by applying sclerosing agents, such as talc and bleomycin[6]. Some authors claim that chest tube water seal rather than active suction promotes healing pneumothorax due to alveolar-pleural fistula and thereby improving the apposition of the lung tissue. It may be due to the use of negative pressure to the chest tube, which potentially can increase the flow through the fistulous tract and interfere with closure and healing[1,17,18]. Ayed AK. evaluated the use of suction versus no suction after surgery for primary spontaneous pneumothorax by randomized 100 patients undergoing surgery for spontaneous pneumothorax to chest tube water seal or continuous suction. The researcher found that those patients placed on water seal rather than suction had chest tubes removed earlier, a lower rate of prolonged air leak , and a shorter duration of hospital stay[19].

In addition to conservative treatments, there were several surgical procedures to treat BPF. The purpose of these surgical procedures is pleural space debridement, minimizing the residual pleural cavity, fistula closure, and the strengthening of the bronchial stump[3]. The success rate of surgical closure of BPF has been reported between 80% and 95%. Surgical fistula closure includes chronic open drainage, direct stump closure with intercostal muscle reinforcement, transsternal bronchial closure, and thoracoplasty with or without transposition of extrathoracic chest wall muscle[1].

There is no consensus on which method is most effective for BPF closure. Since the emergence of video-assisted thoracoscopy (VATS), this technique has also been performed to treat BPF[1,3]. Both VATS and open thoracotomy are effective. Recurrence rates for secondary spontaneous pneumothorax are slightly lower with thoracotomy than VATS, but thoracotomy morbidity is higher[1,20,21]. The main advantage of VATS is better visualization, which allows more secure fixation of the vascularized grafts[8]. Also, this procedure is less invasive and provides an alternative approach in draining empyemas, and as long as that the BPF present, it can be repaired simultaneously[22]. The use of staplers to close the wound resection offers safety with secure bronchial or vascular sealing and quicker to do than manual bronchial suturing[23].

For the patient who is in generally poor condition, the bronchoscopic procedure appears efficient and established

alternative. It is a suitable first option for small BPF that is less than 5 mm in diameter[4]. Endoscopic closure usually use compounds like fibrin glue, cyanoacrylate glue, oxidized cellulose, albumin-glutaraldehyde glue, hydrogel, ethanolamine, ethanol, and tetracycline, or intrabronchial valve and placement of stents. All these agents act as a plug mechanically sealing the leak and then induce an inflammatory reaction with mucosal proliferation and fibrosis, creating a permanent seal[4,20]. The procedure is easy to learn and is performed on an out-patient basis with minimal cost and discomfort to the patient and can be performed in both stable and critically ill patients. The BPF can be closed endoscopically as long as there is no evidence of active infection in the pleural cavity[4]. Due to the limitation of resources in our hospital setting as secondary health care, we couldn't perform whether VATS or bronchoscopic procedures.

Changes in respiratory function in a geriatric patient could be problematic because of chest wall compliance and respiratory muscle strength that decreased gradually, so any decrease in strength may lead to hypoventilation and postoperative pulmonary complications. In addition, the respiratory drive is also impacted in older patients due to blunted responses to hypoxia and hypercapnia[24]. The high priority post-operative care for the geriatric patient is early mobilization[25]. After just two days of bed rest hospitalization, significant functional decline occurs in the geriatric patient, especially in respiratory function. –Early mobilization and chest, physiotherapy includes deep breathing, and coughing exercises will reduce complications like atelectasis, pneumonia, empyema, and deep vein thrombosis[26]. Smoking cessation should be considered for geriatric patients; even just 3-5 days of no smoking can have some benefit to improving clearance and decrease of secretions, and prevents postoperative complications[25,26].

CONCLUSION

A wedge resection for the bronchopleural fistula was performed via posterolateral thoracotomy. The patient was stable throughout the operation room. The patient clinically improved with a remarkable decrease in air leak, then the chest tube was removed in about day seven postoperatively, and the patient was discharged home with fully recovered.

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