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Case Report

Internal Medicine Section

Bronchoscopic Management of Bronchopleural Fistula using Cyanoacrylate Glue

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ABSTRACT

Bronchopleural Fistula (BPF) is a potential complication following pulmonary surgeries, lung infections, chest trauma, chemoradiotherapy, and inappropriate mechanical ventilation with significant morbidity and mortality. Surgical repair of BPF is a definitive treatment, particularly in those who develop BPF following lung resection. However, bronchoscopic management is an excellent treatment option for BPF for causes other than pulmonary resection. The present case report describes about a 50-year-old male patient who presented with a left-sided pneumothorax. He was immediately managed with Intercostal Drainage (ICD) but there was a persistent pneumothorax due to BPF. Video bronchoscopy was done, and at the site of the air leak, cyanoacrylate glue was injected. The resolution of pneumothorax was confirmed with a radiograph, the ICD tube was removed and he was discharged. He was on regular follow-up for the next six months, and there was no recurrence of pneumothorax.

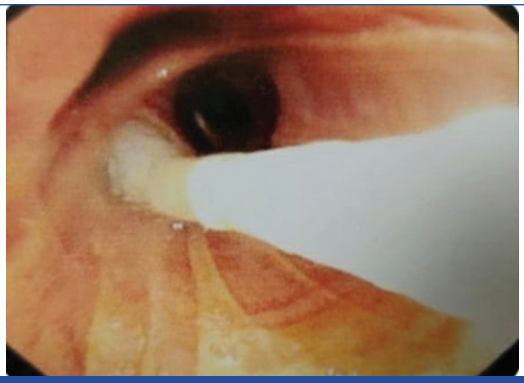
Keywords: Intercostal drainage, Pneumothorax, Video bronchoscopy

CASE REPORT

A 50-year-old male patient presented to the casualty with left-sided chest pain and shortness of breath for two days. A review of symptoms did not reveal fever, cough, or chest trauma. He was a labourer by occupation, with a history of heavy smoking and no known co-morbidities. On examination, a percussion note was hyper-resonant, and auscultation revealed an absence of breath sounds on the left-side. A chest radiograph revealed left-sided pneumothorax. He was maintaining a saturation of 95% with 4 litres oxygen through the face mask. Intercostal Drainage (ICD) tube was inserted immediately in the left 4th intercostal space. The patient symptomatically improved. A continuous air leak was noted. On the third day, a repeat chest radiograph showed the left lung's collapse and pneumothorax's persistence [Table/Fig-1], suggesting a Bronchopleural Fistula (BPF).

[Table/Fig-1]: Chest x-ray demonstrating left pneumothorax with intercostal drainage tube.

The patient was treated with antibiotics and supportive medications, and under observation for 10 days. There was no spontaneous closure of BPF. On the 11th day, a video bronchoscopy was performed. No central BPF was identified, and the endobronchial tree was regular except for excessive secretion from the left bronchial tree. A 5 Fr Fogarty catheter was introduced through the working channel of the bronchoscope sequentially inflated at every segmental opening to look for the disappearance of air leak in the underwater seal bag. There was a possible alveolopleural fistula (APF)/peripheral BPF in the posterior segment of the left upper lobe as air bubbling stopped in the underwater seal bag when the Fogarty balloon catheter was inflated at the particular segmental opening [Table/Fig-2]. After the site of the BPF was established, a thin catheter was passed through the bronchoscope, and the tip of the catheter was placed in the identified segment as distally as possible. A 0.5 mL of n-Butyl-2-cyanoacrylate sterile bioadhesive was injected into the same segment. The postprocedure proximal end of the catheter was cut and pulled out distally, to prevent damage to the bronchoscope.

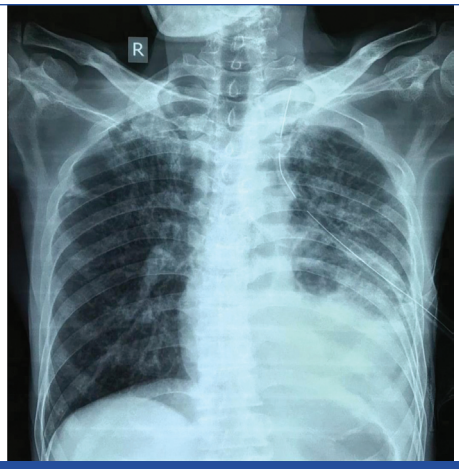


[Table/Fig-2]: Video bronchoscopy image demonstrating inflated Fogarty balloon catheter in the posterior segment of the left upper lobe.

Within 24 hours after instilling glue, the patient's condition improved, and he maintained a saturation of 94% in room air. A repeat chest radiograph showed resolution of left pneumothorax with moderate effusion [Table/Fig-3]. Intercostal drainage tube showed no bubbling for two days, so the chest tube was clamped and another chest radiograph was taken, it showed lung expansion with no recurrence of pneumothorax. ICD was removed and the patient was discharged after 15 days of hospital stay. The patient was followed-up for six months and there was no recurrence of pneumothorax.

DISCUSSION

The BPF is a persistent pathological communication between the bronchial tree and the pleural space that may result from necrotising pneumonia/emphysema (anaerobic, pyogenic, tuberculous, and fungal), lung neoplasms, blunt and penetrating lung injuries, or may occur as a complication of procedures, such as lung biopsy, chest tube drainage, thoracocentesis or may complicate radiation therapy. BPF has two types, central and peripheral BPF. Peripheral



[Table/Fig-3]: Chest x-ray image demonstrating resolution of left pneumothorax with moderate effusion.

BPF/APF is communication between pulmonary parenchyma distal to a segmental bronchus and the pleural space. Air leak is classified into four types [1]:

1. Continuous air leak (C)- This is the largest and the most uncommon, which is present throughout the respiratory cycle.
2. Inspiratory air leak (I)- This is the second largest type, which is present only during inspiration.
3. Expiratory air leak (E)- This is the third largest type, which is present only during expiration.
4. Forced Expiratory leak (FE)- If a leak is present only with coughing, it is referred to as a forced expiratory leak.

The diagnosis of BPF requires clinical, radiographic, and bronchoscopic evaluation. Management of BPF is often a challenge and confusing whether a surgical or bronchoscopic procedure to consider as there are no guidelines on how to manage BPF. The first step in the management of BPF is to relieve tension pneumothorax and address suppurative pleuropulmonary infection, if present with tube thoracostomy, antibiotics, oxygen therapy, and providing adequate ventilation in patients who are in respiratory failure [2]. A tube thoracostomy is often successful as the BPF heals spontaneously. However, if it fails, the patient may require one of the various forms of surgical or bronchoscopic interventions [3]. In the index case, even after ten days of observation, BPF does not heal spontaneously. Persistent BPF usually results in infection of the pleural space and is associated with increased mortality varies between 25% to 71% [4].

Surgical management of BPF is an appropriate choice, particularly in those who develop BPF post-lung resection. It includes direct repair of the fistula, bronchial stump repair with debridement of necrotic tissue, and reclosure of stump with omentum or muscle flaps [5]. Bronchoscopic management of the fistula is a preferred first choice in patients with BPF, as a result of non lung resection causes. It includes several methods of interventions such as the application of airway stents, coils, and occlusive materials. Among these, the selection of intervention method depends on fistula size and the experience of the interventional pulmonologist. If fistula size is ≥8 mm use of airway stents, coils, or Amplatzer devices, is the viable option [6]. Fistula closure with occlusive materials such as N-butyl-cyanoacrylate, methyl-2-cyanoacrylate, albumin-glutaraldehyde tissue adhesive, polyvinyl alcohol sponge, autologous blood patch, gel foam, oxidised regenerated cellulose, and fibrin glue are indicated, if fistula size is less than 8 mm [7-10]. However, outcomes of these bronchoscopic interventions are variable with a success rate ranging from 30% to 80% [11].

Rattiff JL et al., reported for the first time the successful closure of a BPF by endobronchial occlusion with a lead shot [12]. Chawla RK et al., reported a series of nine cases of BPF. Out of nine patients, the BPF was successfully sealed in 8 cases (88.88%) [10]. In one patient of postpneumonectomy, the fistula was big (>8 mm) and had recurrence after the procedure. In two patients, it was observed that the migration of glue resulted in respiratory distress and spillage of glue into the working channel of the bronchoscope. In the index case, the APF was managed with bronchoscopic instillation of n-Butyl-2-cyanoacrylate, as there were several advantages including localisation and closure of the fistula in the same setting. Also, it was easier, faster, cost-effective, and minimally invasive with no complications.

CONCLUSION(S)

Bronchoscopic glue instillation for peripheral BPF is a simple and effective intervention with minimal morbidity to the patient. This procedure must be attempted, before subjecting the patient to an invasive surgical procedure.

REFERENCES

[1] Cerfolio RJ. Advances in thoracostomy tube management. Surg Clin North Am. 2002;82(4):833-48. Doi: 10.1016/s0039-6109(02)00026-9. PMID: 12472132.
[2] Sarkar P, Chandak T, Shah R, Talwar A. Diagnosis and management bronchopleural fistula. Indian J Chest Dis Allied Sci. 2010;52:97-104.
[3] Gogia P, Gupta S, Goyal R. Bronchoscopic management of bronchopleural fistula. Indian J Chest Dis Allied Sci. 2010;52(3):161-63. PMID: 20949736.
[4] Nagahiro I, Aoe M, Sano Y, Date H, Andou A, Shimizu N. Bronchopleural fistula after lobectomy for lung cancer. Asian Cardiovasc Thorac Ann. 2007;15(1):45-48.
[5] Liberman M, Cassivi SD. Bronchial stump dehiscence: Update on prevention and management. Semin Thorac Cardiovasc Surg. 2007;19(4):366-73. Doi: 10.1053/j.semtcvs.2007.11.002. PMID: 18395640.
[6] Fruchter O, El Raouf BA, Abdel-Rahman N, Saute M, Bruckheimer E, Kramer MR. Efficacy of bronchoscopic closure of a bronchopleural fistula with amplatzer devices: Long-term follow-up. Respiration. 2014;87(3):227-33.
[7] Sprung J, Krasna MJ, Yun A, Thomas P, Bourke DL. Treatment of a bronchopleural fistula with a Fogarty catheter and oxidized regenerated cellulose (surgicel). Chest. 1994;105(6):1879-81.
[8] Potaris K, Mihos P, Gakidis I. Preliminary results with the use of an albumin-glutaraldehyde tissue adhesive in lung surgery. Med Sci Monit. 2003;9(7):PI79-83.
[9] Finch CK, Pittman AL. Use of fibrin glue to treat a persistent pneumothorax with bronchopleural fistula. Am J Health Syst Pharm. 2008;65(4):322-24.
[10] Chawla RK, Madan A, Bhardwaj PK, Chawla K. Bronchoscopic management of bronchopleural fistula with intrabronchial instillation of glue (N-butyl cyanoacrylate). Lung India. 2012;29(1):11-14.
[11] West D, Togo A, Kirk AJ. Are bronchoscopic approaches to post-pneumonectomy bronchopleural fistula an effective alternative to repeat thoracotomy? Interact Cardiovasc Thorac Surg. 2007;6(4):547-50.
[12] Rattiff JL, Hill J, Tuchu H, Fallat R. Endobronchial control of bronchopleural fistula. Chest. 1977;71:98-99.

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