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Case Report

A return to 1992: Using the "blowhole" technique for diffuse subcutaneous emphysema caused by a broncho-pleural fistula

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ABSTRACT

A bronchopleural fistula (BPF) is an abnormal communication between the bronchial tree and pleural space resulting in a high risk for morbidity and mortality. We describe a case highlighting the management of a BPF with subcutaneous and mediastinal air resulting in dysphagia and dysphonia using a technique that was first described in a 1992 CHEST article. The "Blowhole" technique may be utilized for patients that are poor surgical candidates requiring rapid correction and prevention of detrimental consequences such as pneumomediastinum, tension pneumothorax, upper airway compromise and pneumopericardium.

1. Introduction

A bronchopleural fistula (BPF) is a communication between the bronchial tree and the pleural space. It can result from various situations, including, but not limited to, pneumonectomy, blunt force trauma, mechanical ventilation, and lung necrosis due to chemotherapy, radiation, or infections [1]. BPF carries a high risk for morbidity and mortality due to its associated complications, such as tension pneumothorax, pneumopericardium, and pneumomediastinum [1–5]. Furthermore, the air from a pneumomediastinum may extend into the adjacent tissue planes, causing diffuse subcutaneous emphysema [2–4,6]. Subcutaneous emphysema generally reabsorbs without drainage once the BPF is corrected, usually by surgical means; however, in some instances, surgery is not a feasible option.

2. Case

A 65-year-old male with severe COPD [Stage E] and right lower lobe stage 3a, non-small cell lung cancer, previously treated with radiation and chemotherapy, was admitted with worsening dyspnea and increased oxygen requirement of 8 LPM. His baseline oxygen requirement was 4 LPM. He was treated for presumed post-obstructive pneumonia and an acute COPD exacerbation with IV vancomycin (1000 mg daily), piperacillin-tazobactam (4.5 g q8), and methylprednisone (initially 125 mg then 40 mg for 5 days). A CT thorax demonstrated an extension of the RLL mass into the right chest wall. Air was noted within the pleural space and subcutaneously without a pneumomediastinum. Pulmonary consultation suspected that a BPF developed secondary to tumor necrosis following radiation therapy. Since the BPF was not causing symptoms and the patient was a poor surgical candidate, no intervention was suggested. To continue cancer treatment, the plan was further radiation and carboplatin therapy a week later, allowing the patient to recover from the pneumonia. Following four days of hospitalization, he improved, was at his baseline oxygen requirement and was discharged with

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a steroid taper.

He returned to the ED one month later with massive facial and chest swelling, profound dysphagia, and dysphonia. He was admitted to the medical intensive care unit because of the potential airway compromise. A CT thorax demonstrated increased subcutaneous emphysema and a pneumomediastinum (Fig. 1A). Thoracic Surgery performed a bedside "blow hole" procedure by making bilateral eight cm vertically elliptical incisions in the anterior chest wall. Dissection was carried down to the level of the pectoralis fascia, the point where bubbling was noted. Two negative pressure air vacs were placed over each incision, rapidly decreasing the subcutaneous emphysema and pneumomediastinum. The patient was able to eat and speak that same evening. The wound vacs remained for four days and were replaced by wet-to-dry dressing. A year later, a large pneumothorax remained without subcutaneous emphysema or pneumomediastinum (Fig. 1B).

3. Discussion

This case highlights the progression of BPF leading to diffuse subcutaneous emphysema and its treatment with the blow hole technique (Fig. 2). Our patient developed significant complications associated including upper airway compromise, pneumopericardium, and pneumomediastinum. BPF introduces extra-alveolar air into the perivascular interstitium. The air travels along the bronchovascular sheath toward the mediastinum, resulting in a pneumomediastinum [1]. Since the bronchovascular sheath is continuous with the pericardium, air that enters the pericardial space causes a pneumopericardium, which can travel further along the adventitia of the great vessels [1]. A pneumomediastinum that ruptures into the free pleural space results in a pneumothorax [1]. In our case, the placement of a chest tube was not ideal since the BPF was unlikely to close, and a chest tube would not correct the pneumomediastinum. Moreover, the lung was unlikely to expand even with a chest tube given that the lung was likely trapped.

The diagnosis of BPF requires the combination of clinical, radiographic, and occasionally bronchoscopic evidence to confirm the air leak [3,4]. BPF will occasionally present with chills, dyspnea, and cough with purulent sputum, similar to this patient's first hospital presentation. At that time, it was thought the patient suffered from post-obstructive pneumonia or an acute COPD exacerbation.

The management of BPFs is highly case-dependent and involves conservative or surgical interventions. Surgical repair is often used post-lung resection and involves debridement of necrotic tissue and suture reclosure of the bronchial stump with either omentum or muscle [6–8]. In most cases, this can be accomplished by video-assisted thoracoscopic surgical approach. Bronchoscopy is used in the localization and assessment of the fistula. Bronchoscopic interventions are preferred in those who are poor surgical candidates, a fistula size less than 8 mm, or whose etiology is caused by malignancy or infection where the bronchial stump is involved [6–8]. Stents, coils, or an Amplatzer device may provide a temporary closure and be used as a bridge to surgery. Our patient was a poor surgical candidate, given that his malignancy had progressed and his end-stage COPD. Bronchoscopy would only be a temporary fix and poorly tolerated given the increased O_2 requirements.

To our knowledge, the "blowhole" technique was first described by Herlan and colleagues in 1992 [3]. These authors performed the procedure on four patients with spontaneous subcutaneous emphysema in their intensive care unit.

4. Conclusion

Our patient was symptomatic with dysphagia, dysphonia and worsening dyspnea due to the massive subcutaneous emphysema. Due to his poor health and multiple comorbidities, the blowhole technique comprising of two anterior incisions with the addition of two wound vacs effectively reabsorbed the subcutaneous air and corrected his symptoms.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

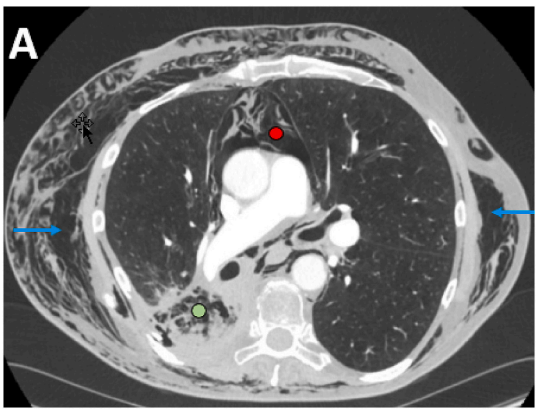

Fig. 1A. CT thorax demonstrating the diffuse subcutaneous emphysema (blue arrows) and pneumomediastinum (red circle). A BPF was thought to be formed from the necrosis of RLL non-small cell lung mass (green circle) eroding through to the pleura.

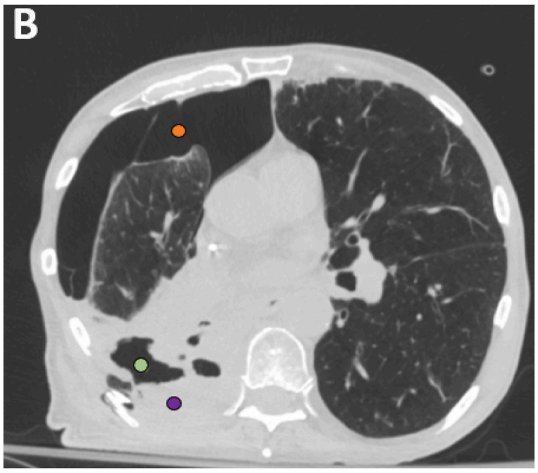

Fig. 1B. CT thorax one year later shows a new pneumothorax (orange circle) with an trapped lung on the right side. There is a malignant pleural effusion (purple circle) on the right side with RLL non-small lung mass.

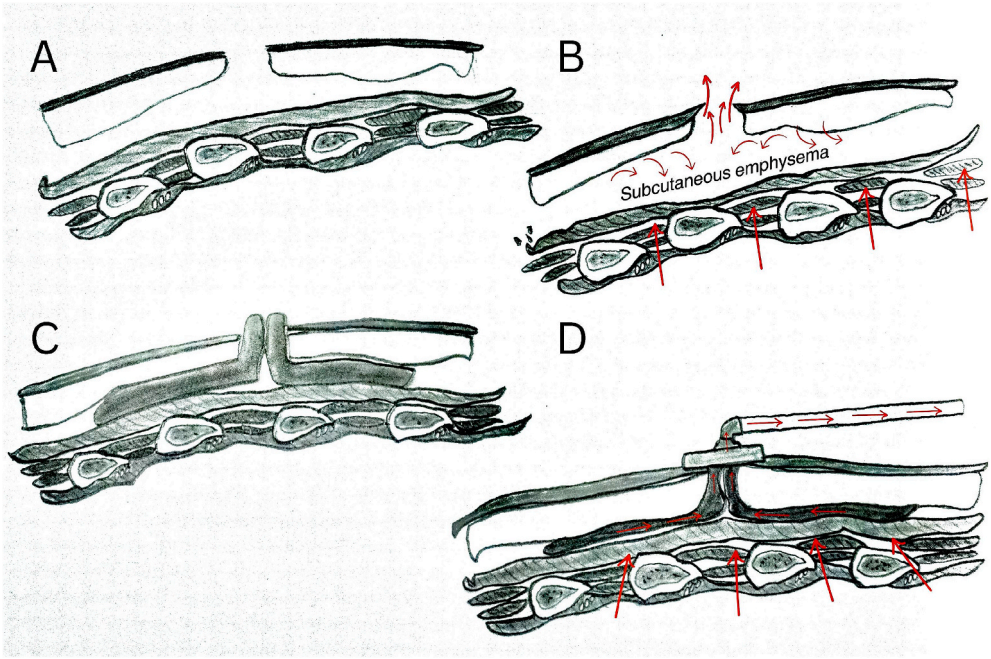

Fig. 2. A drawing of the "blow hole" technique, which begins by making an eight centimetre vertical elliptical incision in the anterior chest wall (A). The dissection is carried down to the level of the pectoralis facia until bubbling is noted (B). A seal is placed over the incision or hole (C). A wound vac is attached allowing for rapid absorption and a decrease in subcutaneous emphysema (D). Illustration by Daniel James Dismuke.

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