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CASE REPORT

# Management of Bilateral Extensive Subcutaneous Emphysema

Kee Nam Tan[1]*, Yon Lek Yap[2], Qin Jian Low[2]

[1] Department of Internal Medicine, Hospital Queen Elizabeth, 88300 Kota Kinabalu, Sabah, Malaysia
[2] Department of Internal Medicine, Hospital Sultanah Nora Ismail, 83000 Batu Pahat, Johor, Malaysia

*Corresponding author's email: tankeenam@gmail.com

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## ABSTRACT

**Subcutaneous emphysema (SE) occurs when there is a trapping of air under the skin due to leakage either from the gastrointestinal or respiratory tract. SE is commonly associated with procedural complications such as chest tube insertion, cardiothoracic surgery; as well as barotrauma, infection and malignancy. The majority of SE resolve spontaneously without any active intervention. However, it is a medical emergency as SE may spread and compromise the airway. Various interventions had been described in other literature. We would like to illustrate a case of extensive SE one day after chest tube insertion for secondary spontaneous pneumothorax, successfully relieved by usage of cannulas and low-grade pressure suction.**

## INTRODUCTION

Subcutaneous emphysema (SE) occurs when air passes through ruptured alveolus to pulmonary interstitial tissue. As the pressure is greater than pleural reabsorption, it causes air to be trapped under the skin. SE is commonly associated with chest drain insertion or cardiothoracic procedures, and self-limiting. Palpable crepitation over the skin with widespread soft tissue distention is a typical clinical sign of SE. Rarely, SE can progress further and involves a larger area of the chest, leading to cardio-respiratory arrest if no preventive measures are taken to address this issue (William et al., 2005). Several methods of managing extensive SE had been reported such as emergency tracheostomy,

multisite subcutaneous drainage, suction pressure from a chest drain, etc. We would like to report a case of extensive SE developed one day after chest tube insertion for secondary spontaneous pneumothorax and our methods to relieve the SE.

## CASE PRESENTATION

A 52-year-old gentleman with underlying chronic obstructive pulmonary disease (COPD), presented with dyspnoea and productive cough for two days. He denied fever, chest pain and hemoptysis. He was tachypneic with an oxygen saturation of 88% upon arrival. His arterial blood gas showed hypoxia with partially compensated respiratory acidosis. An urgent chest radiograph was performed which showed right pneumothorax (3cm size of pneumothorax from right hilar) (Figure 1A). A chest drain (24-French) was inserted immediately at the right fifth intercostal space at the safety triangle. He was much relieved after chest drain insertion (Figure 1B).

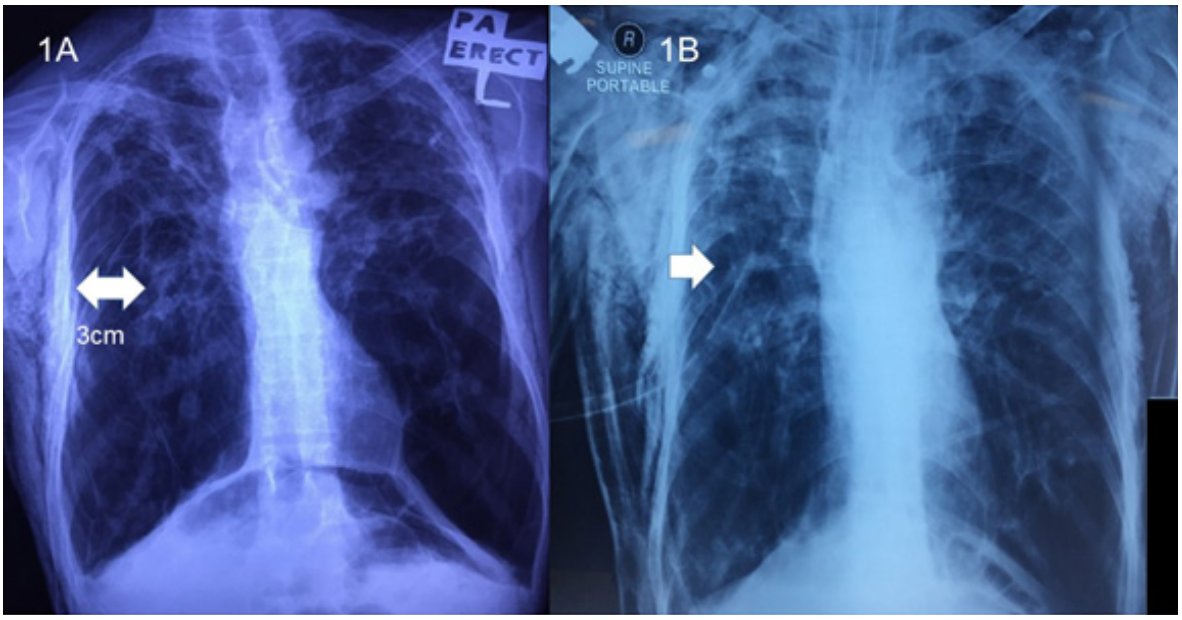


**Figure 1A** Chest radiograph (on admission) showed right pneumothorax with size 3 cm from hilar with bilateral bronchiectasis changes**. Figure 1B** A 24 French size chest drain was inserted (white arrow showed the tip of the chest tube) and the right lung was successfully re-expanded. There was also subcutaneous emphysema seen over the right chest wall (A chest radiograph was taken after the patient was intubated due to respiratory distress).

The next day, the patient developed SE over his bilateral anterior chest wall which gradually extended over to his neck, cheek, bilateral arms, torso and thighs. He was unable to open both of his eyes due to the extensive SE (Figure 2A). At the same time, his underwater seal draining was noted to have an increasing amount of bubbling (air escape). Subsequently, he developed acute respiratory distress with dysphonia. To protect his airway, he was electively intubated and received mechanical ventilation. Chest radiograph performed later showed re-expansion of the right lung with extensive SE seen over the chest wall (Figure 1B). An urgent computed tomography (CT) of the thorax showed extensive SE. There were also emphysematous lung changes with bilateral apical bronchiectasis in keeping with chronic lung disease complicated with right pneumothorax (Figure 3A & 3B). Large bullae were seen at the apical segment of the right upper lobe measuring 3.1 cm × 3.6 cm × 2.3 cm. As such, he developed extensive subcutaneous emphysema with broncho-pleural fistula formation due to chest drain insertion.


**Figure 2** The appearance of the patient before (Figure 2A) showed extensive SE involving bilateral anterior chest wall, upper limbs, cheek and neck and 10 days later (Figure 2B) showed resolve SE.

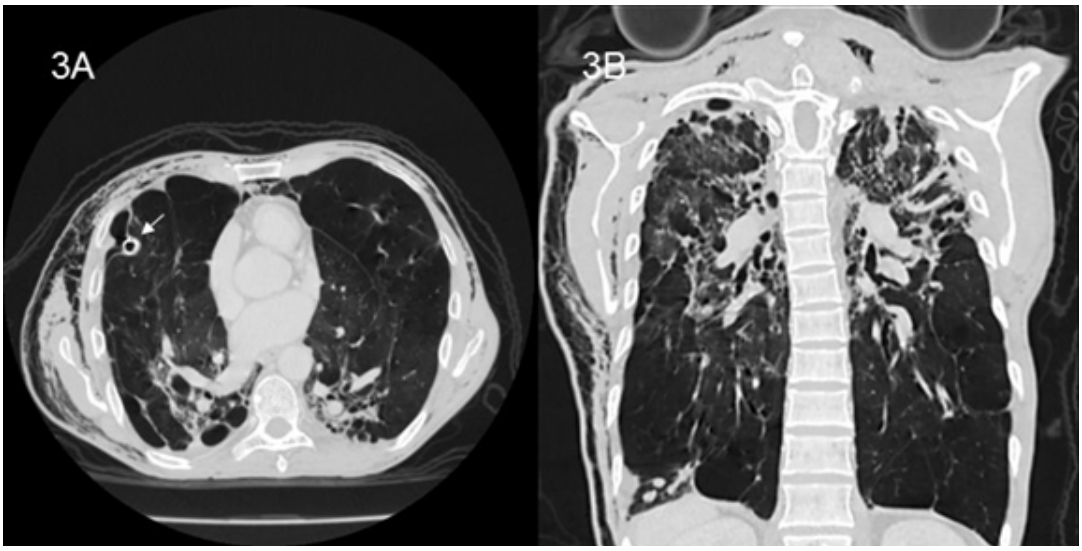


**Figure 3A** (Axial view) and **Figure 3B** (Coronal view) CT thorax showed extensive SE. Emphysematous lung changes with bilateral apical traction bronchiectasis in keeping with chronic lung disease complicated with right pneumothorax. (Arrow showed the chest tube location).

Two 16-Gauge size cannulas were inserted subcutaneously on his anterior chest wall with a low-grade suction of -5cm$H_2O$ applied over his right chest drain as well. Active compressive massage over the face and chest wall area towards the cannula site every 2 hourly during the first 24 hours was performed to facilitate the drainage of the trapped air in the subcutaneous tissue. The SE resolved gradually and he was able to open both of his eyes. His oxygen supplementation was reduced gradually and he was successfully extubated 3 days later. The low-grade pressure suction over the right chest drain was continued for a week. His subcutaneous emphysema resolved completely without any adjustment of the chest tube and eventually, we were able to remove his chest drain (Figure 2B).

## DISCUSSION

The main aim of managing extensive SE is to decompress the thoracic outlet and the neck to ensure airway patency. Massive SE can become a life-threatening event if the airway and cardiovascular are compromised (William et al., 2005). In this case, our patient developed an extensive SE secondary to broncho-pleural fistula after chest drain insertion. We inserted two 16-Gauge size cannulas subcutaneously at his anterior chest wall and a low-grade pressure suction of −5cm $H_2O$ was applied over his right chest drain.

According to Srinivas et al. (2007), the most crucial step in managing SE effectively by using microcatheter drainage is to increase the interstitial hydrostatic pressure by applying compression massage from the face downwards and arm upwards directions respectively towards the catheter site. The resolution of extensive SE only happens after the steps mentioned above were performed (Srinivas et al., 2007). Paul et al. (2002) reported success in managing a patient with recurrent pneumothorax and persistent air leak complicated with extensive SE by using two 14-gauge angiocatheters which were inserted into the subcutaneous space bilaterally at the second intercostal space, midclavicular line. Angiocatheters were modified to create multiple fenestrations on them. By applying this method, SE and pneumothorax were resolved within three days (Paul et al., 2002). Another case reported by Brenton (2018) described the usage of three 14-gauge angiocatheters inserted subcutaneously in different directions and positions over the chest wall in a case of post esophagogastrectomy patient who developed extensive SE. The SE completely resolved within 24 hours after the angiocatheters were inserted (Brenton, 2018).

There are other methods of managing SE which have been reported in the literature. Most of the methods were more invasive and could potentially cause more discomfort to the patients. One of the methods is making a horizontal incision over bilateral clavicles into the fascia region, which is reported by Matthew and Colin (2013) in a perforated duodenal ulcer patient who developed massive SE. Other methods of managing extensive SE such as inserting a trochar-type chest drain subcutaneously from the mid-axillary line and tunnelling it towards the jugular notch (Terada, 1993), insertion of Jackson-Pratt drain over bilateral anterior mid-chest wall (Sherif et al., 1999) and emergency tracheostomy (Lopez et al., 1997).

## CONCLUSION

In summary, we described the usage of two wide-bore cannulas with low-grade suction from chest drain in managing extensive SE. The tools needed are relatively cheap and accessible in most of the general medical wards. Moreover, the procedures can be done bedside by physicians. This treatment aims to relieve the discomfort and avoid complications arising from SE while providing a simple, yet cost-effective as well as the low-risk approach in decompressing SE.

## CONFLICT OF INTEREST

The authors declare that they have no competing interests in publishing this case.

## CONSENT

The authors certify that written consent was obtained from the patient to publish this case report. 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 initials will not be published, and due efforts will be made to conceal his identity, but anonymity cannot be guaranteed. A copy of the written consent is available for review by the Chief Editor.

## ACKNOWLEDGEMENTS

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