JUSINDO, Vol. 8 No. 1, 2026
p-ISSN: 2303-288X, e-ISSN: 2541-7207

Post-Thoracotomy Subcutaneous Emphysema Caused by Airway Blood Clot–Induced Barotrauma: A Rare Case Report

Kevin Christian Kamalo*, Eka Yudha Lantang, Anastasia Magdalena Lantang, Yolanda Edith Pratiwi, Rigel Kent Paat
Sentra Medika Hospital Minahasa Utara, Indonesia
Email: kamalokevin@gmail.com*, ekalantang@gmail.com, Lantanganastasia@gmail.com, yolandaedithpratiwi@gmail.com, rigelpaat@gmail.com

Keywords:
Emphysema subcutis; Barotrauma; Thoracotomy; Airway blood clot

Abstract

Subcutaneous emphysema resulting from barotrauma caused by an airway blood clot is an extremely rare complication following thoracotomy, with few reported cases in the literature. This case report aims to describe the clinical presentation, diagnostic findings, and management of a post-thoracotomy patient who developed subcutaneous emphysema secondary to barotrauma induced by blood clot airway obstruction. A 27-year-old male patient with blunt thoracic trauma underwent exploratory thoracotomy and was postoperatively managed with mechanical ventilation. Data were collected retrospectively from medical records, following the 2013 CARE Guidelines. On the second postoperative day, the patient developed severe shortness of breath, tachypnea, and subcutaneous emphysema in the chest and neck. Chest X-ray confirmed subcutaneous emphysema, and bronchoscopy revealed black blood clots obstructing both main bronchi. Mediastinostomy and bronchoscopic clot removal were performed. Following bronchoscopy, the patient's respiratory condition improved significantly; he was extubated one day later and transferred from the ICU after eight days. Airway obstruction by a blood clot can trigger barotrauma and subcutaneous emphysema in post-thoracotomy patients on mechanical ventilation. Early bronchoscopy is recommended to prevent and manage such life-threatening complications.

INTRODUCTION

Pulmonary barotrauma is a complication that arises from alveolar damage due to increased intrapulmonary pressure, which can lead to pneumothorax, pneumomediastinum, or subcutaneous emphysema. This condition is often found in patients who are on mechanical ventilation or undergoing thoracic surgery, including thoracotomy. The main risk factors include increased peak inspiratory pressure, positive end-expiratory pressure (PEEP), and the use of large tidal volumes, which can increase the risk of alveolar rupture. Furthermore, thoracic trauma (such as rib fractures, pulmonary contusions, or lung lacerations) and the thoracotomy procedure itself (which alters respiratory mechanics, damages pleural tissue, and reduces pulmonary reserve) also increase the likelihood of barotrauma (Battisti et al., 2025; Sharma et al., 2025).

In addition to pressure, blood clots also play a significant role in causing respiratory complications in patients after thoracic surgery (Mali & Haghaninejad, 2019; Tanner & Colvin, 2020). A blood clot obstructing the bronchi can cause airflow obstruction, atelectasis, hypoxemia, and even increased intrapulmonary pressure when the patient is receiving

mechanical ventilation. This condition not only worsens ventilation-perfusion function but can also trigger barotrauma.

In post-thoracotomy patients, the risk of respiratory complications increases due to changes in lung mechanics, loss of pleural continuity, lung tissue trauma, and the need for invasive ventilation. The interaction between positive ventilator pressure and airway obstruction due to blood clots makes patients more susceptible to severe barotrauma. Therefore, early bronchoscopy to clear blood clots is recommended to prevent serious respiratory complications, including barotrauma. Early detection and prompt and appropriate management are crucial to reducing morbidity and mortality (Kramer et al., 2019; Setyawati et al., 2024; Sun et al., 2026).

The uniqueness of this case report lies in the occurrence of post-thoracotomy barotrauma triggered by blood clot obstruction, a relatively rare complication. The combination of these two factors highlights the importance of clinical vigilance, close monitoring of respiratory function, and early consideration of bronchoscopy as strategies to prevent serious complications. This case report follows the 2013 CARE Guidelines Checklist.

Based on the rarity of this complication, this case report aims to describe the clinical presentation, diagnostic findings, and management of a post-thoracotomy patient with subcutaneous emphysema caused by an airway blood clot, highlight the pathophysiological mechanism linking airway obstruction to barotrauma, and emphasize the role of early bronchoscopy. Clinically, it serves as a reminder for thoracic surgeons and intensivists to consider blood clot obstruction as a cause of respiratory deterioration and the value of prompt *bronchoscopic* intervention. Educationally, it contributes to the limited literature on this rare complication, providing a case example for teaching and supporting institutional protocols for early post-thoracotomy bronchoscopy in high-risk patients.

RESEARCH METHODS

This study used a case report design to describe in detail the incidence of subcutaneous emphysema due to barotrauma triggered by airway obstruction by a blood clot in a post-thoracotomy patient. The approach used was descriptive qualitative, focusing on clinical chronology, diagnostic findings, medical interventions, and patient outcomes.

This case report is based on the 2013 CARE (Case Report Guidelines), which includes patient identification, clinical history, physical examination findings, supporting examination results, diagnosis, therapeutic interventions, and patient follow-up and clinical outcomes. Data were obtained retrospectively through patient medical records at the North Minahasa Sentra Medika Hospital.

The subject of this report is a 27-year-old male patient with a history of thoracic trauma due to a work-related explosion. Inclusion criteria were patients experiencing respiratory complications after thoracotomy with indications for mechanical ventilation. Data collected included:

1. Initial clinical data: vital signs, chief complaint, and history of trauma
2. Physical examination: findings in the respiratory and thoracic systems
3. Supporting examinations: laboratory and radiology results (thoracic X-ray)
4. Clinical management: operative measures (thoracotomy), use of a ventilator, and supportive therapy.

5. Further interventions: bronchoscopy and mediastinotomy
6. Clinical outcome: improvement of patient condition to transfer from ICU

Data analysis was conducted narratively, linking clinical findings in patients with current scientific literature on the pathophysiology of barotrauma, the effects of airway obstruction by blood clots, and post-thoracotomy complications. Interpretation was performed to identify causal relationships and the uniqueness of the reported cases.

Ethical aspects of the research were adhered to by maintaining patient confidentiality and ensuring that data was used solely for scientific purposes. Consent for medical procedures was obtained in accordance with hospital procedures, and this report does not include any patient identification.

CASE REPORT

A 27-year-old male patient presented with left-sided chest pain and shortness of breath after being struck by a hard object during a welding explosion. He denied any previous medical history.

Initial physical examination showed a flail chest in the left thoracic region, hematoma diameter ± 10 cm, multiple excoriated vulnus, and second-degree burns with a diameter of ± 10 cm. Vital signs showed tachycardia (pulse 110 beats per minute), tachypnea (patient's breathing 28 times per minute), and Peripheral Oxygen Saturation (SpO_2) 90% without oxygen assistance. Supporting examinations found the patient's hemostasis, namely Prothrombin Time (PT) 12.5 and Activated Partial Thromboplastin Time (APTT) 25.

The patient received 15 liters per minute of non-rebreathable mask (NRM) oxygen therapy and underwent exploratory thoracotomy and Open Reduction and Internal Fixation (ORIF) of CITO ribs. After surgery, the patient was treated in the Intensive Care Unit (ICU) with a mechanical ventilator in Synchronized Intermittent Mandatory Ventilation-Volume Control (SIMV-VC) mode, a frequency of 12 times per minute, a Tidal Volume (TV) of 400 milliliters, Pressure Support (PS) of 10 cmH_2O, Positive End-Expiratory Pressure (PEEP) of 5 cmH_2O, and Oxygen Fraction (FiO_2) of 100%. The patient was routinely suctioned every 3-4 hours.

On the second postoperative day, the patient experienced severe shortness of breath. Physical examination revealed subcutaneous emphysema in the chest and neck region with bilateral wheezing. During the patient's shortness of breath, the ventilator setting was increased to 16 breaths per minute, and PEEP was increased to 6 cmH2O. A CITO chest x-ray revealed subcutaneous emphysema in the soft tissues of the left lateral hemithorax and bilateral supraclavicular regions.

Figure 1. Chest X-ray of subcutaneous emphysema in the soft tissue of the left lateral hemithorax and bilateral supraclavicular regions.
Source: Patient medical record, North Minahasa Sentra Medika Hospital

A mediastinotomy and CITO bronchoscopy were performed. The bronchoscopy revealed black blood clots blocking the right and left main bronchi.

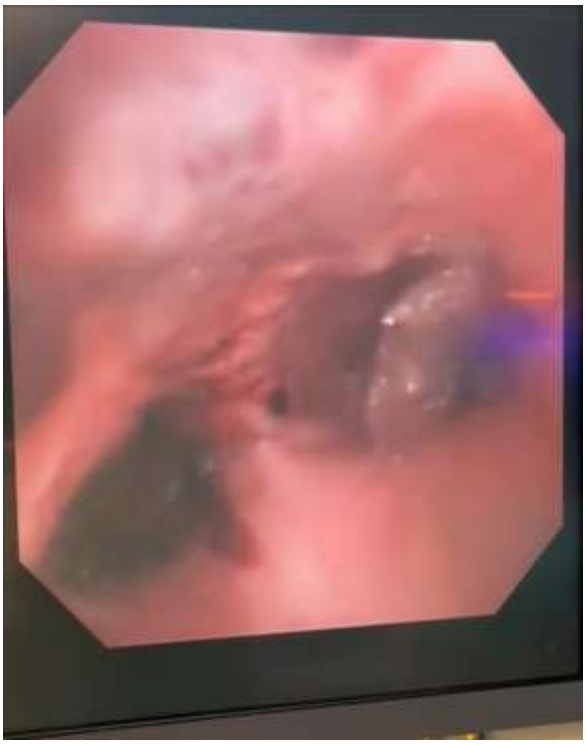

Figure 2. Left and right main bronchus blocked with blood clots
Source: Patient bronchoscopy documentation, North Minahasa Sentra Medika Hospital

Figure 3. Blood Clot Size

Source: Patient bronchoscopy documentation, North Minahasa Sentra Medika Hospital

Following the procedure, the patient's respiratory condition improved. He was successfully extubated one day postoperatively and continued with oxygen therapy with NRM. After eight days of ICU care, he was transferred to a regular ward with significant clinical improvement.

RESULTS AND DISCUSSION

This case illustrates the complication of subcutaneous emphysema due to barotrauma in a post-thoracotomy patient on mechanical ventilation, with the primary cause being airway obstruction by a blood clot.

In thoracotomy, bleeding can occur as a very rare complication. Bleeding occurs in less than 2% of video-assisted thoracoscopy (VATS) procedures and approximately 0.1% to 3% of open procedures (Iyer & Yadav, 2013). Bronchial obstruction by a blood clot causes a ball-valve phenomenon, where air can enter the alveoli during inspiration but is trapped during expiration. As a result, alveolar pressure increases progressively until alveolar rupture occurs and air leaks into the surrounding tissue (Nieman & Habashi, 2024). The main pathophysiological mechanism of subcutaneous emphysema in this case can be explained by the Macklin effect, namely alveolar tearing due to increased intra-alveolar pressure that causes air to enter the pulmonary interstitial space, then follow the perivascular pathway to the mediastinum, and finally spread to the subcutaneous tissue (Puspita & Mahiswara, 2020).

Previous studies have shown a paucity of reports of patients with subcutaneous emphysema experiencing complications from barotrauma caused by blood clots in the airway after thoracotomy (Janssen et al., 2022; Olmstead et al., 2018; Sahoo et al., 2017). In Indonesia, there have been virtually no reports of this type of case in recent years. The uniqueness of this case lies in its rare and potentially complicating complications (Łątka et al., 2024; Townsend et al., 2022). Previous studies have reported similar cases approximately one to two decades ago, involving similar procedures, such as *bronchoscopic* extraction. In these cases, the blood clot was not detected because the patient's hemostasis was within normal limits. Regular

suctioning was performed, and no blood was found on suction. This is a very rare case. Therefore, the authors recommend the importance of considering preventive bronchoscopy in all patients after thoracotomy in the ICU to prevent micro bleeding and subsequent complications.

CONCLUSION

Cases of subcutaneous emphysema, a complication of barotrauma caused by a blood clot blocking the airway after thoracotomy, are extremely rare. Removal of the blood clot using bronchoscopy has shown good results. Increasing awareness of ventilator alarms and early Bronchoscopy after Thoracotomy is expected to reduce the incidence of progressive subcutaneous emphysema. It is recommended that thoracic surgical centers consider routine early *bronchoscopic* evaluation in mechanically ventilated post-thoracotomy patients with unexplained respiratory deterioration or signs of barotrauma, as prompt intervention may prevent life-threatening complications.

REFERENCES

Battisti, A. S., et al. (2025). *Barotrauma*. StatPearls Publishing. http://www.ncbi.nlm.nih.gov/books/NBK482348/

Iyer, A., & Yadav, S. (2013). Postoperative care and complications after thoracic surgery. In M. Firstenberg (Ed.), *Principles and practice of cardiothoracic surgery*. InTech. https://doi.org/10.5772/55351

Janssen, N., Laven, I. E. W. G., Daemen, J. H. T., Hulsewé, K. W. E., Vissers, Y. L. J., & de Loos, E. R. (2022). Negative pressure wound therapy for massive subcutaneous emphysema: a systematic review and case series. *Journal of Thoracic Disease*, *14*(1), 43.

Kramer, A. A., Sebat, F., & Lissauer, M. (2019). A review of early warning systems for prompt detection of patients at risk for clinical decline. *Journal of Trauma and Acute Care Surgery*, *87*(1S), S67–S73.

Łątka, K., Kołodziej, W., Pawuś, D., Waligóra, M., Trompeta, J., Klepinowski, T., Lasowy, P., Tanaka, M., Łabuz-Roszak, B., & Łątka, D. (2024). Extremely rare complications in Uniportal spinal endoscopy: A systematic review with unique case analyses. *Journal of Clinical Medicine*, *13*(6), 1765.

Licker, M., et al. (2003). Risk factors for acute lung injury after thoracic surgery for lung cancer. *Anesthesia & Analgesia, 97*(6), 1558–1565. https://doi.org/10.1213/01.ANE.0000087799.85495.8A

Mali, S., & Haghaninejad, H. (2019). Pulmonary complications following cardiac surgery. *Archives of Medical Science-Atherosclerotic Diseases*, *4*(1), 280–285.

Nieman, G. F., & Habashi, N. M. (2024). Alveolar and Alveolar Duct Mechanics in the Acutely Injured Lung: Peeling Stress and Stress Multiplication. In *Applied Physiology to Reduce Ventilator Induced Lung Injury: Clinical Applications for the Acutely Injured Lung* (pp. 55–80). Springer.

Olmstead, D., Gelfand, G., Anderson, I., & Kortbeek, J. B. (2018). A case report of acute airway compromise due to subcutaneous emphysema. *Case Reports in Medicine*, *2018*(1), 3103061.

Puspita, N. P. T., & Mahiswara, D. G. (2020). Efek Macklin pada kasus trauma: Pneumomediastinum dan emfisema interstisial. *Medicina, 51*(3). https://doi.org/10.15562/medicina.v51i3.674

Sahoo, N. K., Singh, S., Roy, I. D., & Bhandari, A. (2017). Early postoperative malignant subcutaneous emphysema: report and review. *Journal of Maxillofacial and Oral Surgery*, *16*(1), 85–89.

Setyawati, R., Astuti, A., Utami, T. P., Adiwijaya, S., & Hasyim, D. M. (2024). The importance of early detection in disease management. *Journal of World Future Medicine, Health and Nursing*, *2*(1), 51–63.

Sharma, N., et al. (2025). Bronchoscopic cryoextraction in life-threatening airway obstruction from blood clots: A case series of five patients. *SN Comprehensive Clinical Medicine, 7*(1), 376. https://doi.org/10.1007/s42399-025-02154-1

Sun, P., Wan, Z., & Liu, Y. (2026). Towards Comprehensive Chronic Disease Control: Prevention, Early Detection, and Integrated Management. *Medicine Bulletin*.

Tanner, T. G., & Colvin, M. O. (2020). Pulmonary complications of cardiac surgery. *Lung*, *198*(6), 889–896.

Townsend, R. K., Jost, A., Amans, M. R., Hui, F., Bender, M. T., Satti, S. R., Maurer, R., Liu, K., Brinjikji, W., & Fargen, K. M. (2022). Major complications of dural venous sinus stenting for idiopathic intracranial hypertension: case series and management considerations. *Journal of Neurointerventional Surgery*, *14*(1).