CASE REPORT

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Full-body subcutaneous emphysema in chronic tuberculosis post-chest tube insertion: a rare case report

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ABSTRACT

Introduction: Subcutaneous emphysema (SCE) is a rare complication associated with respiratory infections, physical trauma, or iatrogenic causes, including invasive procedures like thoracotomy and intercostal drain (ICD) insertion. Although commonly seen in trauma and post-surgical cases, the occurrence of extensive SCE in patients with chronic pulmonary tuberculosis (TB), particularly due to bullous rupture and secondary pneumothorax, is infrequent. This study aimed to present a case of extensive subcutaneous emphysema in a patient with chronic tuberculosis (TB) complicated by bullous rupture and secondary pneumothorax.

Case presentation: A 31-year-old male with a 5-year history of pulmonary TB presented with progressive shortness of breath and extensive subcutaneous emphysema affecting the face, neck, thorax, abdomen, scrotum, and extremities, two days after a thoracotomy and chest tube insertion. Computed tomography (CT) revealed pneumothorax and multiple bullae in the lungs, with the largest measuring 4.6 × 3.5 × 3.2 cm. The patient was managed with anti-TB therapy, chest tube revision, and video-assisted thoracoscopic surgery (VATS) bullectomy, resulting in gradual clinical improvement and stable discharge on day 24.

Conclusion: This case highlights the rare but severe complication of extensive SCE in a TB patient with bullous rupture and pneumothorax. It underscores the importance of early recognition of such complications in TB patients, careful monitoring during chest tube management, and adherence to anti-TB therapy to mitigate long-term pulmonary damage and prevent life-threatening sequelae.

Keywords: bullectomy, intercostal drain, subcutaneous emphysema, tuberculosis.
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INTRODUCTION

Subcutaneous emphysema (SCE) is a rare clinical condition characterized by the accumulation of air within the subcutaneous tissues, often resulting from trauma, barotrauma, or surgical procedures such as thoracotomy or intercostal drain (ICD) insertion. While SCE typically resolves spontaneously in mild cases, extensive forms can cause significant complications, including respiratory distress and airway compromise. This condition typically presents as soft tissue swelling with palpable crepitus and may extend widely depending on the source of air leakage.[1]

The SCE is generally caused by trauma, barotrauma, or surgical procedures.[1] Among the more common iatrogenic causes, thoracotomy and intercostal drain (ICD) insertion are well recognized, with a study showing that 80% of cases are associated with intercostal drainage for pneumothorax. While SCE is often benign and self-limiting, extensive cases can lead to airway compromise, respiratory distress, or hemodynamic instability, making early recognition and management crucial. The SCE represents a rare clinical condition with diverse underlying etiologies. This phenomenon may arise secondary to infectious diseases, neoplastic processes, or spontaneous alveolar rupture.[2]

Among infectious causes, pulmonary tuberculosis (TB) has been identified as an exceedingly uncommon contributor. Such cases are typically associated with cavitary lesions and have been documented only rarely in the medical literature. TB remains a major public health challenge in Indonesia, with a wide spectrum of clinical manifestations ranging from asymptomatic infection to life-threatening respiratory failure.[3] In pulmonary TB, cavitary lesions may permit air to escape into the pleural space, mediastinum, or subcutaneous tissue through ruptured alveoli or bronchioles. The incidence of SCE associated with active TB has been reported to be approximately 1–2%.[4]

However, the occurrence of extensive full-body subcutaneous emphysema following chest tube insertion in a patient with chronic TB complicated by bullous rupture and pneumothorax is rarely documented. This case report highlights the clinical challenges of managing this unusual and severe complication, which required multidisciplinary intervention,

including chest tube management, high-flow oxygen therapy, and video-assisted thoracoscopic surgery (VATS) bullectomy. The novelty of this case lies in the combination of chronic TB, bullous rupture, pneumothorax, and massive SCE, offering insights into the pathophysiology and management of such rare, complex cases.

CASE DESCRIPTION

A 31-year-old man was referred to the Emergency Department of Ngoerah Hospital with complaints of progressively worsening shortness of breath over two weeks preceding admission. The patient had undergone chest tube insertion connected to a water seal drainage (WSD) system at the referring hospital for two days. However, his condition reportedly deteriorated over two days. He developed swelling that initially appeared in the thoracic region, subsequently spreading to the face, upper extremities, scrotum, and lower extremities. He also reported a productive cough with yellowish sputum, decreased appetite, and weight loss of 52 kg to 42 kg over one month. The patient denied chest pain and hemoptysis. He had a 15-year history of smoking twelve cigarettes daily, with no known history of chronic obstructive pulmonary disease. He was diagnosed with pulmonary tuberculosis in 2018 and received first-line anti-tuberculosis therapy consisting of rifampicin, pyrazinamide, isoniazid, and ethambutol for five months. However, he discontinued treatment due to inability to retrieve medication from his healthcare provider. First-line anti-tuberculosis therapy was reinitiated eight days prior to admission, following bacteriological confirmation of active TB.

On physical examination, the patient appeared to be in fair condition. Vital signs revealed respiratory rate of 24 breath/minute, heart rate of 120 beats/minute, blood pressure of 130/90 mmHg, axillar temperature of 36.8°C, and oxygen saturation of 89–91% on room air, which increased to 99% with a face mask delivering oxygen at 5 liters per minute. Pulmonary auscultation revealed vesicular breath sounds over both hemithoraces, with normal vocal resonance. Swelling was observed on the face, neck, and anterior chest wall. Crepitus was detected over the facial area, submandibular, neck, thoracic region, scrotum, medial third of both forearms, and proximal third of both lower extremities. Subcutaneous emphysema was showed on lower extremities and scrotum, right side view of the thorax and abdomen, right arm, left side view of face and shoulder, left arm, left abdomen and lower extremity, right jaw and shoulder (**Figure 1 and 2**)

Laboratory investigations revealed total leukocyte count of 8,440/mm^3 with neutrophilia (82.5%) and left shift on the differential count. The D-dimer level was elevated at 4.04 µg/L. Arterial blood gas analysis showed a PaO_2 of 178 mmHg, pCO_2 of 45 mmHg, HCO_3- of 33.50 mmol/L, and a blood pH of 7.48. Aspartate aminotransferase (AST/SGOT) was 38.00 U/L. Blood urea nitrogen (BUN) was mildly elevated at 8.4 mmol/L, serum creatinine was normal 0.54 mg/dL.

Figure 1. Subcutaneous emphysema on A) Full-body view, B) Lower extremities and scrotum, C) Right side view of the thorax and abdomen, D) Right arm, E) Left side view of face and shoulder

Figure 2. Subcutaneous emphysema on F) Right arm, G) Left arm, H) Left abdomen and lower extremity, I) Right jaw and shoulder, J) Left arm, thorax, abdomen, and lower extremities

Chest radiography revealed extensive consolidation involving upper to lower lobes of both lungs, linear radiolucent lesions in the soft tissues of the thoracic and cervical regions, and a ginkgo leaf sign, which indicated subcutaneous emphysema. An avascular radiolucent area was observed in the right hemithorax along with a visceral pleural line, consistent with findings of pneumothorax (**Figure 3**). Contrast-enhanced computed tomography (CECT) of the thorax demonstrated multiple bullae and blebs in the upper, middle, and lower lobes. The largest lesion measured 4.6 × 3.5 × 3.2 cm in the left upper lobe. Furthermore, multiple cystic bronchiectases were noted in the left upper lobe, accompanied by left-sided pneumothorax and minimal left pleural effusion (**Figure 4**).

First-line anti-tuberculosis therapy was continued and the patient was administered oral cefixime 200 mg twice daily. Oxygen was delivered via face mask at a rate of 6 liters per minute. Thoracotomy was performed on the right hemithorax, and a second intercostal drain was inserted and connected to a WSD system with suction set at 25 cmH_2O. On the first day of hospitalization, the right WSD drained 40 cc serohemorrhagic fluid, while the left WSD drained 92 cc seroxanthochromic fluid.

On the sixth day of hospitalization, the patient showed clinical improvement. Swelling of the face and chest subsided and scrotal swelling completely resolved. Dyspnea was reported to be minimal, and the coughing had decreased. Drainage from the right WSD had decreased to 10 cc, and left WSD to 50 cc. The patient was able to breathe comfortably on room air. Subsequently, the patient was scheduled for bullectomy on the 13th day of hospitalization due to the indication of bullous rupture.

The surgical procedure lasted 1 hour and 35 minutes, with estimated blood loss of 500 mL. An incision was made at the right fifth intercostal space, followed by the insertion of a wound dilator and thoracoscopy. Multiple bullae were identified on the lung surface, along with pleural adhesions to the pulmonary parenchyma. Decortication and pleurodesis were performed. A

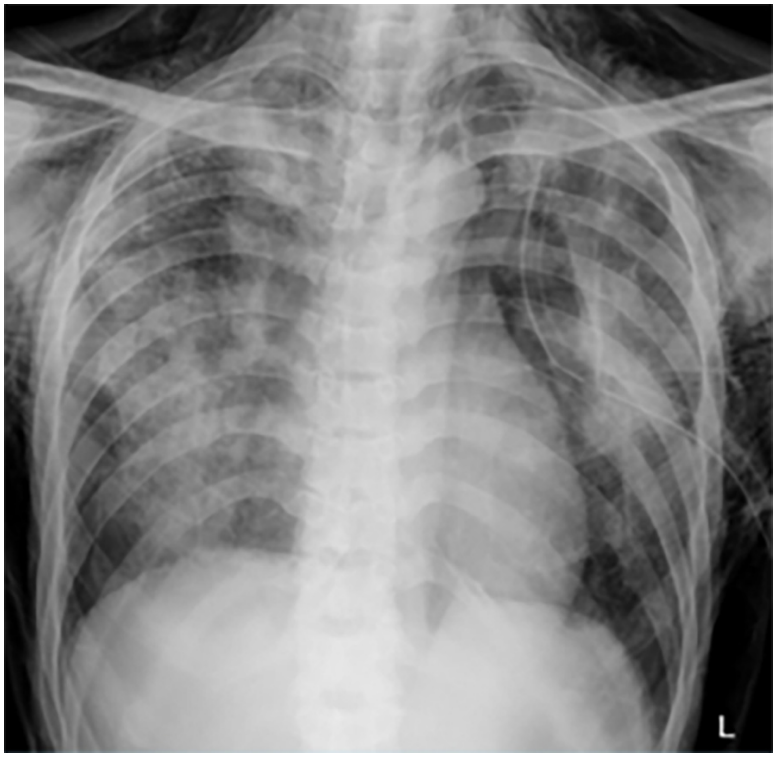

Figure 3. Chest radiograph showing extensive consolidation, avascular area marked with visceral-pleural line on the right hemithorax, and thoracic and cervical subcutaneous emphysema

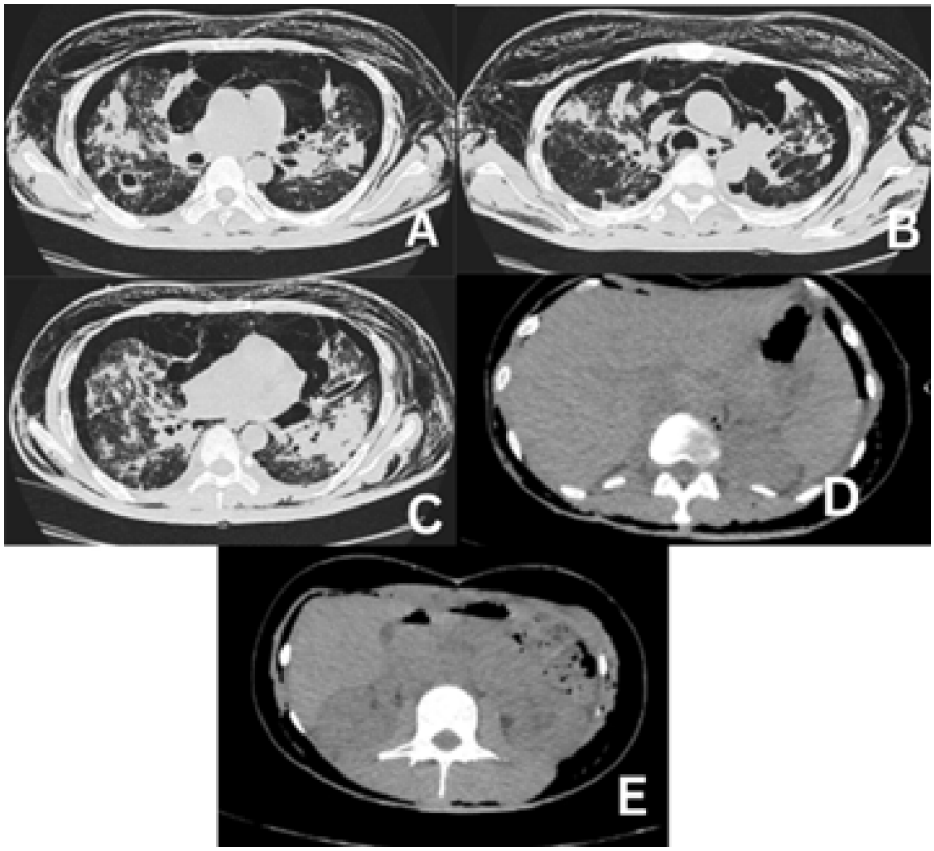

Figure 4. CT Scan showing multiple bullae, multiple cystic bronchiectases in the left upper lobe, accompanied by left-sided pneumothorax and minimal left pleural effusion

bubble test was conducted with negative results, and a 32 Fr thoracic drain was inserted. Postoperatively, the patient was managed in the intensive care unit for three days and received first-line anti-tuberculosis therapy along with paracetamol, ambroxol, omeprazole, and domperidone via nasogastric tube, as well as intravenous ketorolac. The patient was then transferred to the intermediate care ward for further monitoring. Clamping of the chest tube was performed on day 22 of hospitalization. On day 24, the chest tube was removed. The patient was discharged on the same day, which was 11 days after surgery.

DISCUSSION

Subcutaneous emphysema is a clinical condition caused by presence of air within the subcutaneous tissue. It is commonly associated with trauma, barotrauma, iatrogenic causes, or may occur as complication of pulmonary infections and structural abnormalities of the lungs.[5] In the present case, subcutaneous emphysema was a manifestation of active pulmonary tuberculosis, complicated by bullous rupture, pneumothorax, and chest tube placement.[6] Subcutaneous emphysema usually resolves within 10 to 14 days following successful management of the underlying cause. In milder cases, resolution may occur within approximately 10 days, whereas more severe presentations generally improve within 14 days once appropriate treatment is initiated. Cases of subcutaneous emphysema related to chronic lung disease or recurrent lung diseases often require a longer time to resolve. Patient-specific factors—such as advanced age, low body mass index, and impaired baseline pulmonary function—have been identified as contributing to a greater extent or prolonged duration of subcutaneous emphysema.[7]

The development of subcutaneous emphysema in this patient was most likely due to bullous rupture, resulting in air leakage into the pleural cavity and subcutaneous tissue, further exacerbated by the presence of positive pressure from the chest tube.[8] The extensive distribution of air—from the face, neck, and thorax to the scrotum and all four extremities—suggests significant air dissection along fascial planes. However, subcutaneous emphysema of such extent is rarely encountered and may indicate massive air leakage or a persistent communication between the alveolar space and extrapulmonary compartments.[9] In patients with an intercostal drain (ICD) in place, subcutaneous emphysema (SCE) may develop if there is a breach in the parietal pleura, allowing air to enter the subcutaneous tissues directly.[10] When SCE continues to progress in presence of an ICD, it is thought that the amount of air escaping from the pleural cavity into the subcutaneous space surpasses the volume being evacuated by the drain. This situation may arise due to a mismatch between the high airflow through a large parietal pleural defect and the limited drainage capacity of a small-caliber ICD.[11]

Pulmonary tuberculosis is a pulmonary infection that can lead to cavitation and structural damage to the lung parenchyma, potentially resulting in the formation of bullae that may rupture spontaneously and cause further complications. Bullous lung disease has been reported as a complication of pulmonary TB, particularly in cases of treatment failure or interruption, as observed in this patient.[12] The formation and rupture of bullae, along with parenchymal destruction and bronchiectasis, can create pathways for air to escape into the mediastinum and subcutaneous tissues, even with minimal changes in intrathoracic pressure.[9]

Management in this case focused on addressing the underlying cause of the patient's symptoms. Chest tube insertion and the application of negative pressure via the water seal drainage (WSD) system were essential for re-expanding the lung and reducing the air leak responsible for the pneumothorax.[13] This patient was also given high-flow oxygen, right chest tube revision, and a second chest tube placement to alleviate SCE. Administration of high-flow supplemental oxygen was advised for this patient, as it facilitates the reabsorption of subcutaneous air. This effect is achieved by enhancing the nitrogen gradient, thereby promoting the diffusion of nitrogen from the subcutaneous tissues into the alveoli, where it can be exhaled.[14] A study also compared four different modalities for managing subcutaneous emphysema: high-flow oxygen, skin incision, the use of subcutaneous tube, and second intercostal drain placement. While there were no significant differences between resolution time with the four methods, it was shown that second intercostal drain placement showed the fastest resolution time, followed by the use of high-flow oxygen, skin incision, and subcutaneous tube respectively.[7] The patient also underwent an invasive procedure—video-assisted thoracoscopic surgery (VATS) bullectomy with decortication and pleurodesis—which was indicated due to bullous rupture leading to pneumothorax. A study by Asli et al reported no recurrence of pulmonary bullae following bullectomy.[15]

The patient was ultimately discharged on day 24 in a stable condition. This case highlights the importance of a comprehensive and multidisciplinary approach in managing pulmonary tuberculosis with complications. It also underscores the critical role of adherence to anti-tuberculosis therapy, as incomplete treatment significantly increases the risk of chronic complications and structural lung damage.

This report describes a single clinical case; therefore, the findings cannot be generalized to all patients with pulmonary tuberculosis or subcutaneous emphysema. The lack of advanced imaging and laboratory resources limited the ability to fully elucidate the underlying pathophysiological mechanisms and to exclude other potential causes of subcutaneous emphysema. Additionally, long-term follow-up data were unavailable due to the patient's clinical condition and socioeconomic constraints. Despite these limitations, this case highlights an uncommon and clinically significant complication of chronic pulmonary tuberculosis and underscores the importance of careful monitoring following chest tube insertion.

CONCLUSION

This case illustrates a rare but potentially life-threatening complication of pulmonary tuberculosis—extensive subcutaneous emphysema resulting from bullous rupture. The patient's history of discontinuing anti-tuberculosis

therapy without medical supervision likely contributed to the progression of pulmonary damage, including the formation of bullae, cavitary lesions, and bronchiectasis. Radiological evaluation, non-surgical and surgical interventions such as high-flow oxygen therapy, secondary chest tube insertion and VATS bullectomy, were key components of management in this case. This report emphasizes the importance of early recognition of tuberculosis, routine follow-up, and strict adherence to treatment to avoid preventable complications and improve patient prognosis.

DISCLOSURES

FUNDING

No external funding was received for the preparation and publication of this case report.

ETHICAL CONSIDERATION

Written informed consent for publication of this case report and accompanying images was obtained from the patient's family.

CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest regarding the publication of this case report.

AUTHOR CONTRIBUTION

J.N. contributed to the conception, data collection, and manuscript drafting. F.V.A. participated in literature review, data interpretation, and manuscript editing. K.P.Y. provided clinical supervision, critical revision, and final approval of the manuscript. All authors have read and approved the final version of the manuscript.

REFERENCES

1. Lodhia J V, Tenconi S. Postoperative subcutaneous emphysema: prevention and treatment. Shanghai Chest. 2021;5:1–5. Available from: https://doi.org/10.21037/shc.2020.03.08
2. Jones PM, Hewer RD, Wolfenden HD, Thomas PS. Subcutaneous emphysema associated with chest tube drainage. Respirology. 2001;6(2):87–9. Available from: https://doi.org/10.1046/j.1440-1843.2001.00317.x.
3. Pralambang SD, Setiawan S. Faktor Risiko Kejadian Tuberkulosis di Indonesia. J Biostat Kependudukan, dan Inform Kesehat. 2021;2(1):60–71. Available from: https://doi.org/10.7454/bikfokes.v2i1.1023
4. Li T, Li Y hong, Zhang M. Bronchial tuberculosis with recurrent spontaneous pneumothorax: A case report. BMC Pulm Med. 2023;23(1):1–4. Available from: https://doi.org/10.1186/s12890-023-02374-y
5. Elshimy MA, Nadif DA, Almaslami AY, Benragosh NJ, Alahmadi AI, Alqhtani SS. Overview on Emphysema Causes, Prevalence and Management. EC Microbiol. 2021;17(2):56–63. Available from: https://ecronicon.net/assets/ecmi/pdf/ECMI-17-01057.pdf
6. Muthu V, Dhooria S, Agarwal R, Behera D. Rare cause of spontaneous subcutaneous emphysema. Lung India. 2016;33(6):688–9. Available from: https://doi.org/10.4103/0970-2113.192858
7. Goyal M, Jimmy JK, Dixit R, Garg DK. A study of subcutaneous emphysema, factors contributing to its development, resolution and management with different modalities. Monaldi Arch Chest Dis. 2024;94(2):4–8. Available from: https://doi.org/10.4081/monaldi.2023.2583
8. Nair AA, Leena R V, Christopher DJ. Pulmonary tuberculosis presenting as massive spontaneous pneumomediastinum and subcutaneous emphysema. Thorax. 2022;77(11):1154. Available from: https://doi.org/10.1136/thoraxjnl-2022-218908
9. Ismatov SJ, Hikmatov SJ. Features of the Clinic, Diagnosis and Methods of Treatment of Complicated Bullous Lung Disease. Am J Med Med Sci. 2022;2022(7):724–8. Available from: https://webofjournals.com/index.php/5/article/view/2755
10. Melhorn J. The Management of Subcutaneous Emphysema in Pneumothorax : A Literature Review. Curr Pulmonol Reports. 2021;10:92–7. Available from: https://doi.org/10.1007/s13665-021-00272-4
11. Hallifax RJ, Psallidas I, Rahman NM. Chest Drain Size : the Debate Continues. Curr Pul. 2017;6(1):26–9. Available from: https://doi.org/10.1007/s13665-017-0162-3
12. Morán-Mariños C, Vidal-Ruiz M, Llanos-Tejada F, Chavez-Huamani A, Salas-Lopez J, Villanueva-Villegas R, et al. Bullous Lung Disease due to Pulmonary Tuberculosis: A Rare Case Complicated With Tension Pneumothorax and Bronchopleural Fistula. Ther Adv Pulm Crit Care Med. 2024;19:1–5. Available from: https://doi.org/10.1177/29768675241249652
13. Schnell J, Beer M, Eggeling S, Gesierich W, Gottlieb J, Herth F, et al. Management of spontaneous pneumothorax and postinterventional pneumothorax: German S3-guideline. Zentralblatt für Chir für Allg Visz Thorax-und Gefäßchirurgie. 2018;143(S 01):S12–43. Available from: https://doi.org/10.1055/a-0588-4444
14. Grasmuk-Siegl E, Valipour A. "Nitrogen Wash-Out" in Non-Hypoxaemic Patients with Spontaneous Pneumothorax: A Narrative Review. J Clin Med. 2023;12(13):4300. Available from: https://doi.org/10.3390/jcm12134300
15. Asli RH, Aghajanzadeh M, Lahiji MR, Asli HH, Foumani AA, Pourahmadi Y. Results of the surgical treatment of pulmonary bleb and bullous disease: A retrospective study. Lung India. 2022;39(5):455–9.