Life-threatening delayed mediastinal and subcutaneous emphysema after general anesthesia in a rheumatoid arthritis patient: a case report

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Competing interests
The authors declare no conflicts of interest.

Acknowledgments
This work was supported by the Chen Xiao-ping Foundation for the Development of Science and Technology of HuBei Province: “Rui” special research fund (grant number CXJH2000000-07-113)

Peer review information
Clinical Research Communications thanks Xiao-Jie Liu and anonymous reviewers for their contribution to the peer review of this paper.

Abbreviations
CT, computed tomography.

Citation

Executive editor: Xin-Yun Zhang.
Received: 17 July 2023; Accepted: 30 August 2023; Available online: 01 September 2023.
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Abstract
Background: Delayed mediastinal emphysema with subcutaneous emphysema after extubation is rarely reported in current literature. Symptomatic treatment is considered effective for management. Case presentation: We report a case of a 56-year-old female with longstanding rheumatoid arthritis under corticosteroid therapy who developed mediastinal emphysema with subcutaneous emphysema 2 days after recovering from general anesthesia for orthopedic surgery treating a femoral neck fracture. The patient received aggressive subcutaneous decompression and symptomatic management. Results: The patient’s condition improved after treatment. Based on computed tomography scan results, we hypothesize that the longstanding rheumatoid arthritis may have resulted in fragile lung tissue. Violent postoperative coughing likely caused rupture of small airways, leading to mediastinal emphysema. Conclusions: It is crucial to preoperatively assess the risk of airway injury in high-risk patients with longstanding rheumatoid arthritis. Delayed postoperative mediastinal emphysema should be carefully evaluated and managed aggressively to avoid exacerbation or life-threatening scenarios. Further research is warranted to elucidate the pathology and guide perioperative management in these patients.

Keywords: anesthesia; mediastinal emphysema; subcutaneous emphysema; rheumatoid arthritis; orthopedic surgery; postoperative cough
**Introduction**

Mediastinal emphysema is defined as the accumulation of gas in the mediastinum and was first described in 1827. In 1944, scientists explained the pathogenesis of mediastinal emphysema through experiments in cats: increased alveolar pressure causes alveolar rupture, releasing air that subsequently migrates along peribronchial and perivascular sheaths into the mediastinum [1]. Mediastinal emphysema can be classified as spontaneous or secondary. Spontaneous mediastinal emphysema can be caused by various factors, including smoking and recreational drug use [2]. Secondary mediastinal emphysema is further categorized as traumatic or iatrogenic types, which rarely occur in clinical practice. Here, we report a case of delayed mediastinal emphysema combined with subcutaneous emphysema after general anesthesia. This study was approved by the Ethics Committee of The First Affiliated Hospital of USTC (2023-RE-060) and adhered to ethical standards outlined in the Declaration of Helsinki.

**Case presentation**

A 56-year-old female (height: 165 cm, weight: 51 kg, body mass index: 18.73 kg/m²) was admitted for left hip pain after a traumatic fall. The patient signed informed consent form. She had a 21-year history of rheumatoid arthritis treated erratically with oral methylprednisolone. Preoperative chest computed tomography (CT) showed pulmonary fibrosis in the bilateral lower lung lobes (Figure 1). She was diagnosed with a left femoral neck fracture and robotic-assisted internal fixation under general anesthesia was planned. Preoperative airway assessment was unremarkable.

On the day of surgery, after radial artery cannulation, anesthesia was induced with intravenous midazolam 2 mg, sufentanil 25 μg, etomidate 12 mg, and rocuronium 50 mg. A 7.0 mm tracheal tube was inserted after assisted ventilation. The initial intubation depth was 22 cm but breath sounds were diminished on the left. The tube was withdrawn to 20.5 cm with improved breath sounds bilaterally. Anesthesia was maintained with intravenous propofol, remifentanil and inhaled sevoflurane. The 2.5-hour surgery was uneventful. In the post-anesthesia care unit, the patient regained consciousness and spontaneous breathing 10 minutes later. The tracheal tube was then extubated without incident. She was comfortable and transferred to the general ward 20 minutes after extubation.

On postoperative day 1, she complained of throat pain. On day 3, she developed facial and neck swelling, chest tightness and hypoxemia. CT revealed bilateral pneumothoraces, and mediastinal, chest wall, neck and facial emphysema (Figure 2A). A 20F chest tube was inserted into the left second intercostal space at the midaxillary line for closed drainage and decompression by the thoracic surgeon. Oxygen therapy and electrocardiogram monitoring were provided. On day 5, CT showed decreased emphysema and the chest tube was removed. She recovered fully after symptomatic treatment (Figure 2B).

**Discussion**

Mediastinal emphysema is a rare perioperative complication with various manifestations including chest pain, dyspnea, tightness, and sore throat [1]. It frequently extends to the subcutaneous tissues of the face, neck and chest. Known causes include asthma, lung infection, mechanical ventilation, tracheal intubation and tracheostomy [3, 4]. Violent tracheal intubation can lead to airway injury and mediastinal emphysema during anesthesia [5]. Although no obvious airway breach was seen on this patient’s CT, iatrogenic factors cannot be excluded as she refused bronchoscopy.

The possible etiologies in this case include:

- Spontaneous mediastinal emphysema associated with rheumatoid arthritis. Although rare with rheumatoid arthritis, some cases have been reported [6–8]. This patient had a 20-year history of rheumatoid arthritis. Preoperative pulmonary CT showed lung fibrosis, indicating connective tissue disease involvement. Chronic inflammation from rheumatoid arthritis causes structural lung damage, leading to alveolar wall atrophy and thinning. Coughing may have ruptured the fragile small airways, causing spontaneous pneumomediastinum and subcutaneous emphysema. Her complaint of sore throat on postoperative day 1 could have been an early symptom. Spontaneous pneumomediastinum has been reported as the initial presentation of interstitial lung disease in rheumatoid arthritis patients [9].

- Iatrogenic injury during intubation, either from the endotracheal tube tip or excessive cuff pressure compressing the bronchial mucosa, resulting in ischemia or necrosis [10]. Cuff pressures above 30 cm H₂O obstruct mucosal capillary perfusion [11]. Post-intubation studies show airway erythema and edema in many patients [12]. Subsequent coughing may rupture the injured friable airway [13]. Though the

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Figure 1 CT scan reveals scattered fibrotic lesions in the lower lobes of both lungs. CT, computed tomography.

Figure 2 CT scans showing resolution of pneumothorax and mediastinal emphysema over time. (A) The CT scan on October 27 demonstrated a minimal bilateral pneumothorax with gas accumulation in the mediastinum, as well as more extensive subcutaneous emphysema along the left chest wall. (B) The CT scan on October 29 revealed decreased pneumothorax along with near complete resolution of the mediastinal gas and subcutaneous emphysema. CT, computed tomography.
emphysema was not severe, tracheal rupture cannot be excluded given the refusal of bronchoscopy. Fiberoptic examination is the gold standard for identifying the exact site and extent of airway trauma [14].

Barotrauma from mechanical ventilation. The delayed onset of bilateral mediastinal and subcutaneous emphysema indicates repetitive strain on fragile alveoli during ventilation ruptured airways. Cyclic alveolar opening and closing strains attachments, causing rupture [15]. Though peak pressures were not high, they may have damaged susceptible lung tissue. Even plateau pressures around 30 cm H₂O can overdistend and damage diseased lungs [16].

Dynamic hip fluoroscopy during surgery may have increased manipulation and barotrauma. However, this is less likely given the bilateral and delayed presentation.

Despite extensive emphysema, the patient remained stable without respiratory distress. Her symptoms improved with antitussives, antibiotics, chest tube drainage, and oxygen. This case highlights several considerations when managing high-risk patients:

Choosing appropriate anesthesia type based on patient factors. For lower limb surgery, neuraxial anesthesia may avoid airway instrumentation but this patient’s connective tissue disorder raised concerns about dural puncture and epidural hematoma [17]. Risks versus benefits must be carefully weighed.

Using a laryngeal mask instead of endotracheal tube to reduce airway irritation and coughing upon removal. The laryngeal mask may be a reasonable alternative if intubation is not mandatory.

With endotracheal intubation, adequate anesthesia, gentle technique, proper cuff inflation pressure, and small tidal volumes can minimize trauma. Cuff pressures should be monitored and kept below 30 cm H₂O [11].

Adequate suctioning before extubation prevents coughing and high pressures. Smooth emergence without biting, coughing or straining is ideal.

**Conclusion**

In summary, a careful preoperative evaluation to identify patients at heightened risk of airway injury is paramount. Astute assessment of the risks and benefits of different anesthetic techniques can help customize the approach to reduce trauma. During surgery, meticulous airway handling, judicious ventilation strategies, and vigilant cuff pressure monitoring can minimize barotrauma. Smooth emergence without coughing or straining is ideal. Postoperatively, maintaining a high index of suspicion for tracheobronchial injury allows early detection of complications. Rapid tailored management such as antibiotics, oxygen, chest drainage, and airway examination can optimize outcomes and prevent deterioration. Though the etiology was unclear in this complex case, it highlights the need for heightened awareness and individualized care when managing high-risk patients undergoing anesthesia. A multifaceted approach targeting risk mitigation, early recognition of complications, and prompt treatment provides the best chance for successful recovery even when challenges arise.

**References**


