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Rapidly Progressive Massive Subcutaneous Emphysema After Blunt Chest Trauma: Limitations of E-FAST and Emergency Blowhole Decompression

Authors' Contribution:

Study Design A
Data Collection B
Statistical Analysis C
Data Interpretation D
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None declared

Patient:

Male, 45-year-old

Final Diagnosis:

Hemothorax • massive subcutaneous emphysema • pneumomediastinum • pneumothorax

Symptoms:

Dyspnea • tachypnea

Clinical Procedure:

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Specialty:

Emergency Medicine

Objective:

Unusual clinical course

Background:

Extensive subcutaneous emphysema (SE) can complicate blunt chest trauma and interfere with bedside ultrasonography by preventing adequate visualization of deeper structures. We report a case of rapidly progressive Grade 5 SE in which extensive subcutaneous air rendered the initial extended Focused Assessment with Sonography for Trauma (E-FAST) technically non-diagnostic.

Case Report:

A 45-year-old man presented after a 1.5-meter fall onto his chest. He was initially hemodynamically stable with diminished left-sided breath sounds and localized subcutaneous crepitus. Within approximately 10 minutes of emergency department (ED) admission, SE progressed to involve the face, neck, trunk, all 4 extremities, and scrotum, accompanied by worsening dyspnea and tachypnea. E-FAST was technically limited and non-diagnostic because of extensive subcutaneous air artifacts. Computed tomography (CT) demonstrated multiple rib fractures, pulmonary lacerations, pneumothorax, hemothorax, pneumomediastinum, and hepatic laceration. Following CT imaging, bilateral infraclavicular blowhole incisions were performed for subcutaneous decompression, while the traumatic pneumothorax and hemothorax were managed concurrently with tube thoracostomy. Respiratory symptoms improved within minutes. The patient remained hemodynamically stable, did not require mechanical ventilation or operative management, and was discharged after clinical and radiological improvement.

Conclusions:

Extensive SE can render E-FAST technically limited and non-diagnostic and should not be interpreted as a true negative examination. In rapidly progressive symptomatic SE, management should be guided by the evolving clinical condition, with subcutaneous decompression considered alongside definitive treatment of the underlying thoracic injury.

Keywords:

Subcutaneous Emphysema • Traumatology • Ultrasonography

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Introduction

Subcutaneous emphysema happens when air becomes trapped within the tissues beneath the skin and in the soft tissues. It is usually seen in the soft tissues of the upper body such as the neck, chest, and face but it can also be seen in other parts of the body [1]. It can arise from various causes, such as blunt or penetrating injuries, pneumothorax-related barotrauma, infections, malignancies, surgical complications, or even occur spontaneously [2]. While it is usually benign, involvement of deeper fascial layers can lead to rapid clinical decline.

This case report describes an unusually rapid progression of traumatic subcutaneous emphysema from initially localized involvement to generalized Grade 5 severity within approximately 10 minutes after ED admission. [3] The case is notable for the concurrent technical limitation of E-FAST caused by extensive subcutaneous air and the need to integrate serial clinical assessment with bedside subcutaneous decompression and definitive treatment of the underlying traumatic pneumothorax [4]. We highlight the diagnostic challenges posed by massive subcutaneous emphysema during the early assessment of blunt chest trauma and the importance of adapting management to the patient's evolving clinical condition.

Case Report

A 45-year-old White man was brought to the ED by emergency medical services after falling forward from a step ladder approximately 1.5 meters high and striking his chest directly against the ground, resulting in blunt chest trauma. He did not experience loss of consciousness following the fall. He had no known medical history, including no known pre-existing pulmonary disease, was a non-smoker, and was not taking any regular medications. Upon initial assessment, his Glasgow Coma Scale score was 15, and he was oriented and cooperative but appeared agitated. The initial vital signs were as follows: blood pressure, 117/69 mm Hg; heart rate, 82 bpm; oxygen saturation, 93% on room air; body temperature, 36.6°C; and respiratory rate, 20 breaths/min.

Physical examination revealed diminished breath sounds in the left lung field. Extensive subcutaneous emphysema was palpable in the left thoracic and shoulder regions, with audible crepitus upon compression. The E-FAST examination was technically limited and non-diagnostic because extensive subcutaneous air artifacts prevented adequate visualization of the underlying structures.

Given the mechanism of blunt trauma, the patient underwent a diagnostic workup including chest radiography, non-contrast cranial CT, and intravenous contrast-enhanced CT of the thorax

and abdomen. During the first 10 minutes after admission, the initially localized subcutaneous emphysema rapidly progressed from the left thoracic and shoulder regions to involve the face, neck, all 4 extremities, trunk, and scrotum, corresponding to Grade 5 on the Aghajanzadeh Scale. [3] (Figures 1, 2). During this progression, the patient developed worsening dyspnea and tachypnea, with an increase in respiratory rate from 20 to 24 breaths/min. His oxygen saturation ranged from 93% to 95% while receiving supplemental oxygen at 2 L/min via nasal cannula. After completion of CT imaging, bilateral infraclavicular subcutaneous decompression incisions and left-sided tube thoracostomy were performed.

Radiological Findings

Thoracic CT revealed fractures of the left 4th-6th and right 11th ribs, accompanied by diffuse subcutaneous emphysema extending across the neck, thorax and abdomen. Significant pneumomediastinum was identified, encasing the trachea, esophagus, and major vessels. Multiple lacerations and pneumatoceles (up to 44 × 19 mm) were noted in the upper lobe and lingula of the left lung, alongside widespread consolidations, a 39-mm pneumothorax, and a 13.5-mm hemothorax. Abdominal imaging revealed a 2-cm subcapsular hepatic laceration and extensive air dissection within the abdominal wall (Figure 3).

Management and outcome

Following completion of CT imaging, and given the rapid progression of subcutaneous emphysema with worsening respiratory symptoms, bilateral infraclavicular subcutaneous incisions were performed for decompression (Figure 4). Concurrently, an intercostal nerve block was administered between the 7th and 8th ribs, along the left midaxillary line, for pain management. In coordination with thoracic surgery, a 28-Fr chest tube was inserted into the left hemithorax through a separate thoracostomy incision at the fourth–fifth intercostal space along the mid-to-anterior axillary line, distinct from the bilateral infraclavicular blowhole incisions. The chest tube was placed for the left-sided traumatic pneumothorax and concomitant hemothorax and yielded hemorrhagic drainage. A 28-Fr tube was selected to facilitate drainage of both air and blood while minimizing the potential risk of tube obstruction by blood clots. Proper tube placement was confirmed using portable chest radiography. Following these interventions, the patient's dyspnea and tachypnea improved within minutes.

Urology and general surgery consultations were obtained for scrotal emphysema and hepatic laceration, respectively; no emergency surgical intervention was recommended. Thoracic surgery recommended close intensive care unit (ICU) monitoring and initial non-operative management of the pulmonary lacerations, with surgical intervention to be considered in the event



Figure 1. Clinical photographs obtained approximately 10 minutes after ED arrival, demonstrating rapid progression of subcutaneous emphysema with involvement extending from the face to the scrotum, corresponding to Grade 5 on the Aghajanzadeh Scale [3].



Figure 2. Initial chest radiograph obtained within the first minutes after ED arrival, demonstrating extensive subcutaneous emphysema.

of clinical deterioration. The patient was admitted to the ICU for close monitoring following anesthesia consultation. During the 24-hour ICU observation period, supplemental oxygen was

administered via nasal cannula at 2 L/min, with peripheral oxygen saturation maintained between 93% and 98%. On serial examinations, breath sounds remained diffusely diminished bilaterally. The patient remained hemodynamically stable, with blood pressure approximately 130/60 mm Hg, and did not require invasive or non-invasive mechanical ventilation or inotropic support. He remained afebrile and received intravenous fluids, intermittent intravenous fentanyl boluses for analgesia, ceftriaxone 2 g/day, and gentamicin 80 mg 3 times daily.

After 24-hour ICU observation with a stable clinical course and regression of emphysema, the patient was transferred to the thoracic surgery ward, where he was monitored for an additional 4 days. Serial imaging demonstrated regression of the pulmonary and hepatic lacerations as well as the perihepatic fluid collection. Given the patient's continued clinical stability and radiological improvement, operative intervention was not considered necessary. The chest tube was removed on the third day of the thoracic surgery ward stay. On the following day, physical examination revealed bilaterally equal breath sounds and marked regression of the subcutaneous emphysema. Follow-up chest radiography was performed (Figure 5), and the patient was discharged with a recommendation for outpatient follow-up. Formal pulmonary function testing was not performed, and no subsequent follow-up data were available in our hospital records after discharge. The clinical course,

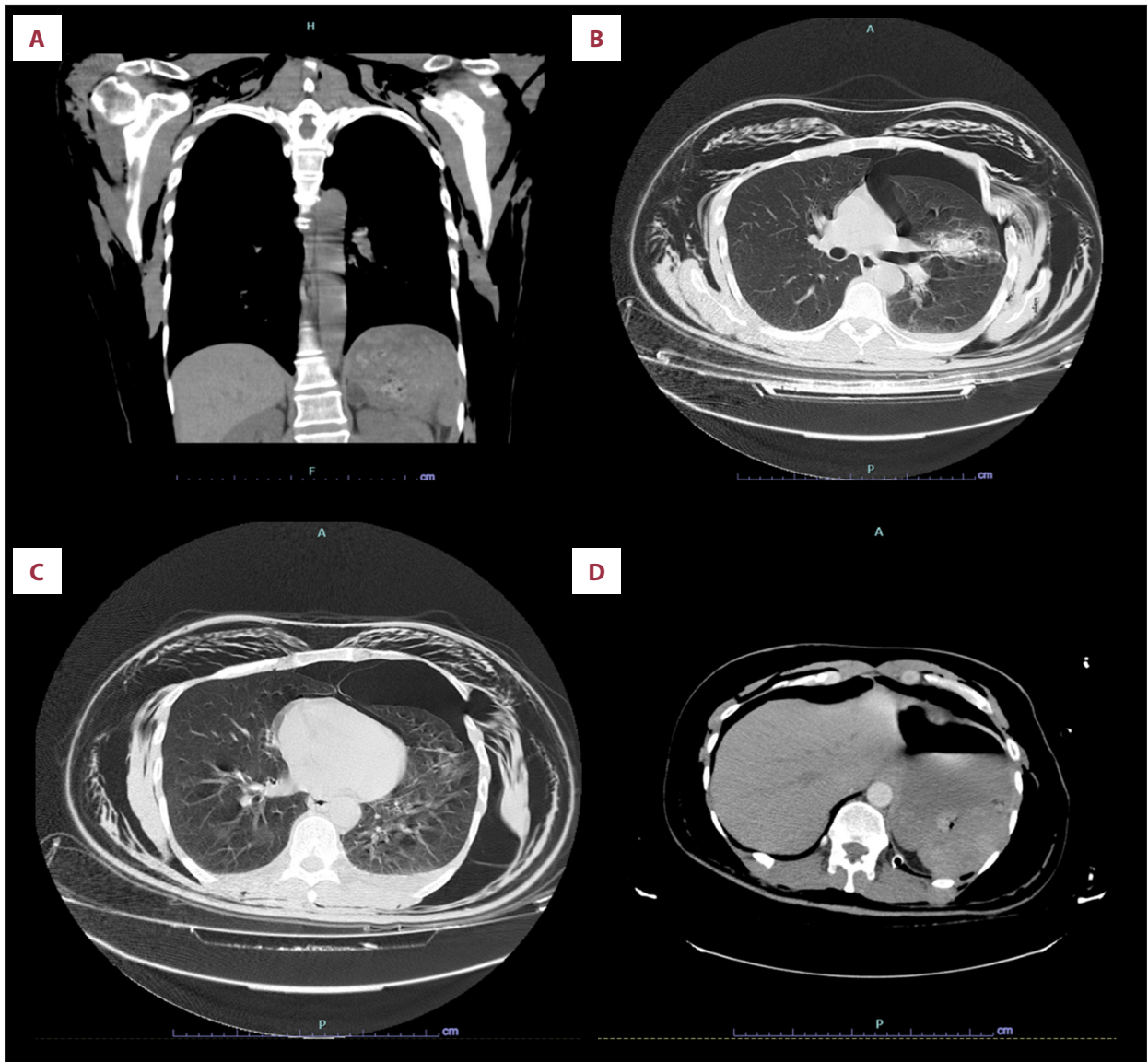


Figure 3. Computed tomography (CT) images obtained shortly after the initial chest radiograph and before subcutaneous decompression and tube thoracostomy. (A) Coronal reformat CT of the thorax demonstrating extensive and diffuse subcutaneous emphysema. (B) Axial (transverse) CT slice showing pneumothorax and pulmonary laceration. (C) Axial CT image revealing pneumothorax, pleural effusion secondary to hemothorax, and associated rib fractures. (D) Axial abdominal CT scan illustrating perihepatic fluid collection secondary to hepatic laceration, accompanied by widespread subcutaneous emphysema extending into the abdominal wall.



Figure 4. Bilateral infraclavicular “blowhole” incisions performed after rapid progression of subcutaneous emphysema during the first approximately 10 minutes after ED arrival. Approximately 3-cm incisions were extended through the subcutaneous tissue to the level of the pectoralis major fascia for decompression. No subcutaneous drains or dressings were used.

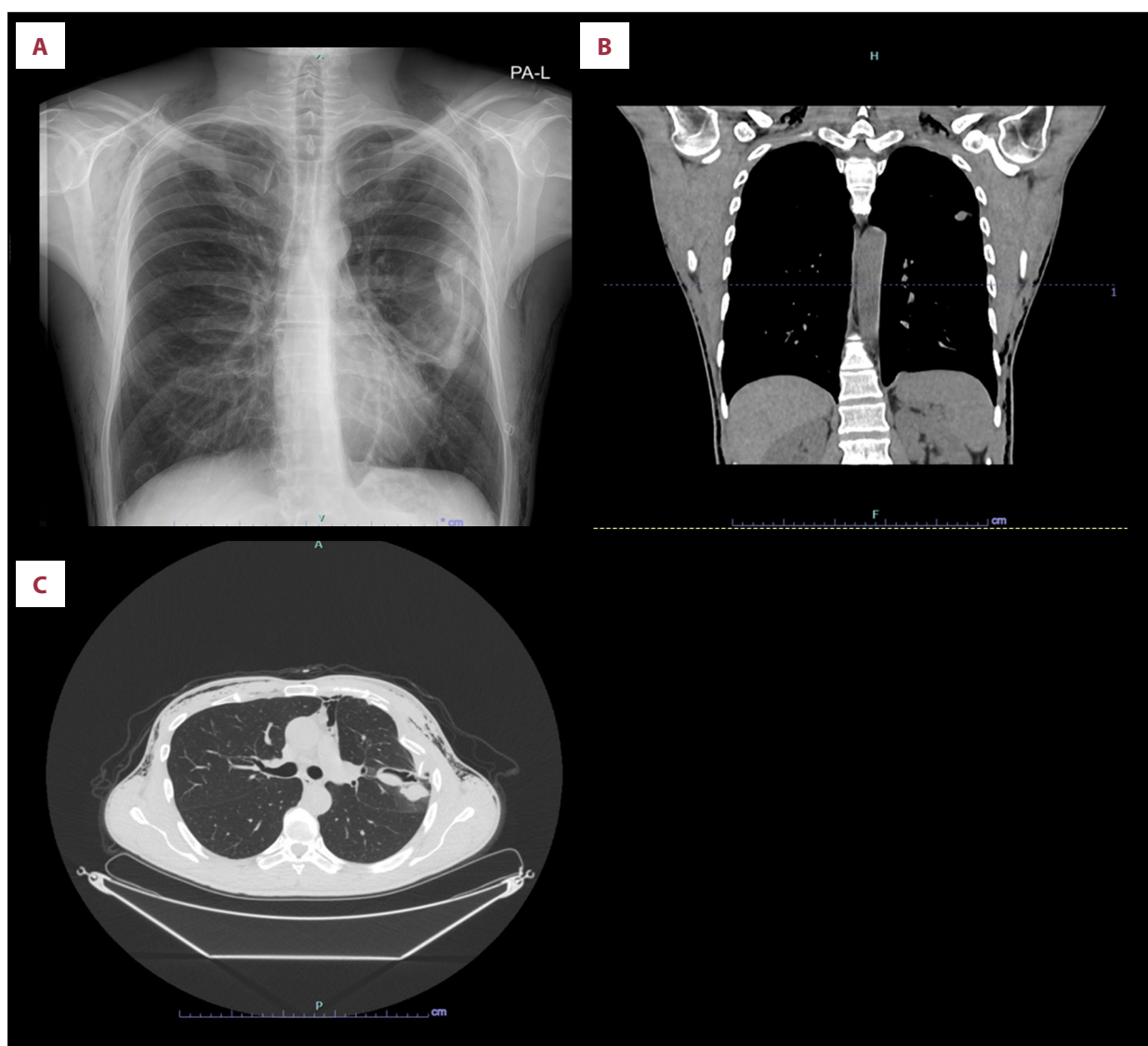


Figure 5. Follow-up imaging obtained on the day of hospital discharge (thoracic surgery ward day 4). **(A)** Posterior-anterior chest radiograph demonstrating resolution of the pneumothorax and significant regression of the subcutaneous emphysema. **(B)** Coronal reformatted CT of the thorax showing an interval decrease in subcutaneous emphysema. **(C)** Axial (transverse) CT slice illustrating the absence of pneumothorax, diminished pleural effusion, and evidence of pulmonary laceration.

diagnostic evaluation, therapeutic interventions, and patient response are summarized chronologically in **Table 1**.

Discussion

The educational value of this case lies not in the novelty of the individual interventions, but in the unusually rapid clinical evolution and the diagnostic and therapeutic challenges encountered during the initial trauma assessment. Within approximately 10 minutes of ED admission, initially localized subcutaneous emphysema progressed to generalized Grade 5 involvement extending to the face, neck, all 4 extremities,

trunk, and scrotum [3]. This rapid progression, together with a technically non-diagnostic E-FAST examination and worsening respiratory symptoms, created a challenging clinical scenario requiring integration of serial clinical assessment, advanced imaging, and timely therapeutic intervention.

E-FAST is an essential, radiation-free bedside tool for the rapid detection of pneumothorax, hemothorax, and hemopericardium in the resuscitation area. Although its repeatable nature allows for serial monitoring, its diagnostic accuracy remains highly operator-dependent [5]. E-FAST is a cornerstone of initial trauma assessment, particularly in hemodynamically unstable patients who cannot undergo immediate advanced imaging;

Table 1. Timeline of clinical progression, diagnostic evaluation, and management.

Time from ED admission / hospital course	Clinical findings and diagnostic evaluation	Management
ED Arrival	Hemodynamically stable; BP 117/69 mm Hg, HR 82 bpm, RR 20 breaths/min, SpO ₂ 93% on room air. Diminished left-sided breath sounds and localized subcutaneous emphysema over the left thoracic and shoulder regions. E-FAST technically limited and non-diagnostic	Initial trauma assessment and diagnostic workup initiated
First minutes after ED arrival	Initial chest radiograph demonstrated extensive subcutaneous emphysema	Supplemental oxygen initiated; further imaging pursued
Within ~ 10 minutes of ED arrival	Rapid progression of SE to Grade 5, involving the face, neck, trunk, all 4 extremities, and scrotum. Worsening dyspnea and tachypnea; RR increased from 20 to 24 breaths/min. SpO ₂ 93-95% on 2 L/min nasal oxygen	Serial clinical reassessment during diagnostic workup
Shortly thereafter	CT demonstrated bilateral rib fractures, left pulmonary lacerations/pneumatoceles, pneumothorax, hemothorax, pneumomediastinum, hepatic laceration, and extensive SE	Thoracic surgery, general surgery, and urology involvement
Immediately after CT	Persistent symptomatic Grade 5 SE with worsening respiratory symptoms	Bilateral 3-cm infraclavicular blowhole incisions and left-sided 28-Fr tube thoracostomy; intercostal nerve block. Dyspnea and tachypnea improved within minutes
First 24 hours	Hemodynamically stable; SpO ₂ 93-98% on 2 L/min nasal oxygen; no requirement for mechanical ventilation or inotropic support	ICU monitoring, oxygen therapy, IV fluids, intermittent IV fentanyl, ceftriaxone, and gentamicin. Non-operative management of pulmonary lacerations
After 24 hours	Stable clinical course with regression of SE	Transfer to thoracic surgery ward
Thoracic surgery ward, days 1-3	Serial imaging showed regression of pulmonary and hepatic lacerations and perihepatic fluid	Continued observation; no operative intervention required. Chest tube removed on ward day 3
Ward day 4 / discharge	Bilaterally equal breath sounds and marked regression of SE. Follow-up chest radiography demonstrated resolution of pneumothorax and significant regression of SE	Discharged with recommendation for outpatient follow-up

Abbreviations: BP, blood pressure; CT, computed tomography; ED, emergency department; E-FAST, extended Focused Assessment with Sonography for Trauma; HR, heart rate; ICU, intensive care unit; IV, intravenous; RR, respiratory rate; SE, subcutaneous emphysema; SpO₂, peripheral oxygen saturation.

however, its diagnostic utility is significantly compromised in the presence of extensive subcutaneous emphysema [6-8]. We performed E-FAST during the initial trauma examination. Although the patient initially had only mild subcutaneous emphysema, air within the subcutaneous soft tissues prevented adequate visualization of deeper structures on bedside ultrasound. This limitation occurs because the acoustical impedance mismatch caused by air within the soft tissues scatters ultrasound waves, creating dense artifacts that may obscure underlying thoracic injuries. Clinicians should recognize that a technically limited or non-diagnostic E-FAST examination in

the presence of extensive subcutaneous emphysema cannot reliably exclude underlying injury and should not delay further evaluation or appropriate intervention based on the patient's clinical condition.

The presumed source of the extensive air leak in this patient was the traumatic pulmonary injury. CT demonstrated multiple pulmonary lacerations in association with pneumothorax, pneumomediastinum, and extensive subcutaneous emphysema. We presume that air escaping from the injured lung entered the pleural and mediastinal spaces and subsequently

dissected along fascial planes into the subcutaneous tissues, resulting in the rapid and widespread distribution of emphysema. The associated rib fractures may also have contributed to the pulmonary injury. Although the precise route of air propagation cannot be definitively established in this case, the coexistence of pulmonary lacerations, pneumothorax, pneumomediastinum, and extensive subcutaneous emphysema supports this proposed mechanism [3].

The traumatic pneumothorax was not associated with documented tension physiology or hemodynamic instability. Tube thoracostomy was performed to address the traumatic pneumothorax and associated hemothorax [9]. A 28-Fr chest tube was selected in consultation with thoracic surgery because of the concomitant hemothorax and concern for obstruction by blood clots. Although larger-bore chest tubes have traditionally been used in thoracic trauma, emerging evidence suggests that smaller-caliber drainage can also be effective in selected hemodynamically stable trauma patients [10]. Despite the presence of multiple pulmonary lacerations, thoracic surgery recommended close observation rather than immediate operative management. As the patient remained clinically stable and serial imaging demonstrated regression of the pulmonary injuries, surgical intervention was not required.

The management of SE depends on its severity and clinical consequences. Mild cases typically resolve after treatment of the underlying cause, whereas extensive SE associated with progressive respiratory symptoms may require additional decompressive measures [11]. Reported bedside techniques include fenestrated angiocatheters, subcutaneous drains, and infraclavicular “blowhole” incisions [4,12,13]. In our patient, the decision to perform subcutaneous decompression was based on the rapid progression to Grade 5 subcutaneous emphysema accompanied by worsening dyspnea and tachypnea, rather than on hemodynamic compromise or established tension physiology. Bilateral 3-cm infraclavicular incisions extending to the pectoralis major fascia were therefore performed to decompress the extensive symptomatic emphysema, while the underlying traumatic pneumothorax was treated concurrently with tube thoracostomy. Following these interventions, the patient’s respiratory symptoms improved within minutes.

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While this case provides valuable insights into the management of massive SE, the inherent limitations of a single case report should be acknowledged. In addition, formal pulmonary function testing was not performed, and long-term follow-up data after hospital discharge were unavailable, limiting assessment of longer-term respiratory outcomes.

Conclusions

Extensive subcutaneous emphysema can render E-FAST technically limited and non-diagnostic, and such findings should not be interpreted as a true negative examination. Further evaluation should be guided by the patient’s clinical condition, with advanced imaging when hemodynamic stability permits. In rapidly progressive symptomatic subcutaneous emphysema, subcutaneous decompression may be considered in conjunction with definitive management of the underlying thoracic injury.

Statement

This article was presented orally at the Intercontinental Emergency Medicine Congress 2026.

Informed Consent

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

Declaration of Figures’ Authenticity

All figures submitted have been created by the authors who confirm that the images are original with no duplication and have not been previously published in whole or in part.

Abbreviations

CT, computed tomography; **ED**, emergency department; **E-FAST**, Extended Focused Assessment with Sonography for Trauma; **ICU**, intensive care unit; **SE**, subcutaneous emphysema

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