

CASE REPORT

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Air under pressure: a case report on tension pneumomediastinum arising from traumatic injury

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Abstract

Background Tension pneumomediastinum (TPM) is a rare but critical condition characterized by the accumulation of air in the mediastinum, leading to increased intrathoracic pressure and cardiovascular compromise. This case report is novel due to the rarity of TPM arising from blunt chest trauma and the necessity for emergent surgical intervention after initial conservative management failed.

Case presentation A 63-year-old male presented with severe chest pain and dyspnea following a high-impact motor vehicle collision. Initial assessment revealed tachypnea, tachycardia, and hypotension, along with extensive subcutaneous emphysema over the chest and neck. Imaging confirmed pneumomediastinum and bilateral pneumothoraces, consistent with TPM. Despite initial management with high-flow oxygen and bilateral chest tube insertion, the patient's condition deteriorated, necessitating emergent mediastinal decompression via an anterior subxiphoid incision. This intervention resulted in immediate hemodynamic improvement.

Conclusions This case underscores the importance of recognizing TPM in patients with chest trauma and highlights the need for prompt surgical intervention in cases of hemodynamic instability. Early and accurate diagnosis and timely surgical management are crucial for improving patient outcomes in TPM.

Keywords Tension pneumomediastinum, Blunt chest trauma, Subcutaneous emphysema, Mediastinal decompression, Hemodynamic instability

Background

Tension pneumomediastinum (TPM) is a critical condition where air accumulates in the mediastinum under pressure, leading to significant cardiovascular and respiratory compromise. The incidence of TPM is not well-documented globally or in India, but it is considered rare.

Thoracic injuries are responsible for 25% of all trauma deaths [1] and pneumomediastinum occurred in approximately 6–10% of all thoracic trauma patients [1, 2]. Air

enters the mediastinum from several sources, including aerodigestive tracts, Macklin effect, pneumothorax, and chest wall injuries. The Macklin effect is caused by air from ruptured alveoli tracking back along peribronchial and perivascular layers and invading the mediastinum [3]. Early and accurate diagnosis is essential for preventing potentially fatal outcomes.

Aims and objective

This case report aims to represent a rare case of tension pneumomediastinum (TPM) resulting from blunt chest trauma, to highlight the diagnostic challenges and management strategies, and to emphasize the importance of prompt recognition and surgical intervention in improving patient outcomes.

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Tension PNM caused by blunt chest trauma is seldom seen. A PubMed search of the English core clinical journal literature over the past 50 years retrieved only 28 case reports. TPM can arise from various causes, including trauma, infections, barotrauma, and iatrogenic injuries. The mechanism involves air leakage from the alveoli or airways into the mediastinum, often exacerbated by positive pressure ventilation or Valsalva maneuvers [4]. In the case of associated pneumothorax, a tear in the parietal pleura may allow access of pleural air into the mediastinum, as may have happened in our case.

Patients with TPM typically present with acute chest pain, dyspnea, and subcutaneous emphysema. Severe cases may exhibit signs of cardiovascular compromise, such as hypotension, tachycardia, and jugular venous distension [5]. These findings necessitate a high index of suspicion for TPM, especially in the context of trauma or respiratory distress.

Chest radiography is the initial imaging modality, but it is limited, as it identifies pneumomediastinum in only 0.6% of patients with blunt chest trauma [1, 2]. Although the sensitivity of chest X-ray for TPM is not mentioned, it must be greater than pneumomediastinum as it is a larger pathology. CT is more sensitive and provides detailed visualization of air distribution and associated complications [6]. However, the disadvantage of CT is that it cannot be used on hemodynamically unstable patients. In the presented case, CT confirmed the presence of extensive mediastinal air and bilateral pneumothoraces.

Management of TPM depends on the severity and underlying cause. Conservative treatment with oxygen therapy and analgesia is often sufficient for stable patients with minimal symptoms. However, cases with significant hemodynamic instability require urgent surgical intervention to decompress the mediastinum. This can be achieved through needle decompression, mediastinotomy, or insertion of a mediastinal drain [7].

In this case, initial conservative measures failed to stabilize the patient, necessitating emergent surgical decompression. This intervention resulted in rapid clinical improvement, highlighting the importance of timely surgical management in severe TPM cases.

The prognosis of TPM varies depending on the etiology, timely recognition, and promptness of treatment. While conservative management is effective in many cases, delayed or inadequate intervention can lead to fatal outcomes. Literature reviews indicate that early surgical decompression improves survival rates in patients with severe TPM [8].

Case presentation

A 63-year-old male presented to the emergency department with severe chest pain and dyspnea following a high-impact motor vehicle collision. An initial assessment was done per ATLS protocol. Subcutaneous emphysema was noted over the chest and neck (Fig. 1), raising concerns for airway compromise. Airway patency was maintained, and cervical spine immobilization was ensured. The respiratory rate was 30 breaths per minute, with decreased breath sounds bilaterally. Oxygen saturation (SpO₂) was 88% on room air. Bilateral pneumothoraces were suspected, which was also supported by eFAST prompting high-flow oxygen therapy initiation with a non-rebreathing face mask at 100% FiO₂. The patient was hypotensive with a blood pressure of 90/60 mmHg and a heart rate of 120 beats per minute. Bilateral chest tube insertion for the pneumothoraces was done, and intravenous access was established. Fluid resuscitation was started, after which the blood pressure increased to 100/65 mmHg. The patient was conscious and oriented with a GCS score of 13 but in significant distress due to respiratory difficulty. The patient was fully exposed for a thorough examination, and subcutaneous emphysema was observed over the chest and neck. Extended Focused Assessment with Sonography for Trauma (eFAST) suggested bilateral pneumothoraces. There is no free fluid in the pericardium or other compartments.

Chest radiography showed pneumomediastinum and bilateral pneumothoraces. Computed tomography (CT) was performed after blood pressure of 100/65 mmHg was achieved. CT confirmed extensive air within the mediastinum, compressing the great vessels and the heart, consistent with tension pneumomediastinum (Fig. 2). Initial management included high-flow oxygen therapy and

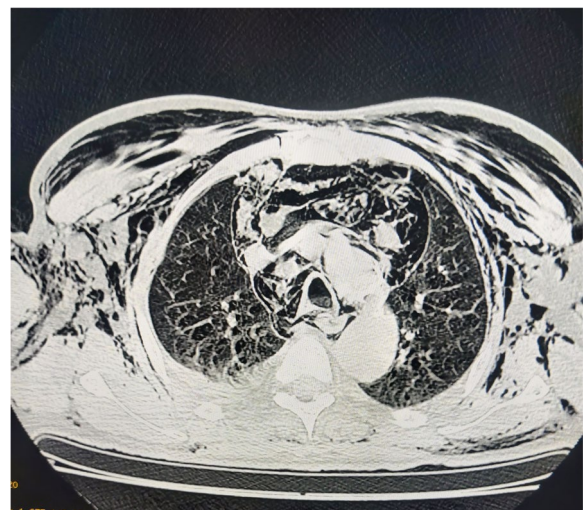


Fig. 1 Subcutaneous emphysema noted over the chest and neck



Fig. 2 Computed tomography of extensive air within the mediastinum

bilateral chest tube insertion for the pneumothoraxes. However, the patient's condition continued to deteriorate, with persistent hypotension (BP 85/55 mmHg) and signs of cardiac tamponade (jugular venous distension and muffled heart sounds).

Emergent mediastinal decompression was performed via an anterior subxiphoid incision, with the placement of mediastinal drains, resulting in immediate hemodynamic improvement. Post-surgical vital signs showed BP of 120/80 mmHg, RR of 20 breaths per minute, HR of 90 beats per minute, and SpO₂ of 98% on high-flow oxygen. The patient's clinical status stabilized, and follow-up imaging demonstrated the resolution of the pneumomediastinum and improved lung expansion. It is important to state that in case of severe hemodynamic instability, the patient should be referred for mediastinal decompression based on initial assessment and chest X-ray.

Conclusion

Tension pneumomediastinum is a critical condition that requires a high level of clinical suspicion for early diagnosis and intervention. This case underscores the importance of identifying TPM in patients with chest trauma and the need for immediate surgical decompression in cases of hemodynamic instability. A thorough understanding and prompt management are vital for improving patient outcomes in TPM.

Abbreviations

TPM	Tension pneumomediastinum
BP	Blood pressure
RR	Respiratory rate
HR	Heart rate
SpO ₂	Oxygen saturation
CT	Computed tomography

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Declarations

Competing interests

The author declares that he has no competing interests.

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References

1. Rezende-Neto JB, Hoffmann J, Al Mahroos M et al (2010) Occult pneumomediastinum in blunt chest trauma: clinical significance. *Injury* 41(1):40–43
2. Dissanaik S, Shalhub S, Jurkovich GJ (2008) The evaluation of pneumomediastinum in blunt trauma patients. *J Trauma* 65(6):1340–1345
3. Wintermark M, Schnyder P (2001) The Macklin effect: a frequent etiology for pneumomediastinum in severe blunt chest trauma. *Chest* 120(2):543–547
4. Nene RV, Hryniewicki AT, Roderick E, Chicotka S, Vazquez MH, Thistlewaite PA, Coffey C, Odish MF (2022) Tension pneumomediastinum from opioid inhalation. *Am J Emerg Med* 53:281.e5
5. Clancy DJ, Lane AS, Flynn PW, Seppelt IM (2017) Tension pneumomediastinum: a literal form of chest tightness. *J Intensive Care Soc* 18(1):52–56
6. Rouleau SG, Manoukian MA, Wong GX, Barnes DK (2023) Tension pneumomediastinum and coronary artery thrombosis following a motorcycle accident: a case report. *Clin Pract Cases Emerg Med* 7(2):97
7. Studeny S, Daphtary K, Stewart R (2019) Emergent mediastinal decompression for intubation-related tension pneumomediastinum. *Crit Care Med* 47(1):839
8. Shaikh N, Al Ameri G, Shaheen M, Abdaljawad WI, Prabhakaran S, Al Wraidat M, Mohmed AS, Khatib MY, Nashwan AJ (2021) Tension pneumomediastinum: a life-threatening condition in patients with COVID-19. *Qatar Med J* 2021(3):55

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