

Tension pneumothorax: Lateral needle decompression

Julie L. Welch*, Nicholas Saltarelli

Department of Emergency Medicine, Indiana University School of Medicine, Indianapolis, IN, USA

A 37 yo man presented to the ED with sudden onset of left sided chest pain and dyspnea after lifting a box. On physical examination the patient was hypotensive (86/55), tachycardiac (HR 125), hypoxic (88%), diaphoretic, with diminished left sided breath sounds. A portable chest x-ray revealed a large left tension pneumothorax with rightward tracheal deviation and mediastinal shift. (Image 1) The patient was placed on oxygen and an emergent needle decompression thoracostomy was performed. A 14-gauge needle was placed into the lateral 4th intercostal space at the mid-axillary line with immediate return of air and improvement in vital signs and symptoms. The needle was then used as a guide for placement of a percutaneous chest tube via the Seldinger technique. (Total procedure time was < 4 min.) A chest x-ray showed re-expansion of the left lung with the chest tube. (Image 2) The patient was admitted to the pulmonary service in stable condition.

This is the author's manuscript of the article published in final edited form as:

Welch, J. L., & Saltarelli, N. (2018). Tension pneumothorax: Lateral needle decompression. *Visual Journal of Emergency Medicine*, 10, 118–119. <https://doi.org/10.1016/j.visj.2017.11.022>

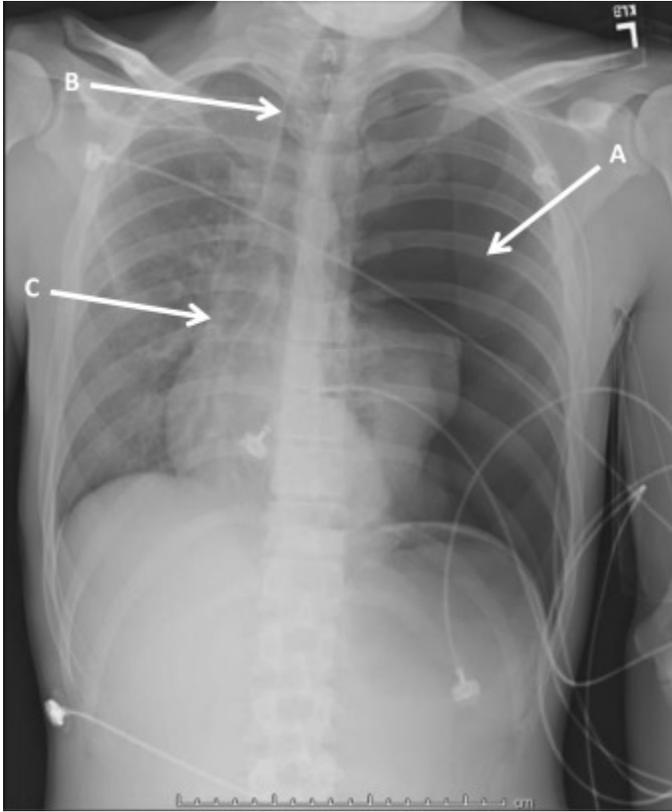


Image 1. Portable chest x-ray revealing the left tension pneumothorax. Findings include (A) the expanded left chest cavity with a lack of lung parenchyma markings, (B) rightward tracheal deviation and (C) rightward mediastinal shift.

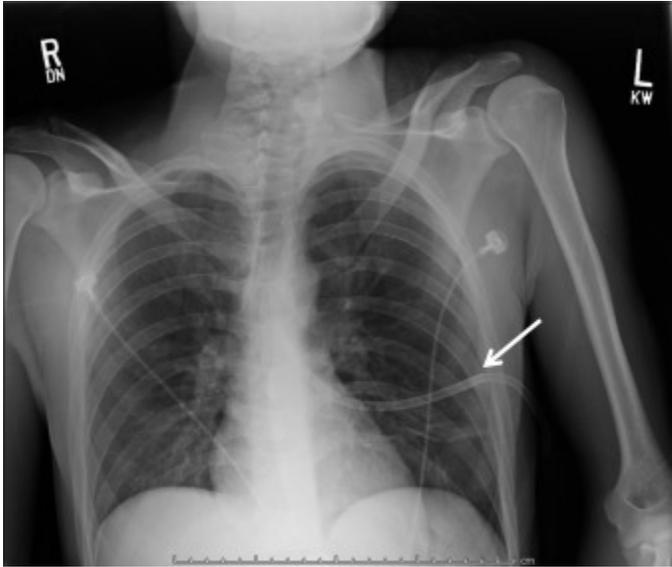


Image 2. Follow-up chest x-ray after needle decompression and percutaneous chest tube placement for the left sided tension pneumothorax. Note the re-expansion of the left lung with lung parenchymal markings and the left chest tube (arrow).

References

1. Raja A. Chapter 38: Thoracic Trauma. Rosen's Emergency Medicine: Concepts and Clinical Practice. Ninth ed. Philadelphia, PA: Elsevier, Inc; 2018:382–403.
2. Light R, Lee G. Chapter 81: Pneumothorax, Chylothorax, Hemothorax, and Fibrothorax. Murray and Nadel's Textbook of Respiratory Medicine. Sixth ed Philadelphia, PA: Saunders, an imprint of Elsevier, Inc; 2016:1439–1460.
3. Hecker M, Hegenscheid K, Volzke H, et al. Needle decompression of tension pneumothorax: population-based epidemiologic approach to adequate needle length in healthy volunteers in Northeast Germany. J Trauma Acute Care Surg. 2016;80:119–124.

Questions

1. In cases of tension pneumothorax, physical exam findings may include which of the following:
 - a. Diminished breath sounds over unilateral chest wall
 - b. Tracheal deviation
 - c. Hypotension
 - d. Hypoxia
 - e. All of the above

2. When the clinical diagnosis of tension pneumothorax is suspected, which of the following actions should be the next step in management?
 - a. Endotracheal intubation
 - b. Central venous catheter placement
 - c. Needle decompression thoracostomy
 - d. Bronchoscopy

3. True or False: In the treatment of tension pneumothorax, insufficient needle length is a common reason for needle decompression failure at the anterior approach (2nd intercostal space in the mid-clavicular line).
 - a. True
 - b. False

Answers

1. All of the above. Explanation: In cases of tension pneumothorax, physical exam findings include diminished breath sounds over the unilateral chest followed by deterioration in cardiopulmonary status (e.g., hypotension, tachycardia, hypoxia, respiratory distress). Additional exam findings include tracheal deviation away from the tension pneumothorax and jugular venous distension. As the tension pneumothorax causes an increase in unilateral intrathoracic pressure, this pressure pushes the trachea and mediastinal contents towards the contralateral chest cavity, thereby compressing the lungs, the airways, the great vessels, and the heart. Hemodynamically, the patient experiences a decrease in cardiac output with hypotension and compensatory tachycardia, as well as a rise in central venous pressure (CVP). From a respiratory status, the patient experiences compromised ventilation, worsening dyspnea, hypoxia, and respiratory distress. Unless emergently treated, the patient will eventually deteriorate into cardiopulmonary arrest.1., 2.

2. Needle decompression thoracostomy. Explanation: When the clinical diagnosis of a tension pneumothorax is suspected, the next step in management should be an emergent needle thoracostomy to decompress and relieve the pressure in the intrathoracic cavity. This involves inserting a large bore needle catheter into either (a) the lateral 4th or 5th intercostal space at the mid-axillary line or (b) the anterior 2nd intercostal space at the mid-clavicular line. After a needle thoracostomy, the vital signs and symptoms should improve and allow time for transport to the hospital and/or preparation for a tube thoracostomy. It can also avoid other procedures, such as endotracheal intubation. In fact, endotracheal intubation before needle decompression thoracostomy can cause grave consequences as ventilation forces more air into the lung and out into the intrapleural space, increasing pressure further. The other procedures, central venous catheter and bronchoscopy, are not treatments for tension pneumothorax.1., 2.

3. True. Explanation: Guidelines for the treatment of tension pneumothorax recommend needle decompression thoracostomy as an emergent procedure to relieve increased intrapleural pressure. Two approaches have been described, the anterior approach (2nd intercostal space in the mid-clavicular line) and the lateral approach (4th or 5th intercostal space at the mid-axillary line). Studies have shown that failure of needle decompression in the anterior approach is commonly due to insufficient length of the needle due to the increased thickness of subcutaneous tissue over this site. While recommendations on needle length have ranged from 4.5cm to 9.3 cm, Hecker et al. performed a population-based epidemiologic study and concluded that a needle length of 7.0 cm is recommended to decompress a tension pneumothorax in the anterior approach in over 90% of cases.³