

Advanced Emergency Nursing Journal Vol. 46, No. 1, pp. 44–48 Copyright © 2024 Wolters Kluwer Health, Inc. All rights reserved.

PROCEDURAL

COLUMN

Column Editor: Jennifer Wilbeck, DNP, RN, FNP-BC, ACNP-BC, ENP-C, FAANP, FAAN

NC PD

Finger Thoracostomy for Tension Pneumothorax

Tony Smith, DNP, ACNP- BC, FNP-BC, CCRN, CFRN, NR-P Jennifer Wilbeck, DNP, RN, FNP-BC, ACNP-BC, ENP-C, FAANP, FAAN

ABSTRACT

One of the injuries associated with chest trauma is pneumothorax, a condition where air accumulates between the parietal and visceral pleura in the chest leading to collapse of the lung due to pressure. Left untreated, a tension pneumothorax may develop leading to cardiovascular collapse. This article reviews the development of a tension pneumothorax, discusses the clinical recognition of the diagnosis, and outlines the procedure for performing a finger (or simple) thoracostomy. A simple mnemonic for the procedure is offered as a memory aid to reduce cognitive load for this procedure. **Key words:** chest trauma, finger thoracostomy, hypoxia, pneumothorax, simple thoracostomy, tension pneumothorax

B MERGENCY MEDICAL SERVICE (EMS) in a remote area arrives at the scene of a 34-year-old man kicked in the chest by a horse to find an awake, alert male complaining of right-side chest wall pain worse upon inspiration. The patient has abrasions to his right chest wall extending laterally from the anterior chest to mid-axillary. He is placed in full spinal immobilization and transported to the local critical access emergency department (ED). Five minutes prior to ED arrival, the patient became restless, anxious, and begins removing his cervical collar

Author Affiliation: Vanderbilt University School of Nursing, Nasbville, Tennessee.

Disclosure: The authors report no conflicts of interest.

Corresponding Author: Tony Smith, DNP, ACNP-BC, FNP-BC, CCRN, CFRN, NR-P, Vanderbilt University School of Nursing, Nashville, TN 37240 (tony.l.smith.1@vanderbilt.edu).

DOI: 10.1097/TME.0000000000000503

and supplemental oxygen. EMS is concerned for possible closed head injury and hypoxia, and elected to perform rapid sequence intubation.

On arrival to the critical access ED, the patient's vital signs are: heart rate 142; blood pressure 86/52; respiratory rate 32; with oxygen saturation of 89% despite bag-valve ventilation with 100% FiO₂ via endotracheal tube. The emergency nurse practitioner (ENP) completes the primary assessment noting that the patient is pale and diaphoretic, with absent breath sounds on the left side and jugular venous distension. The ENP suspects a tension pneumothorax and prepares to perform an immediate decompression.

ASSESSMENT

During an emergency, the most critical intervention is for the clinician to ensure that the airway is intact and maintained. Assessment of breathing follows, noting any hypoxia and restlessness as displayed in the case study. Without pulse oximetry changes, a patient with blunt chest trauma who exhibits increased restlessness should be considered hypoxic until their condition is proven otherwise. As pneumothorax (sometimes referred to as a "collapsed lung") occurs in roughly 35% of patients with chest injuries (Thachulthara-George, 2021), this diagnosis must be suspected in trauma patients with hypoxia.

The development of a pneumothorax is a life-threatening consequence of chest trauma. A pneumothorax occurs when air accumulates between the parietal and visceral pleura in the chest, leading to collapse of the lung due to pressure. Air may enter the pleural space via a penetrating chest wall injury, which allows atmospheric air into the pleural space, or lung defect facilitating movement of air from the alveoli into the pleural space such as barotrauma in a mechanically ventilate patient (Thachulthara-George, 2021). As the air is unable to leave, the pressure within the chest cavity increases (Thachulthara-George, 2021). If a pneumothorax is unrecognized and/or untreated, a tension pneumothorax can develop when the increasing amount of air trapped in the pleural space begins to displace mediastinal structures. As progression to a tension pneumothorax can occur more rapidly in mechanically ventilated patients and the presentation may be more pronounced (Thachulthara-George, 2021), the ENP must remain diligent in assessment.

Three common assessment techniques are used to quickly identify pneumothorax:

1. *Physical assessment*. Prior to advances in technology and greater availability of machines, the fastest way to diagnose a tension pneumothorax was through physical assessment. It is possible for a clinician to identify a tension pneumothorax simply by considering the mechanism of injury and performing a careful physical assessment. Chest pain, respiratory distress, shortness of breath, absent breath sounds, tachycardia, and hypotension are all symptoms of tension pneumothorax (Osterman et al., 2022; Thachulthara-George, 2021). Tracheal deviation away for the injured side and jugular vein distension may also occur with tension pneumothorax, but they are late signs. For critically ill patients, the diagnosis of tension pneumothorax is most often a clinical one (Thachulthara-George, 2021).

- 2. *Chest x-ray.* Chest wall trauma and pathology have classically been identified through portable chest x-ray. There are a number of radiographic signs associated with tension pneumothorax, including mediastinal shifts, diaphragmatic depressions, and expansion of the rib cage (Gaillard, 2022). Chest x-rays may provide definitive diagnosis of tension pneumothorax, but they are time-consuming and may be unavailable immediately in some settings.
- 3. *Point-of-care ultrasound*. The use of ultrasound is increasingly used to identify pneumothorax, and has greater sensitivity for identification (Ioannides et al., 2022). The ultrasound is used to determine whether there is a loss of the normal lung sliding and whether there is movement artifact deep within the pleural line (Pereira et al., 2023; Thachulthara-George, 2021). However, proper training of the technique and repeated practice in performing ultrasound is required to become proficient (Dickson et al., 2017).

Undiagnosed and untreated pneumothoraces may quickly evolve into life-threatening situations such as tension pneumothorax and full cardiac arrest. Immediately upon recognition of a tension pneumothorax, a finger thoracostomy or needle decompression should be performed by an experienced clinician in rapidly decompensating patients. Although needle decompression provides an interval management strategy to buy time, it has a low success rate (Merelman et al., 2022; Osterman et al., 2022; Thachulthara-George, 2021).

Although definitive management of a pneumothorax is accomplished with tube thoracostomy, this procedure is a more advanced requiring further education and specialized equipment, and carries a higher risk for infection (Merelman et al., 2022). Finger thoracostomy, also referred to as "simple thoracostomy," represents a more invasive approach than the traditional needle decompression but is not as involved as tube thoracostomy. In essence, the difference between finger and tube thoracostomy is the placement of a tube. Compared to needle decompression, finger thoracostomy appears to have a higher success rate (Merelman et al., 2022). The procedure for performing a finger thoracostomy is described below.

MANAGEMENT

Finger thoracostomy (also referred to as a "simple thoracostomy") is a life-saving procedure performed in emergency situations to relieve tension pneumothorax and hemothorax. It is important to perform this procedure correctly to minimize complications and ensure the best possible outcome for the patient. To perform finger thoracostomy, the mnemonic "FINGER" can help recall the essential steps for insertion (Merelman et al., 2022):

- If the patient's condition allows, prepare the patient to ensure that the patient is in a supine position with the affected side of the chest exposed.
- F—Find the landmarks. Identify the correct intercostal space by down to the fourth or fifth intercostal space between the anterior and midaxillary line. This space is often aligned with the nipple or inframammary fold. Marking the site with a surgical pen if available is helpful.
- I—Inject local anesthesia (as time permits), typically 5-10 mL of lidocaine subcu-

taneously in a wheel fashion at the marked site. Wait to ensure sufficient anesthesia has occurred. Parenteral analgesia may be used as well.

- N—No infection allowed! Prepare the site by cleansing the marked site with an antiseptic solution and, if available, draping the area with sterile drapes. Utilizing other sterile barriers such as sterile gloves, cap, mask, and gowns decreases infection risks.
- G—Generous incision. Holding the scalpel perpendicular to the skin, make a small longitudinal incision, approximately 2-4 cm long above the rib, through the skin and subcutaneous tissue. If possible, a No. 10 blade scalpel should be used. Placing the incision above the rib avoids the neurovascular bundle located below each rib. Be careful not to cut too deeply to avoid injury to the underlying structures.
- E—Enter the pleural space. Using your sterile gloved finger or curved Kelly clamp, bluntly dissect the underlying tissues above the rib until you reach the pleural space. This will require some force as the intercostal muscles and parietal pleura need to be penetrated. When the pleural space is entered, a "pop" or decrease in resistance should be appreciated. Make sure to avoid major vessels or organs.
- **R**—Reach in with finger; sweep and reassess. Once in the pleural space, rotate your finger to create a larger opening and allow for better drainage or air to escape. When there is a tension pneumothorax, air should immediately escape. If there is a massive hemothorax, blood or fluid should be evacuated.
- The wound created is now considered an open pneumothorax.
- Once the procedure is complete, secure the finger thoracostomy site with a sterile, 3-sided occlusive dressing to prevent air or fluid from re-entering the chest cavity.

To enhance drainage after a life-threatening situation has been diverted, a chest tube should be inserted into the tunnel created by the blunt dissection and connected to a

on 01/30/2024

C95/53ij8HUWFpYXRy6TDkDINsemIVdWYFafD82JLtGXxF

chest drainage system. This procedure is described in detail elsewhere (Ioannides et al., 2022). Following finger or tube thoracostomy, the ENP should continuously monitor the patient's vital signs and response to the procedure. Further intervention and transfer to a higher level of care should be arranged as needed.

CASE CONCLUSION

After completing the primary survey and with an understanding of tension pneumothorax pathology, the nurse practitioner decided to immediately perform decompression and finger thoracostomy. A large rush of air was noted upon chest wall entry, and an immediate improvement was noted in the vital signs. Following thoracostomy, the heart rate decreased to 112, blood pressure increased to 112/68, and oxygen saturation improved to 95%. Lung compliance was also improved with manual ventilations. Following resuscitation and stabilization, the patient was transferred to a tertiary care center with trauma services for further management.

CONCLUSION

Tension pneumothorax is a life-threatening situation; unnoticed and untreated, it may quickly lead to cardiovascular collapse. Understanding the pathophysiology of tension pneumothoraxes and how positive pressure intubation can worsen the process provides the foundation for management. Utilizing finger thoracostomy, with adherence to strict aseptic technique, prior to intubation supports the best possible outcome for patients experiencing tension pneumothorax.

REFERENCES

- Dickson, R., Duncanson, K., & Shepherd, S. (2017). The path to ultrasound proficiency: A systematic review of ultrasound education and training programmes for junior medical practitioners. *Australasian Journal of Ultrasound in Medicine*, 20(1), 5–17. https: //doi.org/10.1002/ajum.12039
- Gaillard, F. (2022, July 22). Tension pneumothorax. https://radiopaedia.org/. Retrieved May 4, 2023, from https://doi.org/10.53347/rID-15362
- Ioannides, K., Algeo, M., & Farney, M. (2022). Pneumothorax. In T. M. Campo & K. A. Lafferty (Eds.), *Essential procedures for emergency, urgent, & primary care settings: A clinical companion* (3rd ed.). Springer Publishing.
- Merelman, A., Zink, N., Fisher, A. D., Lauria, M., & Braude, D. (2022). FINGER: A novel approach to teaching simple thoracostomy. *Air Medical Journal*, 41(6), 526–529. https://doi.org/10.1016/j.amj.2022. 07.006
- Osterman, Jo., Kay, A. B., Morris, D. S., Evertson, S., Brunt, T., & Majercik, S. (2022). Prehospital decompression of tension pneumothorax: Have we moved the needle? *The American Journal* of Surgery, 224(6), 1460–1463. https://doi.org/0. 1016/j.amjsurg.2022.09.014
- Pereira, R. L., Convissar, D. L., Montgomery, S., Herbert, J. T., Reed, C. R., Tang, H. J., & Bronshteyn, Y. S. (2023). Point-of-care lung ultrasound in adults: Image acquisition. *Journal of Visualized Experiments*, (193), e64722. https://doi.org/10.3791/64722
- Thachulthara-George, J. (2021). Pneumothorax in patients with respiratory failure in ICU. *Journal of Thoracic Disease*, 13(8), 5195–5204. https://doi. org/10.21037/jtd-19-3752

Downloaded from http://journals.lww.com/aenjournal by 7kK4iY3JasnTW0kvrmpoIFMgeIYWnBLM0+0GESVKQdaWUD +YIHbYuec1DCPREFq09blevUXSSaTuFM02CSG40HFYbVPrRzkxGQWN5iTBbNTGKwQok6j+H6/zPnJKUSxW9ix+UNRdUhJBRWVpm

C95/53ij8HUWFpYXRy6TDkDINsemIVdWYFafD82JLtGXxF

on 01/30/2024

For more than 100 additional nursing continuing professional development activities related to emergency care topics, go to NursingCenter.com/ce.

Lippincott NursingCenter

TEST INSTRUCTIONS

• Read the article. The test for this nursing continuing professional development (NCPD) activity is to be taken online at **www.nursingcenter.com/CE/AENJ**. Tests can no longer be mailed or faxed.

• You'll need to create an account (it's free!) and log in to access My Planner before taking online tests. Your planner will keep track of all your Lippincott Professional Development online NCPD activities for you.

• There's only one correct answer for each question. A passing score for this test is 8 correct answers. If you pass, you can print your certificate of earned contact hours and access the answer key. If you fail, you have the option of taking the test again at no additional cost.

• For questions, contact Lippincott Professional Development: 1-800-787-8985.

• Registration deadline is March 6, 2026.



Nursing Continuing Professional Development

PROVIDER ACCREDITATION

Lippincott Professional Development will award 1.5 contact hours and 0 pharmacology contact hours for this nursing continuing professional development activity.

Lippincott Professional Development is accredited as a provider of nursing continuing professional development by the American Nurses Credentialing Center's Commission on Accreditation.

This activity is also provider approved by the California Board of Registered Nursing, Provider Number CEP 11749 for 1.5 contact hours. Lippincott Professional Development is also an approved provider of continuing nursing education by the District of Columbia, Georgia, West Virginia, New Mexico, South Carolina, and Florida, CE Broker #50-1223. Your certificate is valid in all states.

Payment: The registration fee for this test is \$17.95.