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Capnospot® - Improving Trauma Care

Clinical Implementation Guideline

Objectives

- Understand the role of Capnospot® in the treatment of tension pneumothorax
- Identify the signs and symptoms of tension pneumothorax in the self ventilating patient
- Identify the signs and symptoms of tension pneumothorax in the patient who is receiving positive pressure or that is mechanically ventilated
- Landmark the 2nd intercostal space, midclavicular line
- Landmark the 4th/5th intercostal space, anterior axillary line
- Insertion of a needle decompression device with Capnospot®
- Observing for signs and symptoms of clinical improvement after relief of tension pneumothorax with Capnospot®
- Troubleshooting the Capnospot® and identification of catheter failure

The Why of Capnospot®

- Patients arrived in the trauma bay looking like this!
- If this is what happens at leading medical centers, what happens in other places
- What is the Pre-Hospital solution? Is there a better way

The Clinical Problem: Tension Pneumothorax

- **100%** fatality rate if not treated immediately
- **30%** of ***preventable*** trauma mortalities occur from tension pneumothorax (1)
- Civilian Incidence “unclear” (2)

  Somewhere between 1% - 20%
- DOD ~3-4% of all combat mortalities(1)
- Prehospital Decompression Reduces 24-hour Mortality by 25%(2)

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1. J. J. McPherson, D. S. Feigin, R. F. Bellamy, Prevalence of Tension Pneumothorax in Fatally Wounded Combat Casualties, *J. Trauma Inj. Infect. Crit. Care* **60**, 573–578 (2006).
2. Muchnok D, Vargo A, Deeb AP, Guyette FX, Brown JB. Association of Prehospital Needle Decompression With Mortality Among Injured Patients Requiring Emergency Chest Decompression. JAMA Surg. 2022 Oct 1;157(10):934-940. doi: 10.1001/jamasurg.2022.3552. PMID: 35976642; PMCID: PMC9386601.

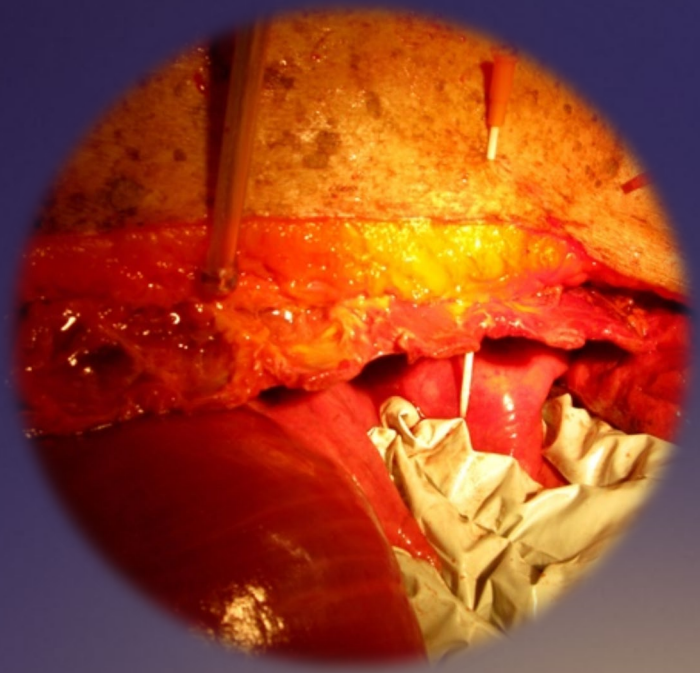
The Current Standard of Care Fails Often

- **Thoracostomy catheter decompresses air in the thoracic cavity**
- *Gold Standard = Listen for a “gush of air”*
- *Clinician: “Wait... did it work?”*
- **Needle Thoracostomy failure rate of 20-50%[3-4]**

3. J. M. Aho, C. A. Thiels, M. M. El Khatib, D. S. Ubl, D. V Laan, K. S. Berns, E. B. Habermann, S. P. Zietlow, M. D. Zielinski, Needle thoracostomy: Clinical effectiveness is improved using a longer angiocatheter., J. Trauma Acute Care Surg. 80, 272–7 (2016).
4. D. V Laan, T. D. N. Vu, C. A. Thiels, T. K. Pandian, H. J. Schiller, M. H. Murad, J. M. Aho, Chest wall thickness and decompression failure: A systematic review and meta-analysis comparing anatomic locations in needle thoracostomy., Injury 47, 797–804 (2016).

Why is the Failure Rate so High?

- The catheters are not large enough – 18ga → 16ga → 14ga → 10ga?
- Catheters are not long enough – 5 cm → 8 cm
- The chest is too thick! - 2nd ICS → 4th/5th MAL/AAL
- Training issues & “High Acuity, Low Occurrence Procedure”
- Failure Rate remains in most series 20-50% [3-4]
- Hearing a “gush of air” as confirmation of correct placement and relief of a tension pneumothorax



3. J. M. Aho, C. A. Thiels, M. M. El Khatib, D. S. Ubl, D. V Laan, K. S. Berns, E. B. Habermann, S. P. Zietlow, M. D. Zielinski, Needle thoracostomy: Clinical effectiveness is improved using a longer angiocatheter., J. Trauma Acute Care Surg. 80, 272–7 (2016).
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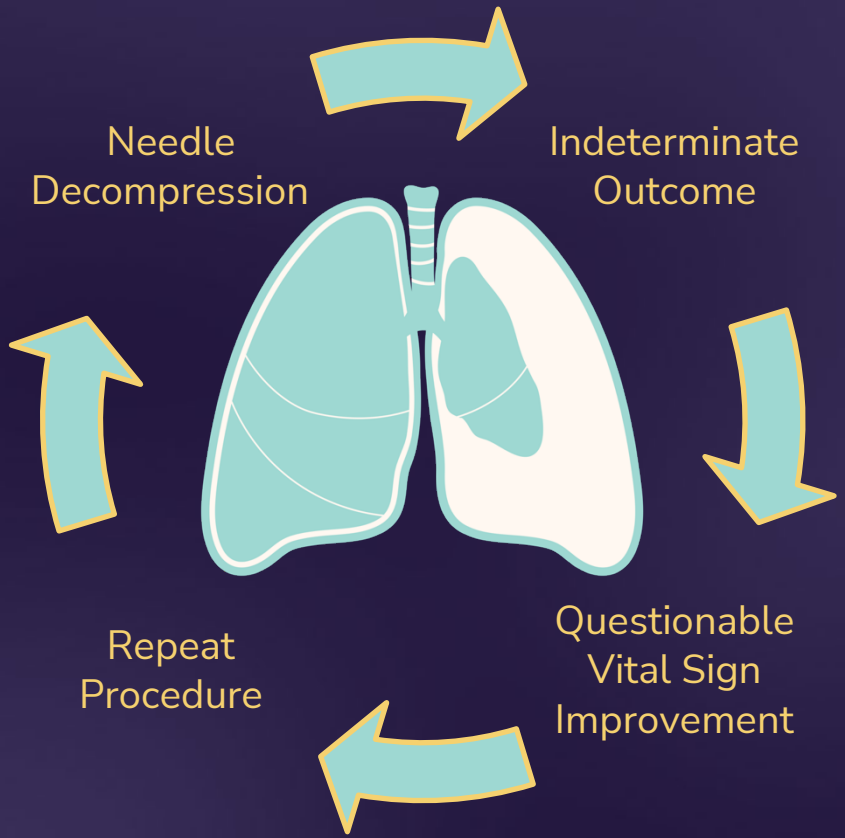
Needle Decompression: The Field Hamster Wheel



Capnospot® - Overview

- The pneumothorax contains CO_2.
- Indicates **visually** if decompression was successful or not within seconds, allowing immediate adjustment of the catheter
- **Objective** confirmation of decompression by detecting CO2 from the pneumothorax and showing an obvious color change to the operator.
- Compatible with all decompression devices and is easy to attach with a standard Luer fitting. Small, lightweight, and compact, and functions in low-light environments.

Signs and Symptoms of a Tension Pneumothorax in a Self Ventilating Patient

Tension pneumothorax detected via advanced imaging, clinical suspicion, or known traumatic injury to the chest, back, or abdomen, with severe or progressive respiratory distress associated with **at least one or more of the following signs and symptoms[3,4]:**

- **Severe or progressive tachypnea**
- **Severe or progressive dyspnea**
- **Tachycardia**
- **SpO_2 < 90%**
- **Absent or diminished lung sounds on the affected side**
- **Hypotension**
- **Persistent loss of consciousness**
- **Traumatic cardiac arrest without obviously fatal wounds**

Signs and Symptoms of a Tension Pneumothorax in a Patient Receiving Positive Pressure or Mechanical Ventilation

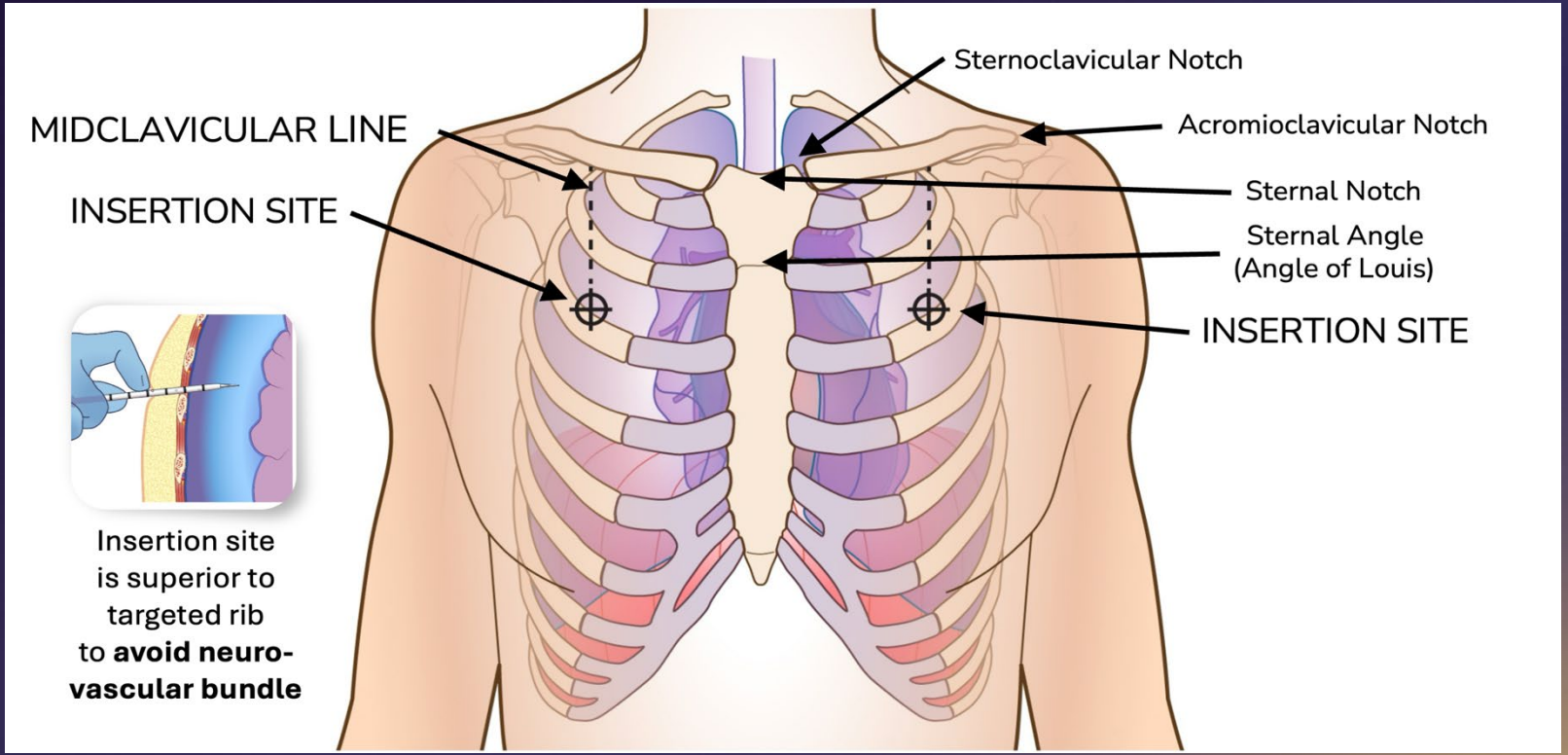
Tension pneumothorax detected via advanced imaging, clinical suspicion, or known traumatic injury to the chest, back, or abdomen, and **at least two or more of the following symptoms presenting with a rapid onset[3,4]:**

- **Severe and progressive respiratory distress in the conscious self-ventilating patient (CPAP or Bi-level Ventilation)**
- **Severe or progressive tachypnea during administration of CPAP or Bi-Level Ventilation**
- **Tachycardia**
- **SpO_2 < 90%**
- **Hypotension**

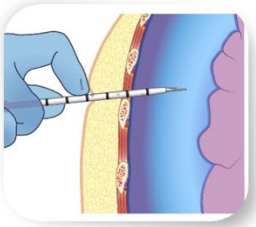
Signs and Symptoms of a Tension Pneumothorax in a Patient Receiving Positive Pressure or Mechanical Ventilation (*continued*)

- Decrease of compliance during ventilation
- Acutely increased or progressive ventilatory requirements
- Subcutaneous emphysema
- Absent or diminished lung sounds on the affected side
- Loss of consciousness (while receiving CPAP or Bi-level Ventilation)
- Cardiac arrest without other known etiology

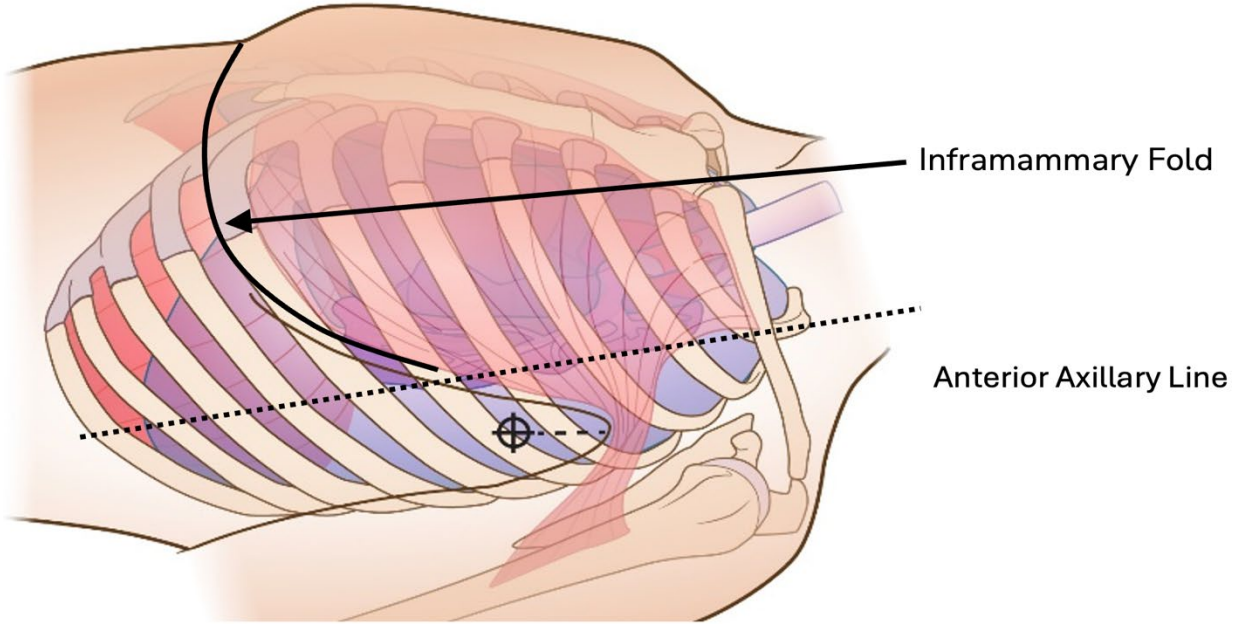
Identifying the 2nd Intercostal Space, Mid Clavicular Line



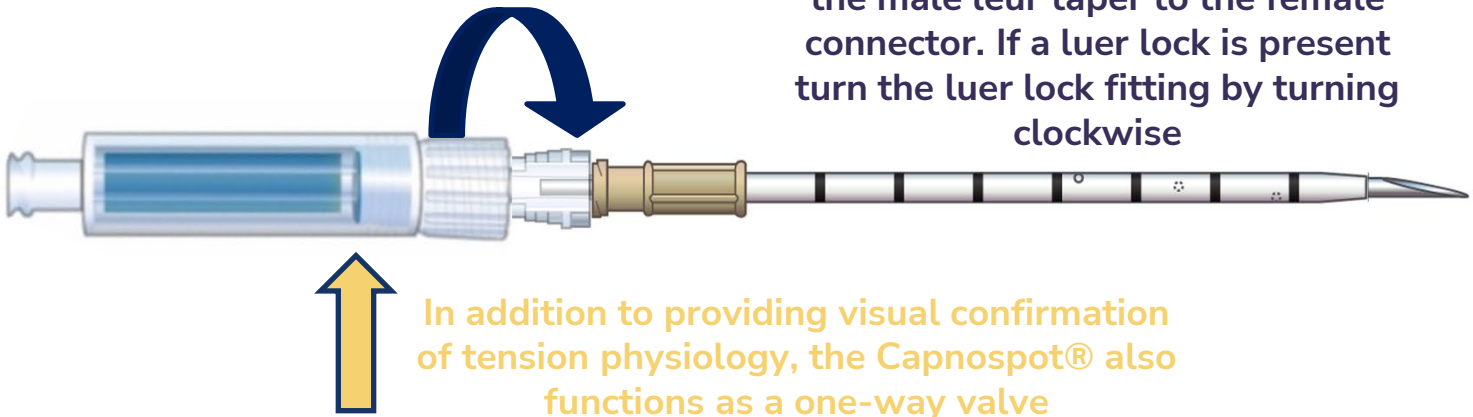
Identifying the 4th/5th Intercostal Space, Anterior Axillary Line



Insertion site is superior to targeted rib to **avoid neuro-vascular bundle**



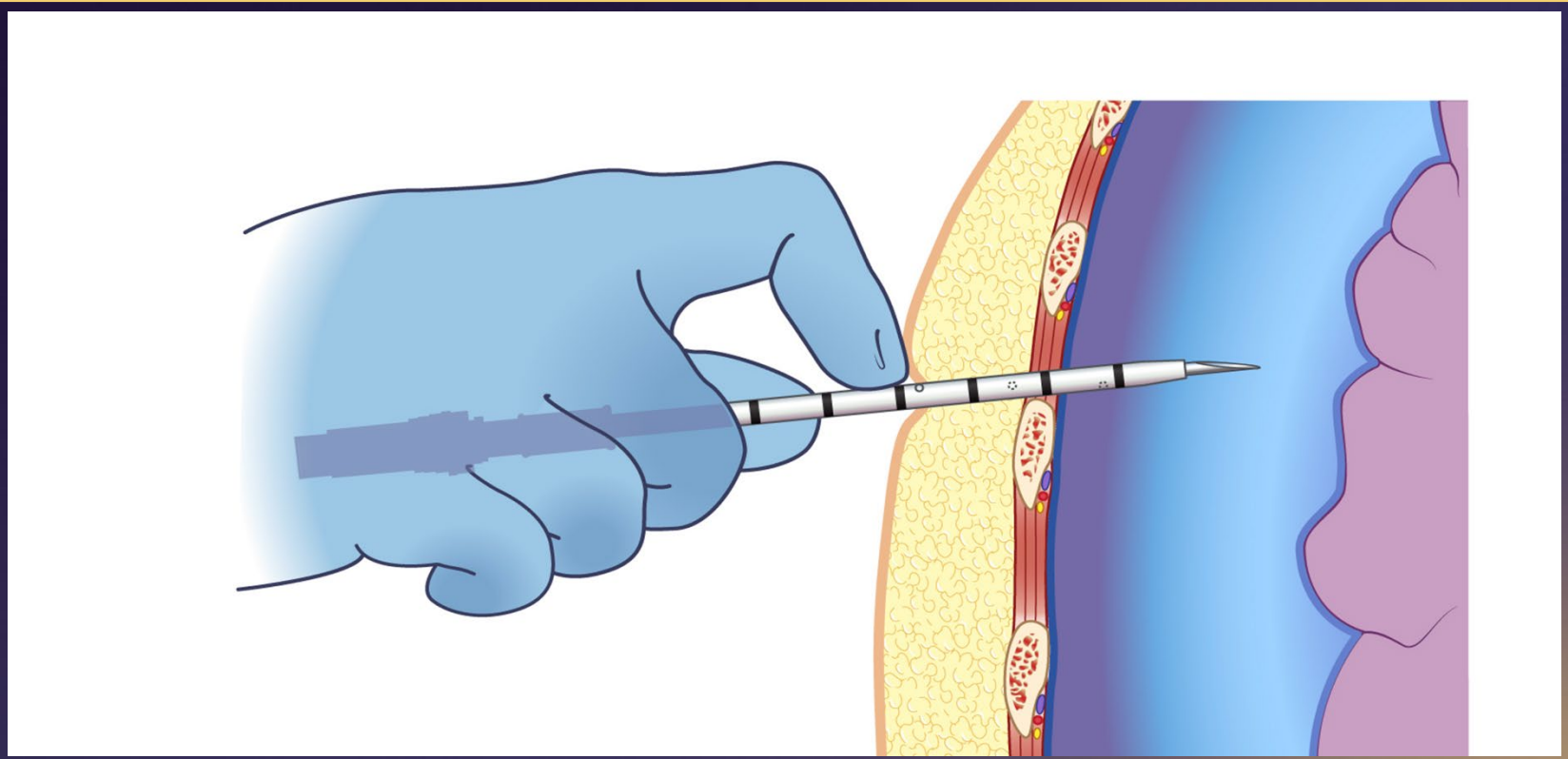
Prepare Equipment



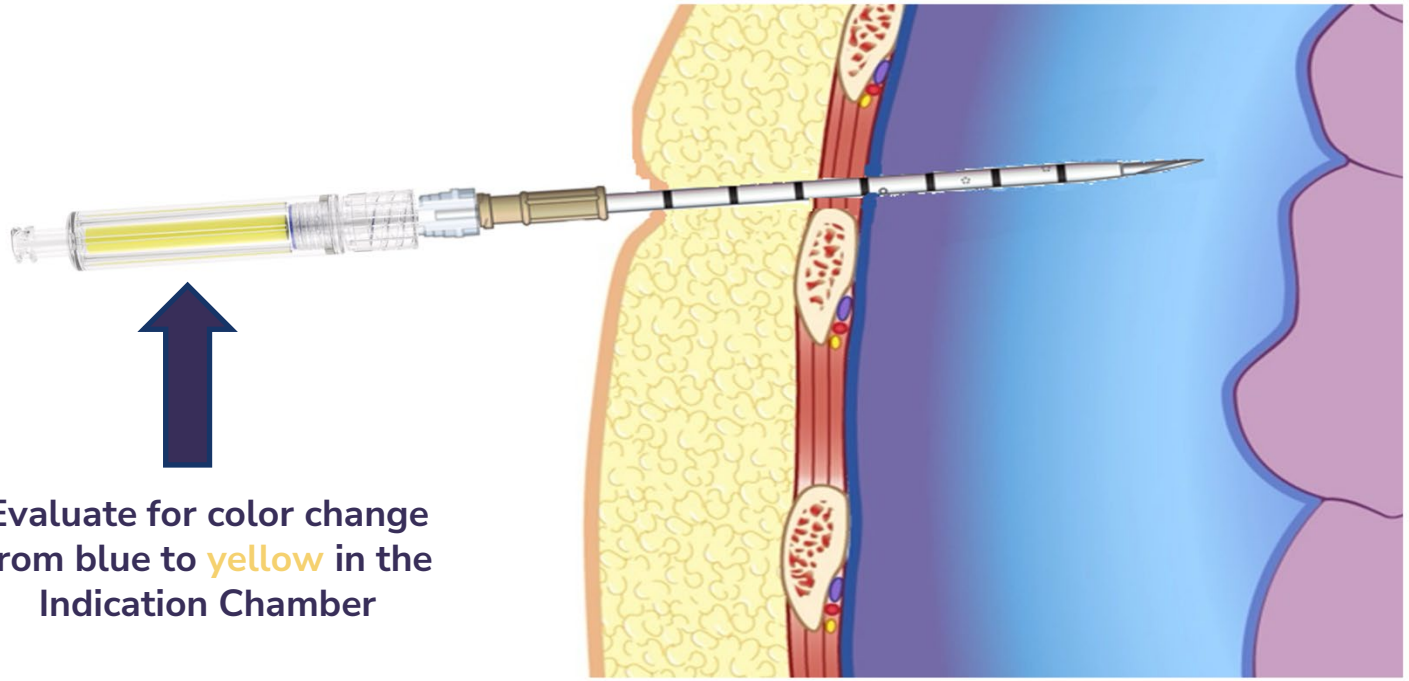
Affix Capnospot® to decompression needle or catheter by connecting the male leur taper to the female connector. If a luer lock is present turn the luer lock fitting by turning clockwise

In addition to providing visual confirmation of tension physiology, the Capnospot® also functions as a one-way valve

Insert the Decompression Device With Capnospot Affixed to Needle

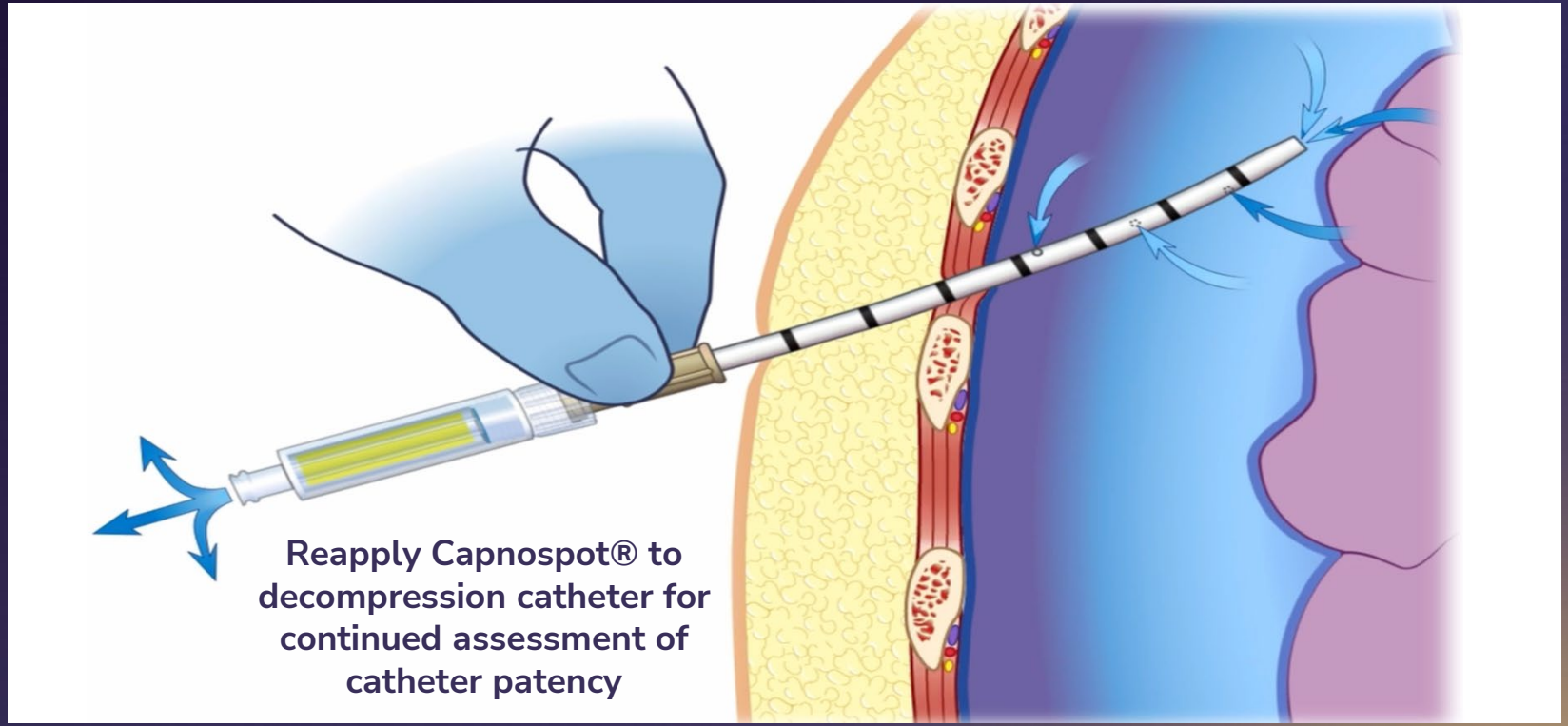


Advancing the Decompression Device



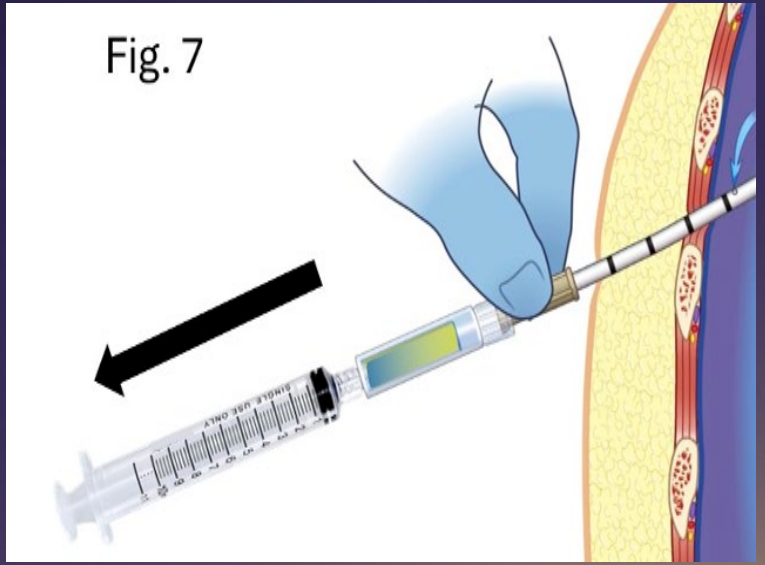
Evaluate for color change from blue to yellow in the Indication Chamber

Continued Monitoring of Catheter Patency and Patient Improvement



Trouble Shooting Capnospot and Evaluating Catheter Patency

If the Capnospot® color changing indicator presents a blue color, attach a 10mL syringe to the female luer connection of Capnospot® and attempt to aspirate air[5]. If the Capnospot® does not change to a yellow color or air is unable to be aspirated without resistance, evaluate the catheter for displacement or obstruction.



THANK YOU

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