Arkansas Department of Health
Office of Preparedness and Emergency Response, Section of EMS
Arkansas EMS Advisory Committee
Advisory and Recommendations

Pilot for Adding Finger Thoracostomy into Paramedic Scope of Practice in Arkansas

As prepared by the Clinical Practices Subcommittee

A. Executive Summary

The Arkansas EMS Advisory Committee recommends that the Arkansas Department of Health, Section of EMS consider adding finger thoracostomy (open thoracostomy) to the paramedic scope of practice for appropriately trained clinicians operating under physician medical direction.

Finger thoracostomy is an evidence-supported intervention used to treat life-threatening tension pneumothorax in traumatic peri-arrest or traumatic cardiac arrest. In critically injured trauma patients, particularly those experiencing traumatic arrest, tension pneumothorax may be rapidly fatal if not promptly treated. Needle thoracostomy may fail due to catheter occlusion, insufficient catheter length, or incomplete pleural decompression. In these situations, finger thoracostomy provides a definitive decompression technique that allows direct entry into the pleural space.

Many advanced EMS systems, including helicopter EMS, tactical EMS, and high-performance ground EMS agencies, have successfully incorporated finger thoracostomy into paramedic protocols with appropriate training and medical oversight.

The Arkansas EMS system continues to advance toward evidence-based trauma care. Allowing paramedics to perform finger thoracostomy under appropriate physician oversight aligns Arkansas with contemporary trauma resuscitation practices.

B. Clinical Rationale

1. Pathophysiology
   a. Tension pneumothorax occurs when air accumulates within the pleural space and cannot escape, leading to progressive lung collapse, impaired venous return, reduced cardiac output, obstructive shock, and cardiac arrest if untreated.
   b. Traumatic cardiac arrest frequently involves reversible causes such as tension pneumothorax. Rapid pleural decompression is therefore a critical component of resuscitation.
2. Limitations of Needle Thoracostomy
   a. While needle decompression remains the traditional first-line intervention,

multiple studies have demonstrated limitations including:[1-7]
   i. Inadequate catheter length for chest wall thickness
   ii. Catheter kinking or occlusion
   iii. Failure to reach the pleural space
   iv. Re-tension after initial decompression
b. Finger thoracostomy provides:
   i. Direct confirmation of pleural entry
   ii. Ability to release trapped air or blood
   iii. Ability to perform repeated decompression if re-tension occurs
c. Current trauma resuscitation guidelines increasingly recognize finger thoracostomy as the preferred intervention in traumatic peri-arrest or arrest.

C. Recommended Clinical Indications

1. Finger thoracostomy should be considered in the following situations:
   a. Primary Indications
      i. Paramedics may perform finger thoracostomy when all of the following are present:
         a. Severe traumatic illness or injury
            i. Penetrating or blunt chest trauma
         b. Evidence of life-threatening respiratory or circulatory compromise
            i. Hypotension
            ii. Hypoxia
            iii. Respiratory failure
            iv. Cardiac arrest
         c. Suspected tension pneumothorax, which signs may include:
            i. Absent or diminished breath sounds
            ii. Increased resistance to ventilation
            iii. Jugular venous distention
            iv. Tracheal deviation
            v. Hyper-resonance to percussion
            vi. Subcutaneous emphysema
   b. Specific Situations
      i. Finger thoracostomy may be particularly appropriate in:
         a. Traumatic cardiac arrest
         b. Traumatic peri-arrest with shock
         c. Failure of needle decompression
         d. Suspected recurrent tension pneumothorax after needle decompression
      ii. In traumatic cardiac arrest, bilateral finger thoracostomy may be strongly considered as the primary intervention (before needle decompression), as tension pneumothorax may be present without classic signs.

D. Training Requirements

1. An EMS agency who wants to initiate a finger thoracostomy protocol must first submit a letter of intent from the agency's medical director, to the AR Department of Health Section of EMS, indicating their desire to train and credential on the procedure, their training plan, a copy of their proposed protocol or guideline, and how they plan to maintain procedural competency going forward. Once approved by the Section of EMS, and after completion of the training, the medical director must submit another letter with the list of paramedic names and license numbers who have completed the training and are now credentialed to perform the procedure within their agency.
2. The Arkansas EMS Advisory Committee recommends that finger thoracostomy only be performed by paramedics who have successfully completed formal competency-based training and physician verification.
3. Initial education and training should include:
    a. Didactic education
        i. Trauma pathophysiology
        ii. Recognition of tension pneumothorax
        iii. Indications and contraindications
        iv. Relevant thoracic anatomy
        v. Complications and mitigation strategies
        vi. Procedural decision-making in traumatic arrest
        vii. Emphasis on re-education on proper indications for needle thoracostomy as first-line for tension pneumothorax
    b. Simulation and procedural training
        i. Cadaver laboratory training when feasible
        ii. Animal model or high-fidelity simulation
        iii. Procedural practice on task trainers
        iv. Emphasis on identification of the zone of safety
        v. Emphasis on re-education on proper indications for needle thoracostomy as first-line for tension pneumothorax
    c. Procedure technique
        i. Training should follow the procedural framework described in the clinical practice guideline:
            a. Incision at the 4th or 5th intercostal space in the anterior axillary line
            b. Blunt dissection to the pleural space
            c. Finger sweep to confirm entry and relieve tension physiology
4. Minimum Competency Expectations
    a. Training programs should require:
        i. Demonstration of anatomical landmark identification
        ii. Simulation-based procedural performance
        iii. Knowledge assessment
        iv. Documentation of competency

E. <u>Medical Director Oversight and Credentialing</u>

1. Finger thoracostomy must be implemented under the authority of the agency's physician medical director.
2. Each EMS agency adopting the procedure should:
    a. Write a clear procedure and incorporate finger thoracostomy into local clinical protocols
        i. See Appendix A for a sample clinical practice guideline
    b. Define clear indications and decision pathways
    c. Include guidance for bilateral decompression in traumatic arrest
    d. Define equipment standards and procedure kits
3. Physician credentialing
    a. Prior to performing the procedure in the field, each clinician should receive formal approval from the agency medical director.
    b. Credentialing should include completion of required training, demonstration of procedural competence, and direct medical director sign-off on skills verification.
    c. The medical director retains authority to approve or restrict clinician participation, establish continuing competency requirements, and suspend privileges if necessary.
4. Continuing education
    a. Agencies should require annual review of procedural indications, case reviews, and simulation-based refreshers.

F. <u>Quality Improvement and Case Review</u>

1. Because finger thoracostomy is a high-acuity, low-frequency procedure, robust quality oversight is essential.
2. Every finger thoracostomy performed should undergo medical director quality review, including evaluation of:
    a. Clinical indications
    b. Recognition of tension physiology
    c. Procedural technique
    d. Timing of intervention
    e. Patient outcome
3. Agencies implementing finger thoracostomy should track:
    a. Number of procedures performed
    b. Indications for procedure
    c. Complications
    d. Survival outcomes in traumatic arrest
    e. Need for repeat decompression
4. Quality review should assess:
    a. Appropriate patient selection

   b. Compliance with protocol
   c. Equipment performance
   d. Opportunities for training improvement
5. Case review findings should inform:
   a. Ongoing training
   b. Protocol revisions
   c. Statewide trauma care improvements

G. Safety Considerations

1. Finger thoracostomy should not replace needle decompression in stable patients with tension pneumothorax.
2. Needle thoracostomy remains appropriate in:
   a. Stable patients (not peri-arrest) with suspected tension pneumothorax
   b. Situations where open thoracostomy training is not available
3. Finger thoracostomy should primarily be used in:
   a. Traumatic peri-arrest
   b. Traumatic cardiac arrest
   c. Failure of needle decompression

H. Implementation Considerations

Successful implementation will require medical director leadership, structured training programs, standardized equipment kits, and strong quality improvement oversight. Arkansas EMS agencies with advanced trauma capabilities may choose to implement the procedure based on local system needs and medical direction.

I. Conclusion

Adding finger thoracostomy to the Arkansas paramedic scope of practice represents an important advancement in trauma resuscitation capability. With appropriate training, physician oversight, and quality review, paramedics can safely perform this life-saving procedure in situations where immediate pleural decompression may determine survival.

This recommendation supports continued modernization of the Arkansas EMS system and aligns with evolving trauma care practices across advanced EMS systems.

J. References

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Appendix A - Sample Clinical Practice Guideline for Needle and Finger Thoracostomy

Needle and Finger Thoracostomy

Recognize

- Signs and symptoms of tension pneumothorax with respiratory compromise
- Signs and symptoms of hemothorax with associated respiratory compromise
- Hypotension, diminished breath sounds, and signs of shock, the patient may have a simple pneumothorax and another reason for hypotension such as hemorrhage or tamponade
- Peri-arrest with hypotension, clinical signs of shock, poor end organ perfusion indicators, and at least one of the following signs:
    - Jugular vein distension
    - Tracheal deviation away from the side of the injury (often a late sign)
    - Absent or decreased breath sounds on the affected side
    - Hyper-resonance to percussion on the affected side
    - Increased resistance with ventilating a patient
- Traumatic arrest with chest or abdominal trauma may require bilateral finger thoracostomy in the absence of the signs above

Evaluate

- History with understanding of mechanism of injury that causes suspicion of tension pneumothorax
- Focused primary survey of breathing and circulation
- Jugular vein distension
- Tracheal deviation away from the side of the injury (often a late sign)
- Absent or decreased breath sounds on the affected side
- Subcutaneous emphysema
- Hyper-resonance to percussion on the affected side
- Increased resistance with ventilating a patient
- End organ perfusion: skin signs, color, and temperature, CRT, pulse quality, LOC, urinary output

Administer Treatment

- Don appropriate PPE
- Administer high flow oxygen via non-rebreather mask
- Identify and prepare the site on the symptomatic side:
    - Caution: Keep insertion above diaphragm, never below the nipple line
    - Preferred Location: Insert at anterior axillary line at 4th or 5th ICS within the "zone of safety" **(Figure A)** depending on position/location/access to site
        - Male: lateral to the side of the nipples
        - Female: at the mammary fold or about two inches above the sterno-xiphoid junction
    - Alternate Location: 2nd ICS, at anterior mid-clavicular line (Needle ONLY)

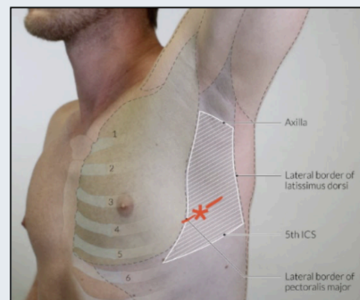

Figure A. The "zone of safety" extends from the axilla down to the lateral border of the pectoralis major on the anterior aspect, the 5th ICS on the inferior aspect, and the lateral border of the latissimus dorsi on the posterior aspect.

Needle and Finger Thoracostomy

- **Needle Thoracostomy:**
  - Clinical Indications: Tension Pneumothorax (Not Peri-arrest status)
    1. Prepare the site with chlorhexidine, betadine or alcohol
    2. Insert the catheter (10 or 14 G at least 3.25 inches for adults) or appropriate needle decompression device into the skin, and direct it just over the top of the identified rib (superior border) into the interspace, anterior axillary preferred, midclavicular as alternative
    3. Advance the catheter through the parietal pleura until a "pop" is felt and air or blood exits under pressure through the catheter, then advance only the catheter to chest wall
    4. Remove the needle, leaving the plastic catheter in place
    5. Secure the catheter hub to the chest wall with dressings or tape as needed
    6. Repeat procedure or progress to Finger Thoracostomy as indicated
- **Finger Thoracostomy:**
  - Clinical Indications: Traumatic Peri-Arrest (critical hypotension, hypoxia, or respiratory failure) and for Traumatic Arrest (strongly consider performing bilaterally in traumatic arrest)
    1. Prepare the axillary area on the symptomatic side with chlorhexidine (or betadine, alcohol, etc.) and drape if time permits
    2. Make a 3-4 cm transverse incision through the skin and subcutaneous tissues in the 4th ICS, following the curvature of the rib (Figure A)
       - Consider moving up a rib space for pregnant patients.
    3. Perform blunt dissection with finger down to the intercostal muscles in the 4th ICS
    4. Using a Kelly clamp, go over the top of the 5th rib, and enter the pleura, prevent the clamps from penetrating too deeply and injuring the underlying lung tissue (Figure B)
    5. Enter the pleural space and spread the forceps widely, keeping them spread open wide while pulling the clamps out
    6. Insert gloved finger through your incision and into the thoracic cavity. Perform a finger sweep (use caution if suspected rib fractures). Ensure you are feeling lung tissue (or empty space) and not liver/spleen (Figure C)
    7. Cover opening with 4x4 gauze pads, tape on 3 sides
    8. Repeat steps for the opposite side as needed
    9. When able, and appropriate to do so give Cefazolin: contraindicated in penicillin allergy; use caution when allergies cannot be determined due to acuity of condition
       - Adults (age > 15 years or > 50kg): **Cefazolin 2 grams slow IV/IO push** over 3-5 minutes or in 50-100mL of D5W or NS over 30 minutes
       - Pediatrics (age < 15 years or < 50kg): **Cefazolin 30mg/kg slow IV/IO push** (max 2 grams) over 3-5 minutes or in 50-100mL of D5W or NS over 30 minutes
    10. Repeat steps 6 above if re-tension occurs

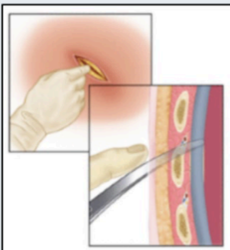

Figure B. Use the curved forceps to go "up and over" the 5th rib, into the 4th ICS. Use your fingertip as a "bumper" to prevent the forceps penetrating too deeply after puncturing the parietal pleura.

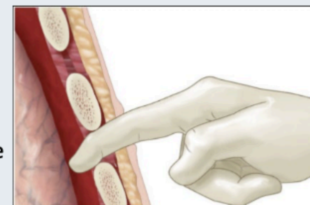

Figure C. Finger sweep procedure through thoracostomy incision.

Needle and Finger Thoracostomy

Consider Contraindications

- Needle Decompression: Simple pneumothorax without tension physiology
- Finger Thoracostomy: Stable patient with tension pneumothorax, perform needle decompression

Transport Considerations

- Needle Decompression: Continuous reassessment is required as additional decompressions may be needed for catheter occlusion or proceed to finger thoracostomy
- Finger Thoracostomy: May need to reinsert forceps or gloved finger into thoracic space for symptoms of re-tension

Information

- Finger Thoracostomy Equipment
  - Scalpel #10, protected/safety style
  - Curved Rochester Pean hemostat, 8-inch
  - Chlorhexidine swab sticks – 3-pack (single 3-pack, enough for bilateral if needed)
  - Sterile 4x4 gauze pads in 2-packs – 3 packs (6 pads total)
  - Silk/cloth tape roll, 1–2" width – 1 roll

Other populations

- Pediatrics: (Newborn to 8 years)
  - Needle Decompression: simple catheter over needle with 18, 20, 22, or 24 gauge IV catheter
  - Finger Thoracostomy: Finger thoracostomy is applicable to both adult and pediatrics
    - May not be feasible in small children due to the tiny intercostal spaces
    - Local medical direction with competency training will guide procedural specifications
- Obstetrics:
  - Consider placing in 3rd ICS due to elevated diaphragm

Subcommittee: Clinical Practices
Advisory Title: Adding Finger Thoracostomy into Paramedic Scope of Practice in Arkansas
Version: 2.0

Advisory Status: FINAL
Date: 3/18/26

Needle and Finger Thoracostomy