



LATERAL APPROACH FOR NEEDLE DECOMPRESSION IN TCCC

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Presenting Issues

- Needle decompression (NDC) failure rates are high.
- For a variety of operational, tactical and medical reasons, alternative NDC sites to the traditional 2nd ICS MCL may be beneficial



Question

- Should the CoTCCC consider recommending a lateral approach for needle decompression as a primary or alternative option?



Current Wording (TCCC Guidelines 110808)

“In a casualty with progressive respiratory distress and known or suspected torso trauma, consider a tension pneumothorax and decompress the chest on the side of the injury with a 14-gauge, 3.25 inch needle/catheter unit inserted in the second intercostal space at the midclavicular line. Ensure that the needle entry into the chest is not medial to the nipple line and is not directed towards the heart.”

-PHTLS, Military Seventh Edition, pg 613.



Current Wording (TCCC Guidelines 110808)

Tactical Field Care

3. Breathing

- a. In a casualty with progressive respiratory distress and known or suspected torso trauma, consider a tension pneumothorax and decompress the chest on the side of the injury with a 14-gauge, 3.25 inch needle/catheter unit inserted in the second intercostal space at the midclavicular line. Ensure that the needle entry into the chest is not medial to the nipple line and is not directed towards the heart.
- b. All open and/or sucking chest wounds should be treated by immediately applying an occlusive material to cover the defect and securing it in place. Monitor the casualty for the potential development of a subsequent tension pneumothorax.



Current Wording (TCCC Guidelines 110808)

Tactical Field Care

18. Cardiopulmonary resuscitation (CPR)

Resuscitation on the battlefield for victims of blast or penetrating trauma who have no pulse, no ventilations, and no other signs of life will not be successful and should not be attempted. However, casualties with torso trauma or polytrauma who have no pulse or respirations during TFC should have bilateral needle decompression performed to ensure they do not have a tension pneumothorax prior to discontinuation of care. The procedure is the same as described in section 3 above.



Current Wording (TCCC Guidelines 110808)

Tactical Evacuation Care

2. Breathing

- a. In a casualty with progressive respiratory distress and known or suspected torso trauma, consider a tension pneumothorax and decompress the chest on the side of the injury with a 14-gauge, 3.25 inch needle/catheter unit inserted in the second intercostal space at the midclavicular line. Ensure that the needle entry into the chest is not medial to the nipple line and is not directed towards the heart.
- b. Consider chest tube insertion if no improvement and/or long transport is anticipated.



Current Wording (TCCC Guidelines 110808)

17. CPR in TACEVAC Care

- a. Casualties with torso trauma or polytrauma who have no pulse or respirations during TACEVAC should have bilateral needle decompression performed to ensure they do not have a tension pneumothorax. The procedure is the same as described in section 2 above.
- b. CPR may be attempted during this phase of care if the casualty does not have obviously fatal wounds and will be arriving at a facility with a surgical capability within a short period of time. CPR should not be done at the expense of compromising the mission or denying lifesaving care to other casualties.



Proposed Change: TFC

3. Breathing

- a. In a casualty with progressive respiratory distress and known or suspected torso trauma, consider a tension pneumothorax and decompress the chest on the side of the injury with a 14-gauge, 3.25 inch needle/catheter unit inserted in the second intercostal space at the midclavicular line. Ensure that the needle entry into the chest is not medial to the nipple line and is not directed towards the heart. **An acceptable alternate site is the 4-5th intercostal space at the anterior axillary line.**
- b. All open and/or sucking chest wounds should be treated by immediately applying an occlusive material to cover the defect and securing it in place. Monitor the casualty for the potential Proposed Change: TACEVAC

2. Breathing

- a. In a casualty with progressive respiratory distress and known or suspected torso trauma, consider a tension pneumothorax and decompress the chest on the side of the injury with a 14-gauge, 3.25 inch needle/catheter unit inserted in the second intercostal space at the midclavicular line. Ensure that the needle entry into the chest is not medial to the nipple line and is not directed towards the heart. **An acceptable alternate site is the 4-5th intercostal space at the anterior axillary line.**
- b. All open and/or sucking chest wounds should be treated by immediately applying an occlusive material to cover the defect and securing it in place. Monitor the casualty for the potential development of a subsequent tension pneumothorax.



Proposed Change: TACEVAC

17. CPR

- a. Casualties with torso trauma or polytrauma who have no pulse or respirations during TACEVAC should have bilateral needle decompression performed to ensure they do not have a tension pneumothorax. **The procedure is the same as described in section 2 above.**
- b. CPR may be attempted during this phase of care if the casualty does not have obviously fatal wounds and will be arriving at a facility with a surgical capability within a short period of time. CPR should not be done at the expense of compromising the mission or denying lifesaving care to other casualties.

NDC: Background



NDC: Background

- Tension pneumothorax was found to be the cause of death in 3-4% of combat fatalities in the Vietnam Wound Data and Munitions Effectiveness Team (WEDMET) data. (McPherson 2006)
- OIF/OEF: rates lower
 - Why?
 - Better data collection, body armor and needle decompression
- But unrelieved tension pneumothorax continues to contribute to preventable deaths in U.S. combat casualties. (Harcke 2007, Holcomb 2007)



NDC: Background

- Prehospital needle decompression (NDC) may be lifesaving for combat casualties torso trauma. (Butler 1996, Kotwal 2011)
- NDC potentially lifesaving when performed by paramedics in selected civilian trauma patients (Davis 2005, Eckstein 1996)
- Procedure Incidence 0.2-1.7% (Eckstein 1998)
- Failure rates for anterior needle decompression with 2 inch catheters has been reported to be between 30-50% (Barton 1995; Davis 2005; Ball 2010)
- Rare but significant potential complications from procedure



NDC: Complications

- Failure of the attempted NDC may result in the death of the casualty. (Harcke 2007)
- Although unusual, significant and life threatening complications may be associated with NDC. (Riwoe 2011, Butler 2003)
 - ▣ Pulmonary artery injury and cardiac tamponade have been reported with NDC performed in the midclavicular line. (Butler 2003)
 - ▣ Laceration of the subclavian artery has been reported as a complication of attempted NDC. (Riwoe 2011)
- Because of the complications noted at the current site for NDC, authors have recommended using the 3rd or 4th ICS at the MAL as an alternate site. (Riwoe 2011)



NDC: Complications

- **Biggest: Not decompressing Tension PTX**
- Potential Complications
 - Anterior
 - Internal mammary artery injury
 - Cardiac injury
 - Great vessel injury
 - Lateral
 - Cardiac injury (if significant cardiomegaly; and left sided procedure)
 - Long thoracic nerve injury
 - Liver/spleen puncture
- Netto (2008)
 - Prospective trial, 1135 trauma patients
 - 598 with potential indication (e.g. torso trauma)
 - N= 17 patients with 18 ND → All indicated
 - 17/18 (94%) within Cardiac Box
 - 8/18 (44%) medial to MCL (though no major complications)

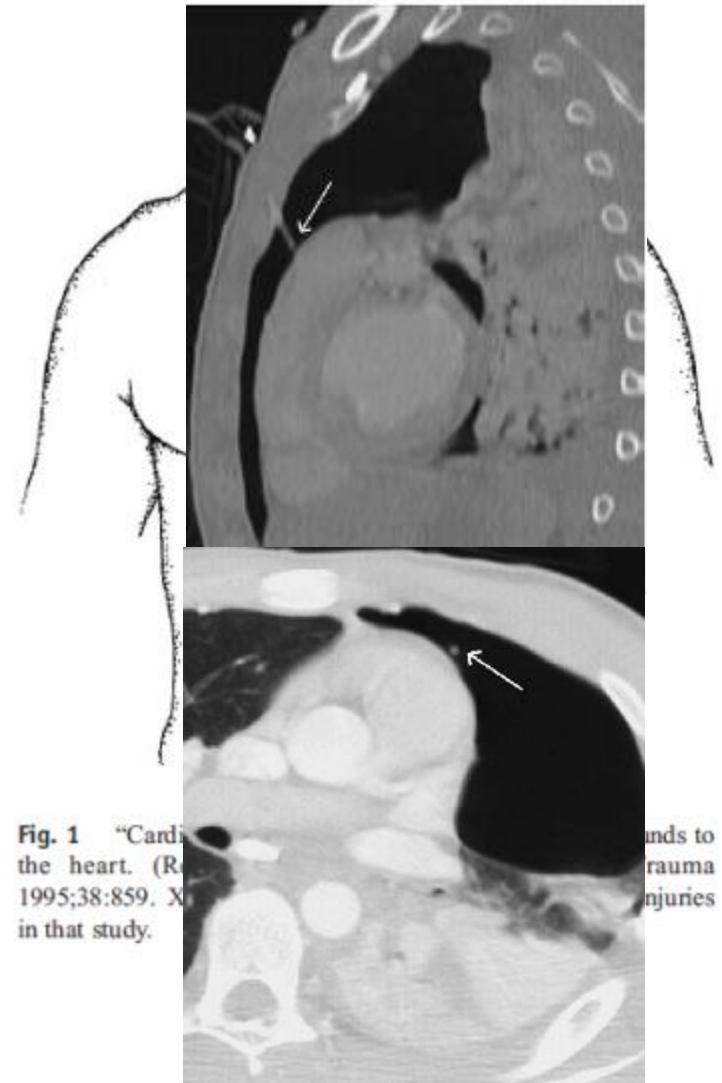


Fig. 1 "Cardiac injury in trauma patients: a review of the literature." (Resuscitation 1995;38:859. X-ray in that study.

ends to trauma injuries



NDC: Failure Rates

- Why ND fail
 - Training and improper technique
 - Needle/catheter length
 - Catheter location
 - Catheter kinking
 - Muscle mass
 - Blood clot in catheter
- ND challenges in tactical environment
 - Exposure
 - Equipment/Body armor
 - Hypothermia prevention
 - Anatomy and physiology
 - Muscle mass
 - Threat
 - Requirement for rapid interventions



NDC: Failure Rates

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Catheter Length

- The Advanced Trauma Life Support course currently recommends that needle decompression be performed with **a 5 cm catheter**, placed in the 2nd ICS, at the midclavicular line. (Korteek 2008)
- Several studies suggest that a 5 cm catheter may be too short to be optimal for NDC at 2 ICS MCL or 4-5 ICS AAL. (Ball 2010, McLean 2010, Stevens 2009, Rathinam 2008, Wax 2007, Givens 2004, Britten 1996)
- Previously used 5 cm (2-inch) needles were inadequate to penetrate the chest wall and were associated with several fatalities in U.S. Combat fatalities at Dover. (Harcke 2007)
- Accordingly, an 8 cm needle is now recommended in TCCC. (Butler 2009, Butler 2010)



NDC: Location

- The Advanced Trauma Life Support course currently recommends that needle decompression be performed with a 5 cm catheter, placed **in the 2nd ICS**, at the midclavicular line. (Korteek 2008)
- One study of 17 attempted prehospital NDCs in Canada found that **44% were performed too medially** (Netto 2008)
- Observational study of 25 Irish EM physicians of varying experience demonstrated that although most (**88%**) could name the site where the needle should be placed, many (**40%**) could not correctly mark this spot on a human volunteer (Ferrie 2005).
- Inaba found that NDC was done at the correct location in 100% of attempts at the 4-5th ICS AAL, but in only 58% of attempts at the traditional second intercostal location. (Inaba 2011)
- Chest X-rays of tension pneumothorax typically display a marked shift of the ipsilateral lung (and the heart when the pneumothorax is left-sided) away from the lateral chest wall and towards the mediastinum.



NDC: Location

- ATLS recommends the 5th ICS just anterior to the MAL as the primary site for tube thoracostomy. (Kortek 2008)
- Anatomy: the 5th ICS is located at the level of the nipple in young, fit males. The AAL is located at approximately the lateral aspect of the pectoralis major muscle, making this location easy to identify.
- Moving the decompression site more laterally and slightly inferior to the 4-5th ICS at the anterior axillary line (AAL) would thus be expected to reduce complications resulting from this procedure (Inaba 2011)
- Execution: In a tactical situation, the lateral approach may be faster and safer given body armor configuration and ability to reassess.



Summary

- Currently, needle decompression is recommended as a Combat Lifesaver (CLS), Combat Medic (CM), and Combat Paramedic (CPM) Level Skill.
- Two major practice guidelines, Prehospital Trauma Life Support (PHTLS) and Special Operations Forces Tactics, Techniques and Procedures (SOF TTP), recommend AAL 4-5th ICS as acceptable alternative site for needle decompression of tension pneumothoraces.
- No prospective studies or case series were found that documented the relative safety or efficacy of using the 2nd ICS at the MCL as opposed to the 5th ICS at the AAL.



Summary

Oxford Centre for Evidence-based Medicine Levels of Evidence (March 2009)

- Level of evidence: 4 (Case-series and poor quality cohort and case control studies)
 - In support of 2nd ICS MCL
 - In support of 4-5th ICS AAL



Summary

- *Non- inferiority:*
 - No definitive literature was found that establishes the superiority of the 2nd intercostal space at the midclavicular line over the 4-5th intercostal site at the anterior axillary line as the preferred site for needle decompression of a presumed tension pneumothorax.
 - No adverse safety data exists regarding the lateral approach for NDC
 - All current data suggests that the 8cm catheter placed at the 4-5th ICS AAL will be effective for the majority of casualties.

- *Potential Superiority:*
 - The 4- 5th intercostal space at the anterior axillary line is more remote from the heart and great vessels and may reduce the incidence of complications from needle decompression.
 - The lateral approach may offer distinct tactical advantages that improve successful execution of the procedure.



Conclusions

- There is no definitive literature that establishes the superiority of the 2nd intercostal space at the mid-clavicular line over the 4-5th intercostal space at the anterior axillary line as the preferred site for needle decompression of a presumed tension pneumothorax.
- The 4-5th intercostal space at the anterior axillary line is more remote from the heart and great vessels and may reduce the incidence of complications from needle decompression as well as offer tactical advantages.



Recommendation

- CoTCCC should include recommendation that lateral approach (4-5th ICS AAL) is acceptable alternative to the traditional anterior mid-clavicular 2nd ICS and draft supporting text to that effect.



Proposed TCCC Language

In a casualty with progressive respiratory distress and known or suspected torso trauma, consider a tension pneumothorax and decompress the chest on the side of the injury with a 14-gauge, 3.25 inch needle/catheter unit inserted in the second intercostal space at the midclavicular line. Ensure that the needle entry into the chest is not medial to the nipple line and is not directed towards the heart.

An acceptable alternate site is the 5th intercostal space at the anterior axillary line.

Discussion



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