INTERNATIONAL TRAUMA LIFE SUPPORT

NEEDLE DECOMPRESSION OF TENSION PNEUMOTHORAX

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INTRODUCTION

The purpose of this document is to update International Trauma Life Support (ITLS) instructors and providers of the position of ITLS in regard to the needle decompression of tension pneumothorax.

The seventh edition of the ITLS Provider manual includes additional locations at which a needle decompression of a tension pneumothorax can be carried out beyond the traditional anterior location of the 2nd intercostal space in the mid-clavicular line. A number of other texts, including several used in the tactical medical environment, recommend performing decompression at either the 3rd or 4th intercostal space laterally. These apparently conflicting recommendations have led to confusion on the part of some ITLS instructors and providers with respect to the proper location for needle chest decompression of a tension pneumothorax.

BACKGROUND

A tension pneumothorax results when air enters the pleural space and is under pressure so that it causes the lung on the affected side to collapse. As a result, the lung is not able to exchange air with the environment and this leads to hypoventilation and hypoxemia. As the pressure rises in the affected hemithorax, the mediastinum can be shifted away from the side of injury and this can cause the vena cava to be compressed. As a result, little to no blood flows back into the heart, resulting in an obstructive or mechanical shock.

The signs and symptoms of a tension pneumothorax include progressive dyspnea, absent breath sounds on the affected side, tympany to percussion of the affected side (sound like a drum when percussed), jugular venous distention as venous return is compromised (may be absent if bleeding present), tachycardia, and in the late stages, circulatory collapse with hypotension and tracheal deviation away from the side of injury.

CONSIDERATIONS

Remember, any patient receiving positive pressure ventilation (bag mask or ventilator) who develops a pneumothorax, by definition has a tension pneumothorax.

PROCEDURE

Pre-hospital management of a tension pneumothorax has traditionally included airway support and needle decompression of the chest to release the air under pressure in the pleural space.

In the hospital setting, a chest tube (tube thoracostomy) is performed for management of tension pneumothorax, with the chest tube being placed via an incision at the 4th or 5th intercostal space laterally in the anterior axillary line. Early EMS chest decompression also recommended large bore catheter-needle combinations in the same location. However, for a number of reasons, the anterior approach is preferred for EMS decompression.

Reasons include:

- risk of injury to abdominal contents if inserted in the lateral location because the diaphragm can rise to the 4th ICS with full exhalation;
- the catheter gets in the way of chest tube insertion;
- in the field, accessing the lateral site is more difficult than the anterior chest.

For EMS, the recommended approach is to insert a catheter-needle combination anteriorly in the 2nd intercostal space (just over the 3rd rib) in the mid-clavicular line. In most patients, the risk of unintended injury to vital structures other than the lung is markedly reduced using this approach.

Although the anterior location for needle decompression has been recommended by most pre-hospital courses for years, it is not without problems. Research has shown that in larger persons, standard IV catheters may not be long enough to enter the pleural space and thus are not effective in decompressing a tension pneumothorax. In a patient with a tension pneumothorax who has undergone needle decompression and who is receiving positive pressure ventilation, a one-way valve is not needed, as the air flow is from internal to external. This is not the case with a sucking chest wound where the negative pressure on inspiration can cause air to be pulled into the chest. In this situation, a one-way valve should be used to cover the wound.

Studies by Stevens et al[1] and Ball et al[2] recommend using a catheter longer than the standard IV catheter carried on most ambulances. Another study by Netto et al [3] suggests that the lateral approach allows more catheters to reach the pleural space because the chest wall is thinner laterally. Netto's study also showed that in many cases, catheters were being inserted too medially, resulting in injuries to internal mammary arteries and great vessels. This was particularly true if the insertion site was lower than the recommended 2nd intercostal space (ICS). There are no studies that show that field decompression of tension pneumothorax improves patient outcomes. Anecdotally, several leading trauma surgeons question the efficacy of the procedure.

Tactical medicine courses, which emphasize management of penetrating injuries and the high potential for associated tension pneumothorax, have encouraged performing needle chest decompression laterally.[4] This is for two reasons: first, the belief that a lateral approach is more likely to ensure successful entry of the catheter into the pleural space, and second, the ability to perform the procedure quickly without removal of body armor. The indications for needle chest decompression are the same, regardless of tactical or civilian environment.

The TCCC course recommends the 4th intercostal space (between 4th and 5th ribs) in the anterior axillary line (AAL) (Tactical Combat Casualty Care 2012). The TacMed Essentials course teaches use of the 3rd ICS laterally. Either lateral location will be effective, assuming that the needle enters the pleural space. There is theoretically less risk of damaging solid organs (liver, spleen) in the 3rd ICS compared to the 4th ICS and that site may also be more rapidly accessible in a tactical or combat environment.

MEDICAL OVERSIGHT

Medical oversight should review current literature and develop pre-hospital EMS protocols in regard to appropriate location of needle decompression site(s). Implementation of this protocol should be monitored and supervised through a quality assurance program.

CONCLUSION

It is important for instructors to emphasize to students that the different sites are not mutually exclusive, but the risks to the patient and the ability to promptly and effectively perform the procedure when indicated will help dictate whether the anterior or lateral approach is most appropriate in any given situation. Instructors should teach the procedure based on the standards set forth by the course they are instructing. What is important to convey to the student is how to recognize a tension pneumothorax and how to carry out the appropriate field management, rather than to focus on which interspace or approach the catheter should be inserted.

REFERENCES

1. Stevens et al, Needle thoracostomy for tension pneumothorax: failure predicted by chest computed tomography. PEC 2009 Jan-Mar;13(1):14-7.

2. Ball et al, Thoracic needle decompression for tension pneumothorax: clinical correlation with catheter length Can J Surg. 2010 June; 53(3): 184–188.

3. Netto et al, Are needle decompressions being performed appropriately for appropriate indications? AJEM 2008 26: 597-602.

4. Kharod CU Mabry RL, Needle Decompression for Tension Pneumothorax Emergency Physicians Monthly 21:8-9, 2014

Current Thinking

Needle Decompression of Tension Pneumothorax

International Trauma Life Support

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Abstract

This is the official current thinking of International Trauma Life Support (ITLS) regarding needle decompression of tension pneumothorax.

Current Thinking

It is the position of International Trauma Life Support that:

1. It is important to convey how to recognize a tension pneumothorax and how to carry out the appropriate field management.

2. The anterior approach is preferred for EMS decompression.

3. In the EMS setting, accessing the lateral site is generally more difficult than the anterior chest. In patients wearing body armor the lateral site is easier to access and is recommended for that operational environment

4. For EMS, the recommended approach is to insert a catheter-needle combination anteriorly in the 2nd intercostal space (just over the 3rd rib) in the mid-clavicular line using either a purpose designed needle decompression device or an intravenous catheter of sufficient length to assure entry into the pleural space (>3.25 inches or 8 cm).