CHEST TUBE MANAGEMENT PROTOCOL

Written on 09/01/2013

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PURPOSE:

1. To describe the management of a chest tube
2. To describe the procedure for placing a chest tube
3. To describe the procedure for removing a chest tube

CHEST TUBE INDICATIONS

1. Obvious pneumothorax as evident by CXR.
2. Suggested pneumothorax based on clinical exam and hemodynamic instability
3. Hemothorax as evident by CXR or ultrasound.
4. **Occult pneumothorax (OPTX)
    1. Defined by no obvious PTX on CXR, but noted on CT scan.
    2. Most blunt trauma patients with OPTX have been safely observed in several prospective studies. OPTX progression and respiratory distress are independently associated with observation failure. Indications for intervention remain controversial and are the attending surgeon's discretion.[i]
    3. Positive pressure ventilation does not increase failure rate for observation of OPTX.[ii

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PROCEDURE FOR CHEST TUBE PLACEMENT

1. If possible, and with permission from the attending trauma surgeon, adequate sedation should be provided to the patient.
2. The patient is to be prepped and draped appropriately for chest tube placement. Rarely is the patient in such extremis from chest pathology that can be managed by chest tube alone that appropriate sterile technique should be abandoned.
3. The preferred location for chest tube placement is the 5-6th intercostal space at the anterior axillary line. In practice, this corresponds to the inframammary fold. Do not use the nipple as a landmark as it may not necessarily have a stationary location depending on the patient's body habitus.
4. Wide local anesthetic infiltration should be performed, if possible, to include an attempt to reach the parietal pleural surface.
5. A skin incision will be created sharply below the intended entry level of the thoracic cavity to create a subcutaneous flap, followed by dissection above the rib (using either curved Mayo scissors or a Kelly clamp) to enter the chest cavity. Once the instrument has penetrated the pleura, it should be opened widely and withdrawn to create an adequate sized tract to place a gloved finger.
6. Digital inspection will be performed to insure appropriate location (thoracic cavity) and to verify no adhesions are present which would hinder CT placement.
7. A 32-36Fr chest tube* will be directed into the chest with the tip of the tube ideally positioned in the posterior apical location.
8. The chest tube will be connected to the pleurovac and secured into position with an appropriate suture, followed by application of a sterile occlusive dressing.

* In a prospective analysis for chest trauma, chest tube size did not impact the clinically relevant outcomes: there was no difference in the efficacy of drainage,rate of complications including retained hemothorax, need for

additional tube drainage, or invasive procedures. Furthermore, tube size did not affect the pain felt by patients at the site of insertion.[iii]

PROCEDURE FOR CHEST TUBE MANAGEMENT

All chest tubes will remain in place for a minimum of 24 hours. Initially, all chest tubes will be placed to 20cm water suction via the thoracic drain apparatus (pleurevac). The output of the chest tube must be recorded every morning for the prior 24 hour period. Daily am CXRs will be obtained on all patients who have a chest tube in place.

The chest tube is considered ready for removal only after all of the following conditions have been met:

1. Complete resolution or a minimal, stable pneumothorax
2. < 200 ml of pleural drainage evacuated over the preceding 24 hour period
3. Absence of air leak on valsalva maneuver or forceful cough

Positive pressure ventilation status alone should not cause delay in proceeding with placing chest tubes to water seal and subsequent removal.[v]

Once a chest tube has been deemed ready for removal, the chest tube will be placed on water seal for four (4) hours followed by a CXR. This is to allow for sufficient time to transpire to ensure that a slowly reoccurring pneumothorax is not missed.[vi] There is NO NEED to wait more than 4 hours to obtain the next CXR to determine whether a tube should be discontinued.

Note: A normal chest radiograph obtained 3 hours after placing a chest tube on water seal effectively excludes development of a clinically significant pneumothorax.[vii]

**Failure to meet criteria for removal of the chest tube after 72 hrs of chest tube placement should prompt an evaluation for VATS, which would include non-contrasted CT scan of the chest. (ie persistent drainage >200ml, persistent air leak, or inability to clear effusion/hemothorax on CXR).

Chest X-rays

Daily CXRs are to be obtained if a patient has a chest tube in place. Otherwise, wait at least four hours before obtaining x-rays after making changes to the chest tube (i.e. after changing to water seal, or after pulling the tube from the chest).

Suction

Initially, all chest tubes will be placed to 20cm water suction via the thoracic drain apparatus. The water level in the suction chamber must be monitored daily and kept at the appropriate level by adding sterile water to counteract the normal evaporative losses that will diminish the effective interpleural suction force of the chest tube. There is no need to adjust the amount of suction at the wall as the amount of effective interpleural suction force is determined by the water level in the pleurevac container.

Water Seal

Disconnecting the chest tube reservoir apparatus from wall suction constitutes placement of the patient on water seal. This will be done prior to chest tube removal.

Tube Clamping

The chest tube should never be clamped except when interrogating the system to determine where an air leak may be originating from. AT NO TIME SHOULD A

CLAMP BE LEFT ON A PATIENTS CHEST TUBE OR PLERUVAC TUBING WHILE UNATTENDED; doing so in a patient with a residual pleural leak, even if small, can lead to a tension pneumothorax and resultant cardiac arrest.

Removing the Chest Tube

1. Remove the sutures around chest tube while holding chest tube steadily in place.
2. Instruct the patient to perform Valsalva maneuver.
3. Withdraw the chest tube quickly while simultaneously covering entrance site with vaseline gauze.
4. Tape 4 X 4 gauze over entire entrance site ensuring that no air is able to leak into the chest tube wound.
5. Order a CXR four (4) hours following chest tube removal.

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[i] Blunt traumatic occult pneumothorax: is observation safe?--results of a prospective, AAST multicenter study. Moore et al. J Trauma. 2011 May;70(5):1019-23

[ii] Occult pneumothoraces in critical care: a prospective multicenter randomized controlled trial of pleural drainage for mechanically ventilated trauma patients with

occult pneumothoraces. Kirkpatrick et al. J Trauma Acute Care Surg. 2013 Mar;74(3):747-54

[iii] Does size matter? A prospective analysis of 28–32 versus 36–40 French chest tube size in trauma. Inaba et al. J Trauma Acute Care Surg. 2012: 72 (2): 422-427

[iv] Presumptive antibiotic use in tube thoracostomy for traumatic hemopneumothorax: an Eastern Association for the Surgery of Trauma practice management guideline. Moore FO et al. J Trauma Acute Care Surg. 2012 Nov;73(5 Suppl 4):S341-4

[v] Impact of Positive Pressure Ventilation on Thoracostomy Tube Removal. Tawil et al. J Trauma. 2010 Apr;68(4):818-21.

[vi] Prospective Randomized Trial of Thoracostomy Tube Algorithms. Martino, et al. J Trauma. 1999 Mar; 46 (3): 369-373.

[vii] How long should you wait for a chest radiograph after placing a chest tube on water seal? A prospective study. Schulman CI et al. J Trauma. 2005 Jul;59(1):92-5