Chest Tubes

Stanley John RT, BS, RRT-NPS, CPT, CPC, ACCS, AE-C
- Assistant Director - NSUH Respiratory Therapy Department
- Vice Chairman - New York State Education Department Respiratory Therapy & Polysomnography Technology Licensure Board
- Adjunct Instructor - Molloy College
- Clinical Preceptor - Independence University

Disclosure of conflict of interest

I do not have any affiliations with any individual or entities that could be perceived as having a bearing on my presentation

Chest Tube

- Clear hollow tube
- Mostly made of soft silicon, clear polyvinylchloride (pvc) or a mix of both
- Have a radiopaque strip. The strips have gaps that serve to mark the proximal drainage holes

Pressure Changes in the Thoracic Cavity

Pleural space and negative pressure

Pleural space

Chest Tube Placement

"Insertion of a silicon or polyvinylchloride (pvc) tube through the chest wall into the pleural cavity to evacuate the accumulated air/blood/pus from the pleural space."

Chest Tube Placement Procedure

Chest tube are inserted
- At the bedside
- In the operating room
- or in an interventional radiology suite

When ever possible, informed consent should be obtained

Indication for Chest Tube Insertion

Air
- Pneumothorax (Spontaneous, Traumatic, Iatrogenic)
- Tension Pneumothorax (Unilateral Pneumothorax)

Fluid (Pleural Effusion)
- Hydropneumothorax
- Chylothorax - Lymphatic fluid
- Empyema - Pus

Air & Fluid
- Hypopneumothorax

Bronchopleural Fistula (BPF)
- Post Op, Mechanical Ventilation

Pleurodesis
Chest Tube Insertion and Placement

- Air: 2nd intercostal space & mid clavicular line
- Fluid: 4th-5th intercostal space & mid-axillary line
- Chest tube is inserted above the rib (superior border)
- Avoiding the vein, artery and nerve – pain receptor which runs under the rib (inferior border)

Evolution of the Drain Unit

The 3 bottle drainage system

#1 - Collection/Trap Bottle
- Collects the pleural drainage
- Marked to allow measurement of pleural drainage
- Single or multi chamber
- Once the collection chamber gets filled up the whole drainage system needs to be changed

#2 - Water Seal Bottle
- Middle bottle is the water seal bottle
- Prevents air from entering the pleural cavity
- Normally, there is no bubbling here.
- Continuous bubbling should be reported because this means there is an active air leak.

#2 - Water-Seal Bottle
- If the water seal should break, submerge chest tube in a glass of water
- If patient is receiving PPV leave tube open to air until a new system can be set up. Do not clamp the tube
- Prevent tension pneumothorax.
- Pulmonary edema may result if there is a malfunction that creates a sudden re-expansion of the lung.
- Water in the water seal bottle must be monitored to prevent any sudden change in pleural pressure
#3 - Suction Regulating Bottle

- Apply suction when large amounts of fluid must be drained.
- Regulates the amount of negative pressure being applied to the water seal.
- The water height in the suction control bottle will determine the amount of negative pressure regardless of suction set on the vacuum regulator.
- Normally set at -20 cm H2O
- Higher negative pressure can help speed the re-expansion process but can also damage the tissue and prolong healing.

Drainage Unit Positioning

- Keep drain below the chest for gravity drainage
- This will cause a pressure gradient with relatively higher pressure in the chest.

Trouble shooting

- Chest tube gets dislodged – Cover the area with a 4 x 4 gauze
- The collecting tubing gets disconnected or when changing the drainage bottle - Clamp the chest tube momentarily (release the clamp as soon as possible)
- No bubbling in the drainage bottle – Possible occlusion, clot or re-expanding lung
- Any SUDDEN decrease in drainage may indicate a possible clot or occlusion
- No bubbling in the drainage bottle – Possible occlusion, clot or re-expanding lung
- Any SUDDEN increase in drainage may indicate active bleeding
- Any SUDDEN increase in drainage may indicate a possible clot or occlusion

Chest Tube Removal - Criteria

- Tidal Volume Loss
- Pressure Swing aka Tidalizing
- Tidal Volume Loss
- Key - Prevention of pneumothorax during removal
- Have petroleum gauze dressing and several strips of cohesive tape already disposed to apply to the dressing once the tube has been removed
- Explain to patients that they will need to inspire deeply and hold their breath (valsalva maneuver) during tube removal. Review this prior to the actual procedure.
- This prevents gasping and thus causing negative intrathoracic pressure that could draw air into the chest and lead to recurrent pneumothorax
- For patients on a mechanical ventilator - Removal of tube should be timed to end expiration or perform an inspiratory hold

Potential Complications

- Excessive bleeding, especially if a blood vessel is accidentally cut
- Hypotension
- Risk for infection
- Increases with duration of tube placement
- Subcutaneous emphysema may arise as pleural-space air leaks into subcutaneous tissue
- Evaluate tissues of the neck, face, and chest for any swelling
- Look for the classic crepitus on palpation

Chest tube and mechanical ventilation

- Pressure Swing aka Tidalizing
- Tidal Volume Loss
- If the returned exhaled tidal volume is less than the set tidal volume then there is a volume loss occurring through the chest tube
- Increasing the set tidal volume pressure to compensate for the lost volume will further increase the bronchopleural leak
- Increasing the set rate and decreasing the set tidal volume will help maintain the desired minute ventilation and promote healing of the rupture site

The Heimlich Flutter Valve
A 52yr male is admitted to the ER with increased WOB and SPO2 89% on NRB. A STAT chest radiograph was ordered. The NP asks you for your opinion.

A. Atelectasis  
B. Left sided Pneumothorax  
C. Right sided Pneumothorax  
D. Pleural effusion

A patient is transferred to the ICU with a right-sided pleural effusion. Where should the chest tube be placed?

A. Right chest, anterior between 2nd and 3rd intercostal space below upper the rib margin.  
B. Right chest, aimed toward the posterior, between the 4th and 5th intercostal space above the lower rib margin.  
C. Right chest, anterior between 2nd and 3rd intercostal space above the lower rib margin.  
D. Left chest, aim toward the posterior, between the 4th and 5th intercostal space above the lower rib margin.

An immediate CXR was ordered and the following was observed

What is the most appropriate course of action?

A. Push the chest tube back into the cavity  
B. Immediately apply an occlusive dressing around the site.  
C. Pull out the dislodged chest tube and apply pressure to the site  
D. Clamp the chest tube

A 38Fr chest tube was successfully inserted and connected to the drainage unit and attached to suction. Two hours later you notice continuous bubbling in the water seal chamber. What do you suspect?

A. A newly developed spontaneous pneumothorax  
B. A dislodged chest tube  
C. Increase in suction pressure from the wall outlet  
D. Resolving pleural effusion

Upon examining the chest tube insertion site you notice some fenestrated drainage holes from the catheter protruding outside the thoracic cavity. What is the most appropriate course of action?

A. Push the chest tube back into the cavity  
B. Immediately apply an occlusive dressing around the site.  
C. Pull out the dislodged chest tube and apply pressure to the site  
D. Clamp the chest tube

Questions ???

“The man who asks a question is a fool for a minute, the man who does not ask is a fool for life.”

- Confucius