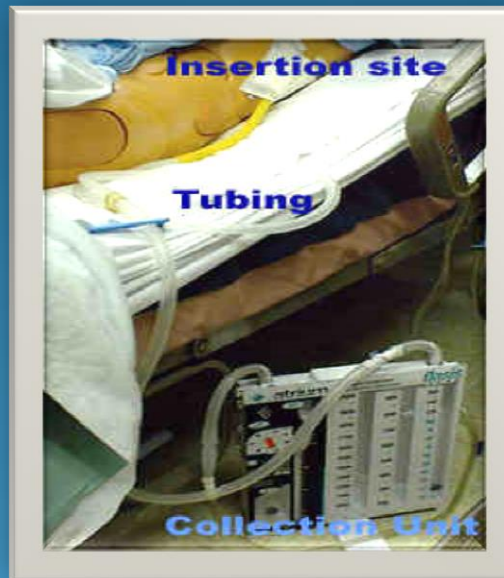


Nursing Care and Monitoring of Patient undergoing Chest Tube Insertion (Underwater Seal)



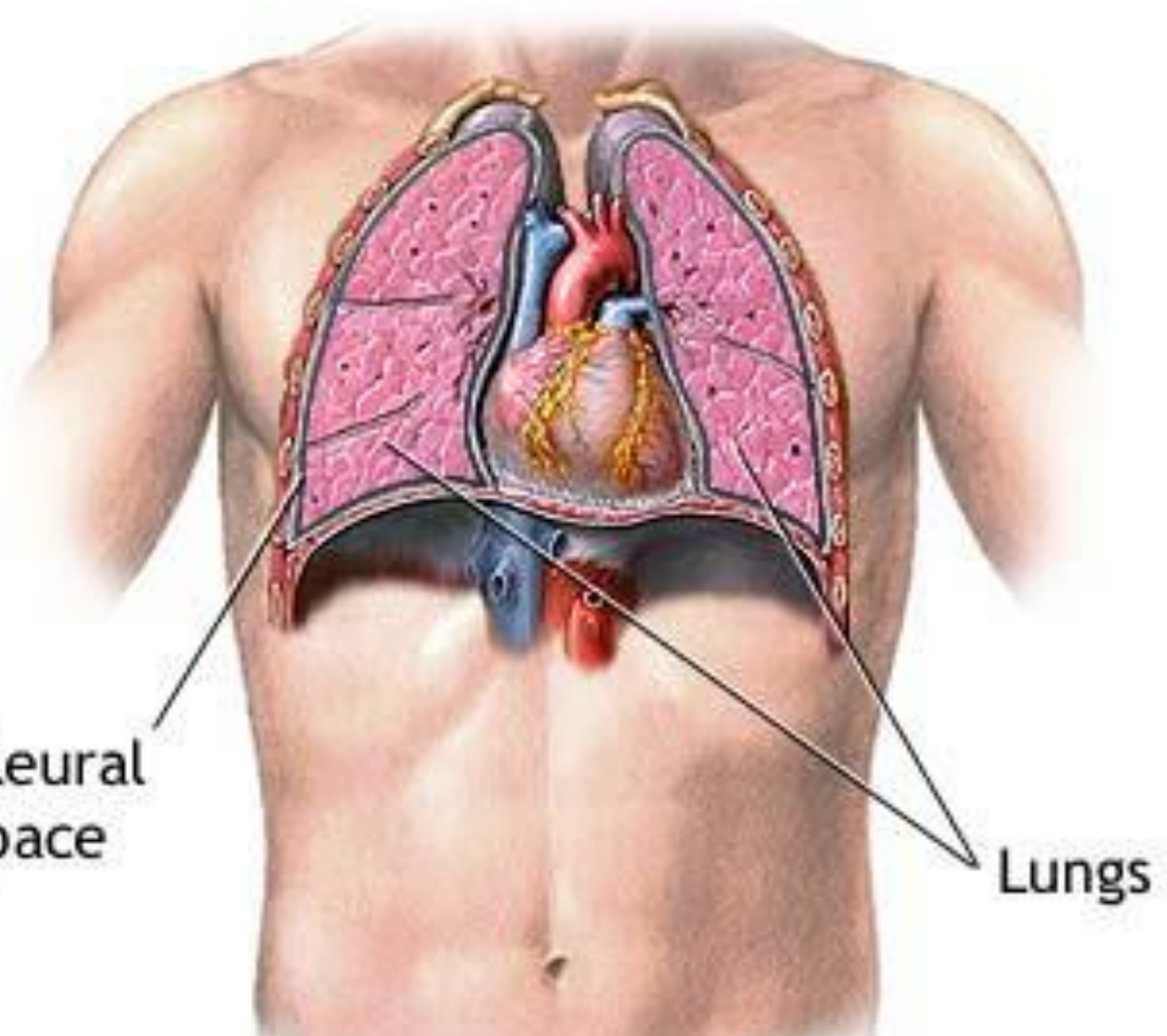
Prepared by : Mrs. Sohad Noorsaeed, RN,MSN

Outlines:

- Definition.
- Indications
- Site of chest tube insertion.
- Insertion technique and equipment.
- Nursing role and responsibilities.
- Chest drainage management.
- Complications and contraindications.
- Criteria of chest tube removal.

Definition:

- A **chest tube (chest drain or tube)** is a flexible plastic tube that is inserted through the Lateral/ or Mediastinal of the chest into the pleural space . It is used to remove excess **air** or **fluid**, or **pus** from the intrathoracic space and to help **regain –ve pressure**.



This anatomical diagram illustrates the internal organs of the human chest. The lungs are shown in a pinkish-red color with visible branching bronchial structures. The heart is centrally located, depicted in red and blue to represent oxygenated and deoxygenated blood flow. The pleural space is the cavity between the two lungs, lined by a thin membrane. Labels with leader lines identify the 'Pleural space' and 'Lungs'.

Pleural
space

Lungs

Indications:

- To remove the residual air and drainage fluid from the pleural space.
- This assists in the re expansion of remaining lung tissue.
- To restore negative pressure.
- Chest tube used during and immediately after thoracic surgery (e.g. open heart surgery). Mediastinal.

Site of insertion:

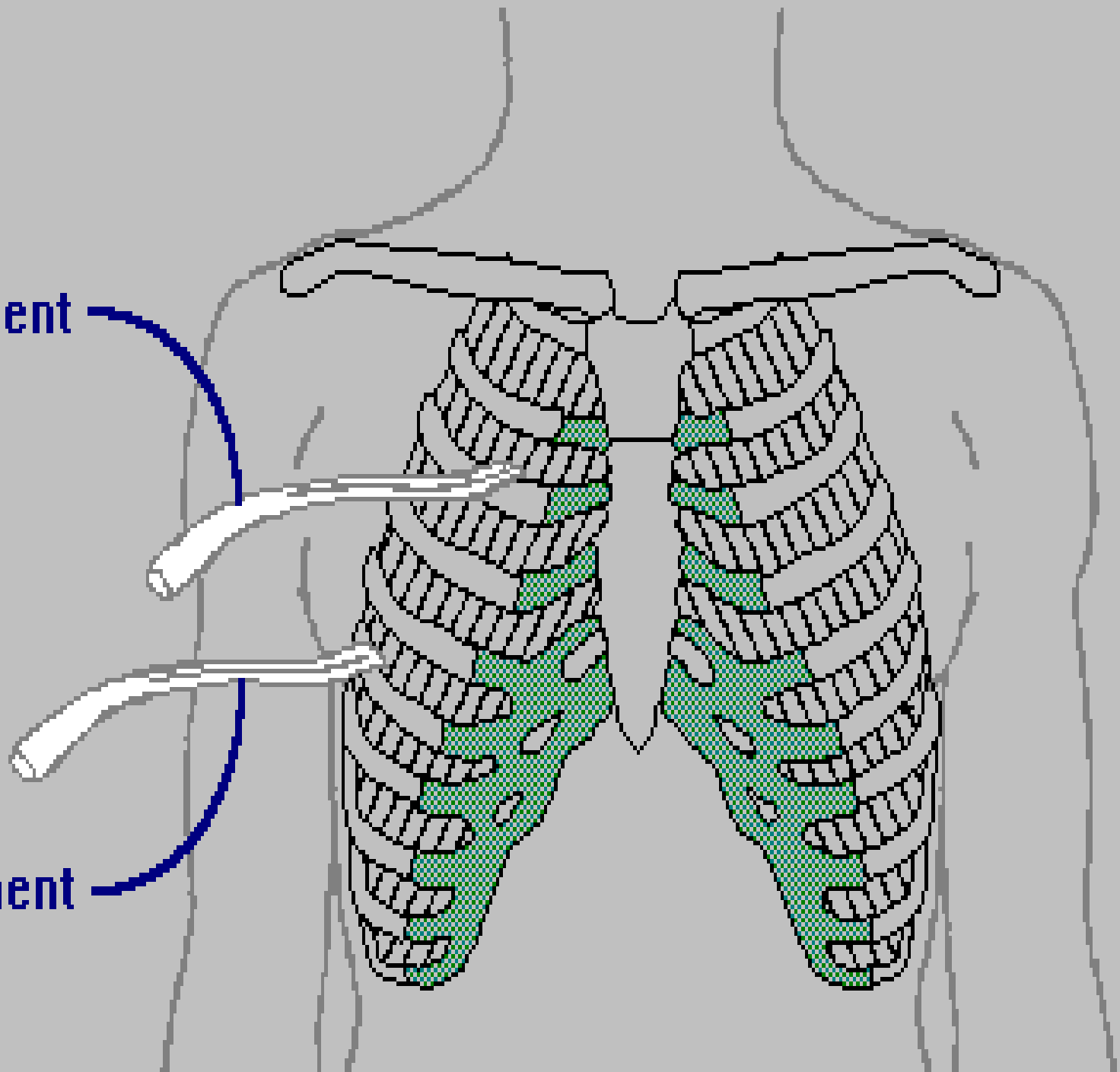
Remember Air Rises and Fluid Falls

Location depends on what is being drained

- Free air in the pleural space (**Pneumothorax**) rises >>> tube is placed above the 2nd intercostal space.
- Fluids (**e.g.: Hemothorax ,pleural effusion**) gravitate to the most dependent point >>>tubes places at the 4th to 5th intercostal space.
- Mediastinal tubes are put in place after cardiac surgery to drain fluid from around heart.

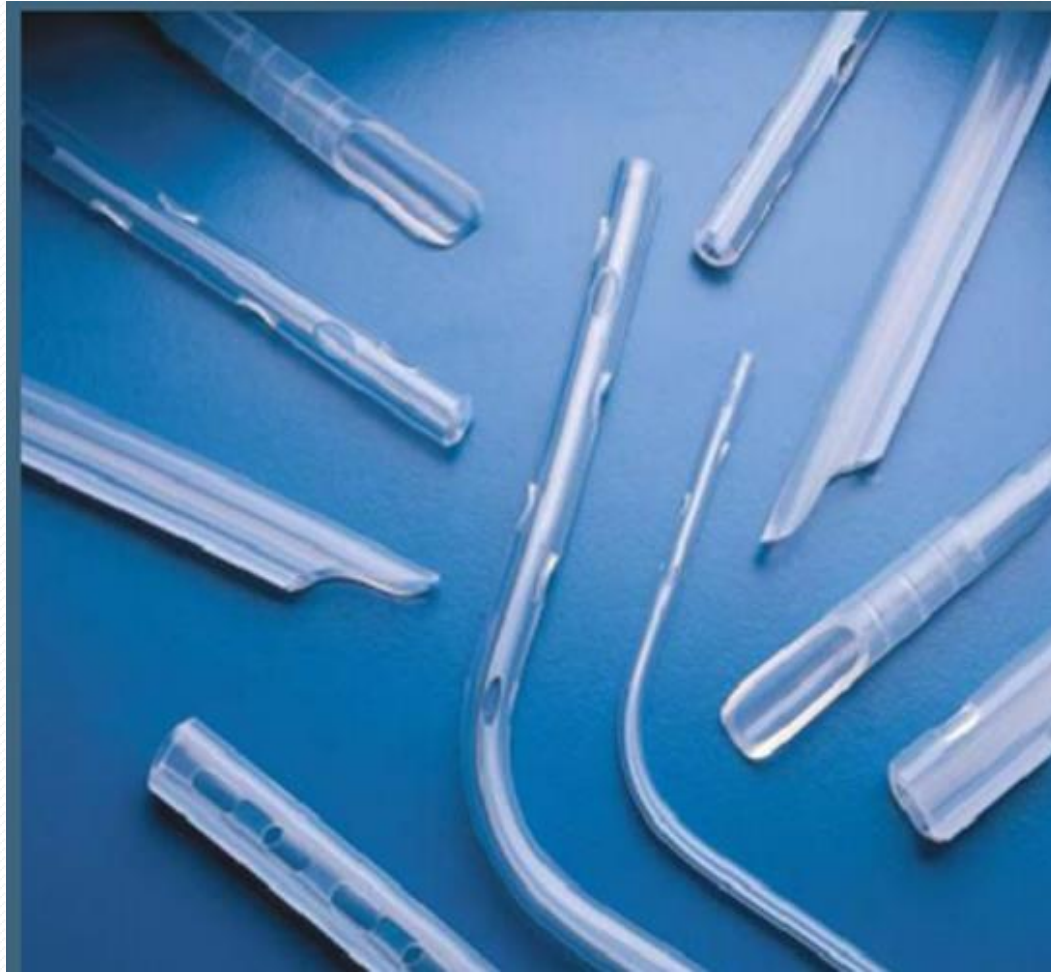
Tube placement
to drain air

Tube placement
to drain fluid



Nursing role:

- Assess patient for pneumothorax, hemothorax or presence of respiratory distress.
- Obtain a chest X-ray.
- Assemble drainage system.
- Reassure the patient.
- Explain to patients the steps of the procedure. Tell the patient to expect a needle prick and a sensation of slight pressure during infiltration anesthesia.
- Position the patient according to physician preference.



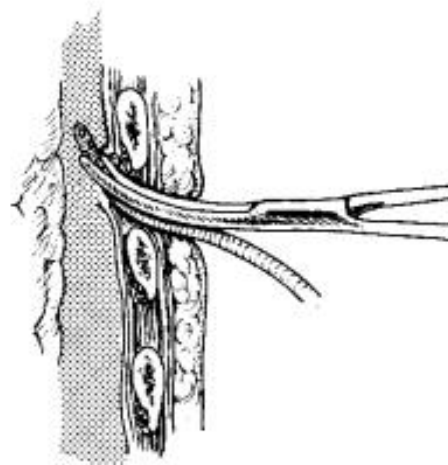
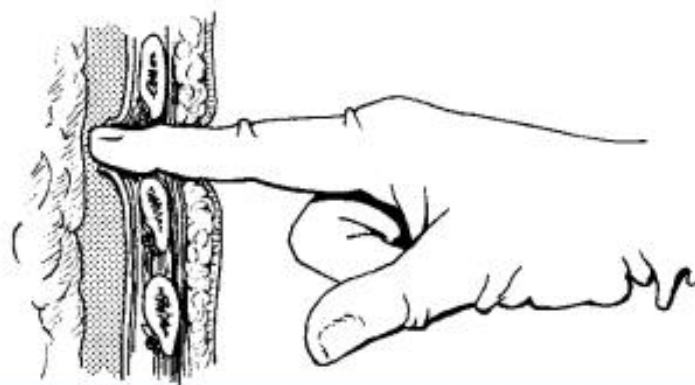
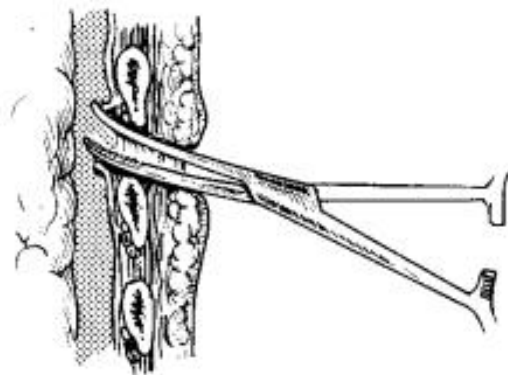
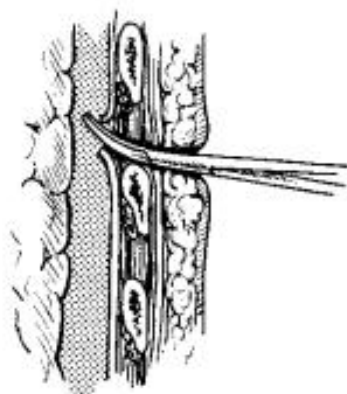
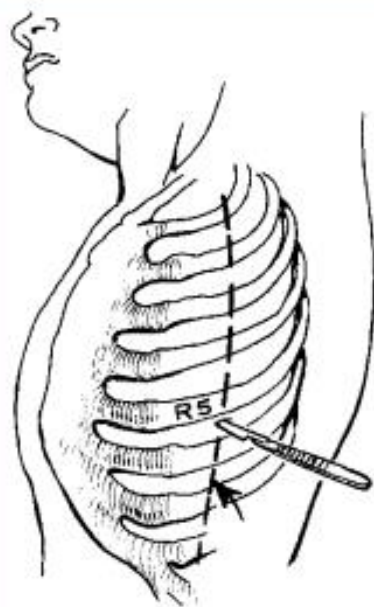
Equipments:

- Tube thoracotomy tray.
- Suture material.
- Local anaesthetic.
- Chest tube.
- Syringes.
- Needles.
- Iodine
- Sterile water.
- Sterile scalpel and gloves.
- Two large clamps.
- Chest drainage system ,collection bottles



(Insertion) by Physician

- The skin is prepared and anesthetized using local anesthetic with a short 25 G needle.
- The needle catheter is inserted through the needle into the pleural space.
- A small incision through the muscle in the intercostalspace is performed.
- chest tube is inserted into the pleural space and connected to a drainage system.
- The catheter is attached to a connector/tubing and attached to drainage system (underwater-seal or commercial system).
- The tube is sutured in place and covered with a sterile dressing.



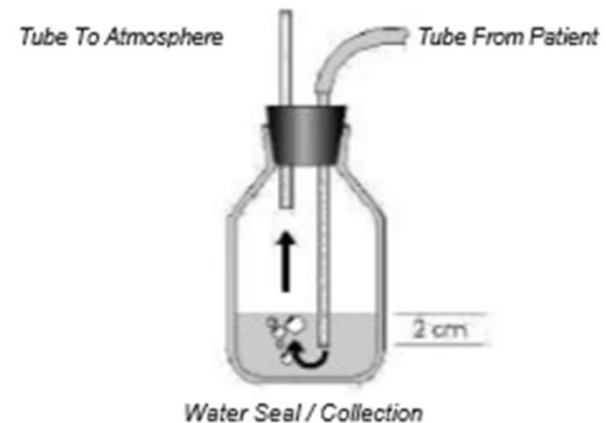




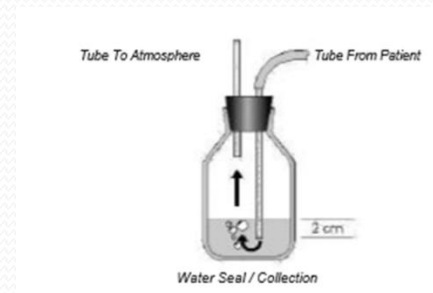


The Single-Bottle Water-Seal System

- (1) Connecting or drainage tubing joins the patient's chest tube with a drainage tube that enters the drainage bottle.
- (2) The end of the glass rod is submerged in water, extending about 2-3 cm below the water level (The higher the fluid level, the more pressure it takes to push air through the fluid as it leaves the chest).
- (3) The water seal provides a low-resistance, one-way valve that allows air to leave the chest while preventing atmospheric air from being pulled into the chest during breathing.
- (4) Drainage depends upon gravity.

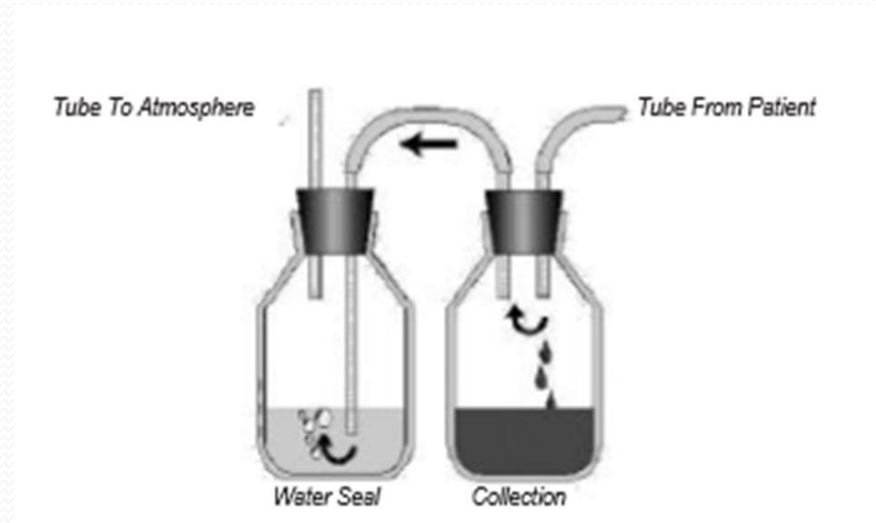


- (5) The second tube in the drainage bottle is a vent for the escape of any air drained from the lung. The air will bubble through the water and leave the chest drain system through the atmospheric vent.
- (6) Bubbling at the end of the drainage tube may or may not be visible. Bubbling may mean persistent air leaking from the lung or a leak in the system.
- (7) The water level in the bottle **fluctuates as the patient breathes**. It rises when the patient inhales and lowers when the patient exhales. **Continuous bubbling in this bottle indicates air leakage.**
- (8) Since fluid drains into this bottle, be certain to mark the water level prior to opening the system to the patient. This will allow correct measurement of patient drainage.



The Two-Bottle Water-Seal System

- 1) The two-bottle system consists of the same water-seal bottle plus a fluid collection bottle.
- (2) Pleural fluid accumulates in the collection bottle, not in the water-seal bottle as in the single-bottle system.





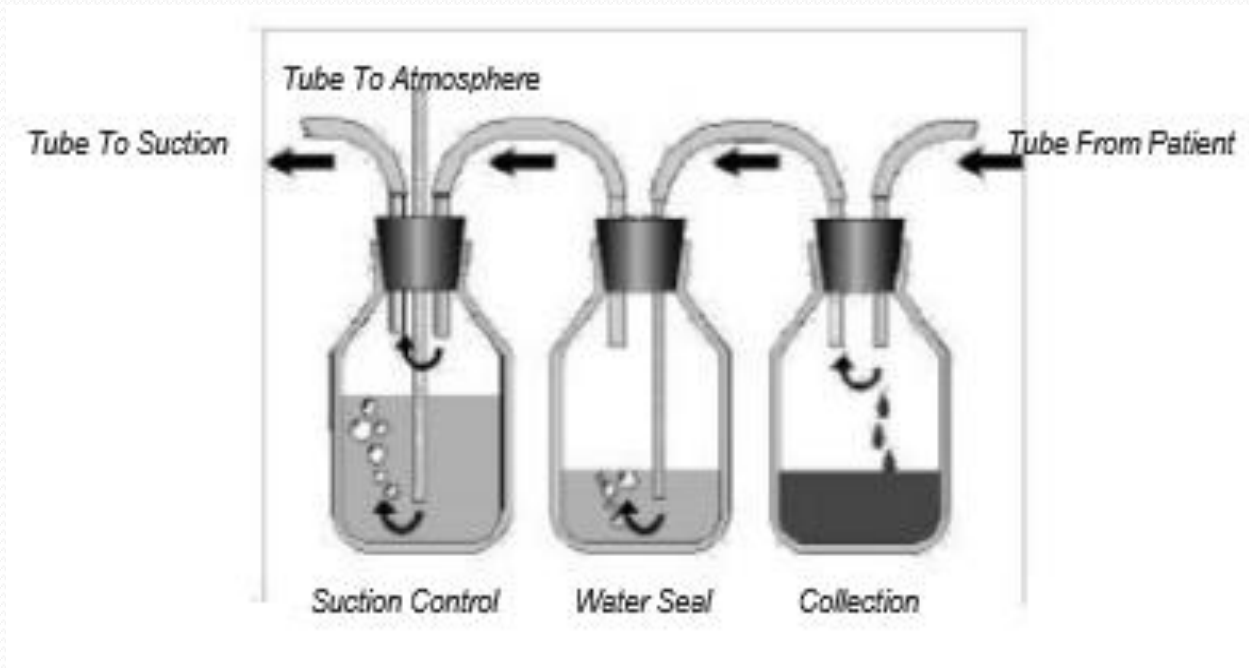
Both the one and two-bottle chest drainage systems rely on **gravity**.

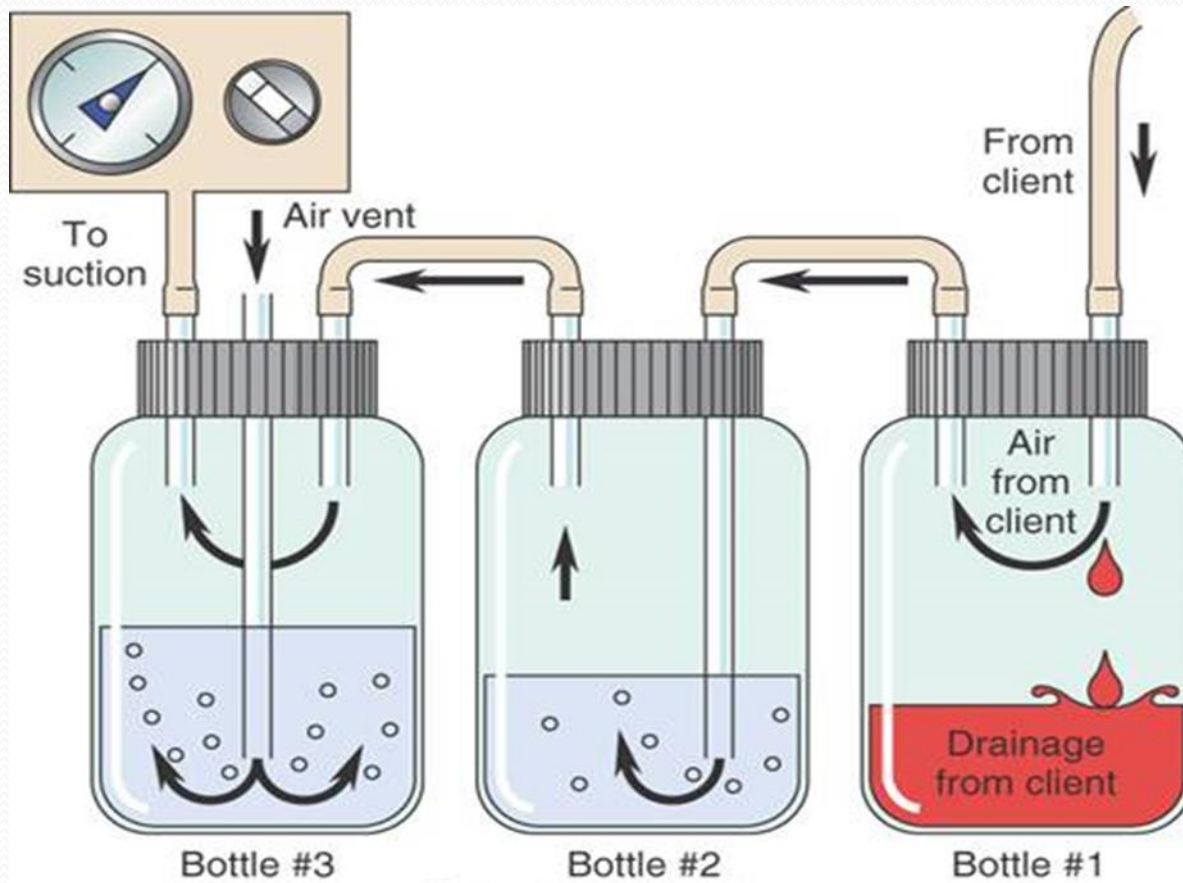
However, if the patient has a large air leak into the pleural space, gravity drainage may **not be sufficient** to evacuate the chest, and suction may be required. This also means the addition of a third bottle to the system — a suction control bottle.

The Three-Bottle Water-Seal System

- (1) This system consists of the water-seal bottle, the fluid collection bottle, and a third bottle which is the suction control bottle.
- (2) The third bottle has three tubes. One short tube above the water level comes from the water-seal bottle. A second short tube leads to the suction. The third tube extends below the water level and opens to the atmosphere outside the bottle. It is this tube that **regulates the suction**, depending upon the depth the tube is submerged. It is normally submerged **20 cm**. The key is that the depth of submersion of the tube in the suction control bottle determines the amount of suction imposed on the patient too much suction causes traumatic injury to the lungs.
- (3) The suction pressure causes outside air to be sucked into the system through the tube, creating a constant pressure. Bubbling in the suction bottle indicates the system is functioning properly.

The Three-Bottle Water-Seal System





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Commercial Chest drainage system

WET SUCTION CONTROL

- The height of water, not the setting of the suction source, that actually limits the amount of suction transmitted to the pleural cavity. A suction pressure of -20 cm H₂O is commonly recommended.

DRY SUCTION CONTROL

(water seal dry- dry seal dry)

- Instead of regulating the level of suction with a column of water, the dry suction units are controlled by a self-compensating regulator. Suction can be set at -10 , -15 , -20 , -30 , or -40 cm of water.
- a one-way valve replaces the traditional water seal. No water is required to establish the one-way seal.

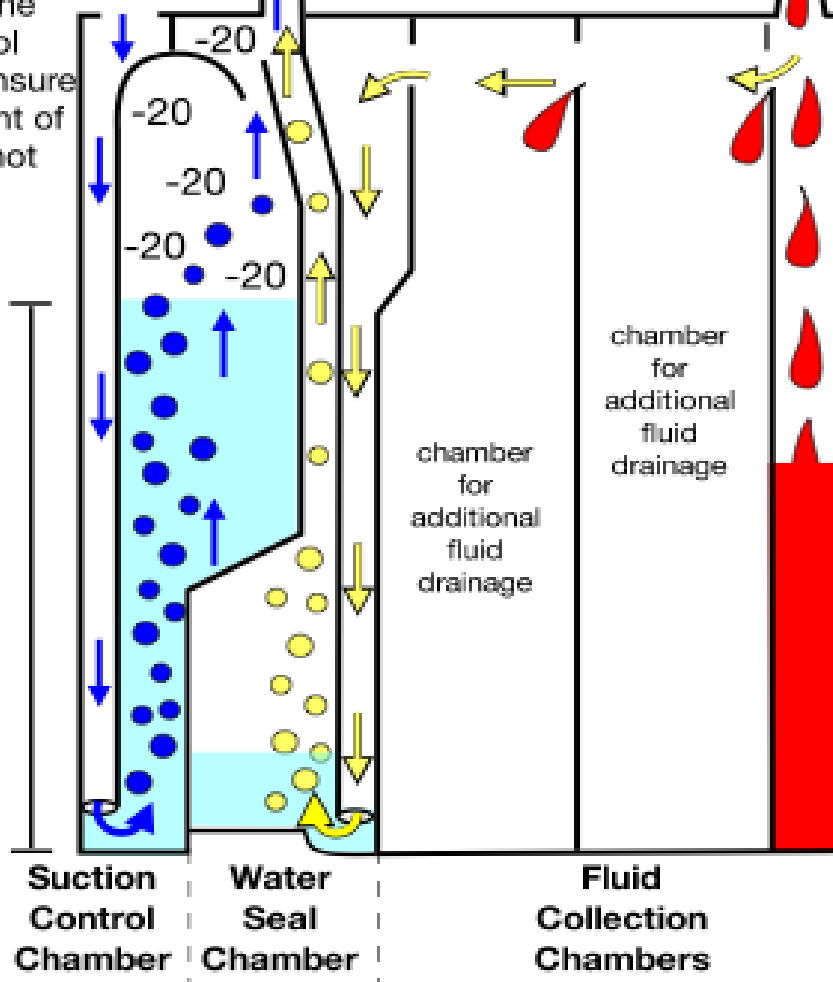
To help remove air from the pleural space,
but not to exceed -20 cm suction,
attached to **Wall Suction**:

Filtered room air is drawn into the
Suction Control
Chamber to ensure
that the amount of
suction does not
exceed

20 cm

Chest Drainage Unit

From the
patient



Blood/fluid drained
from the patient's
pleural space:

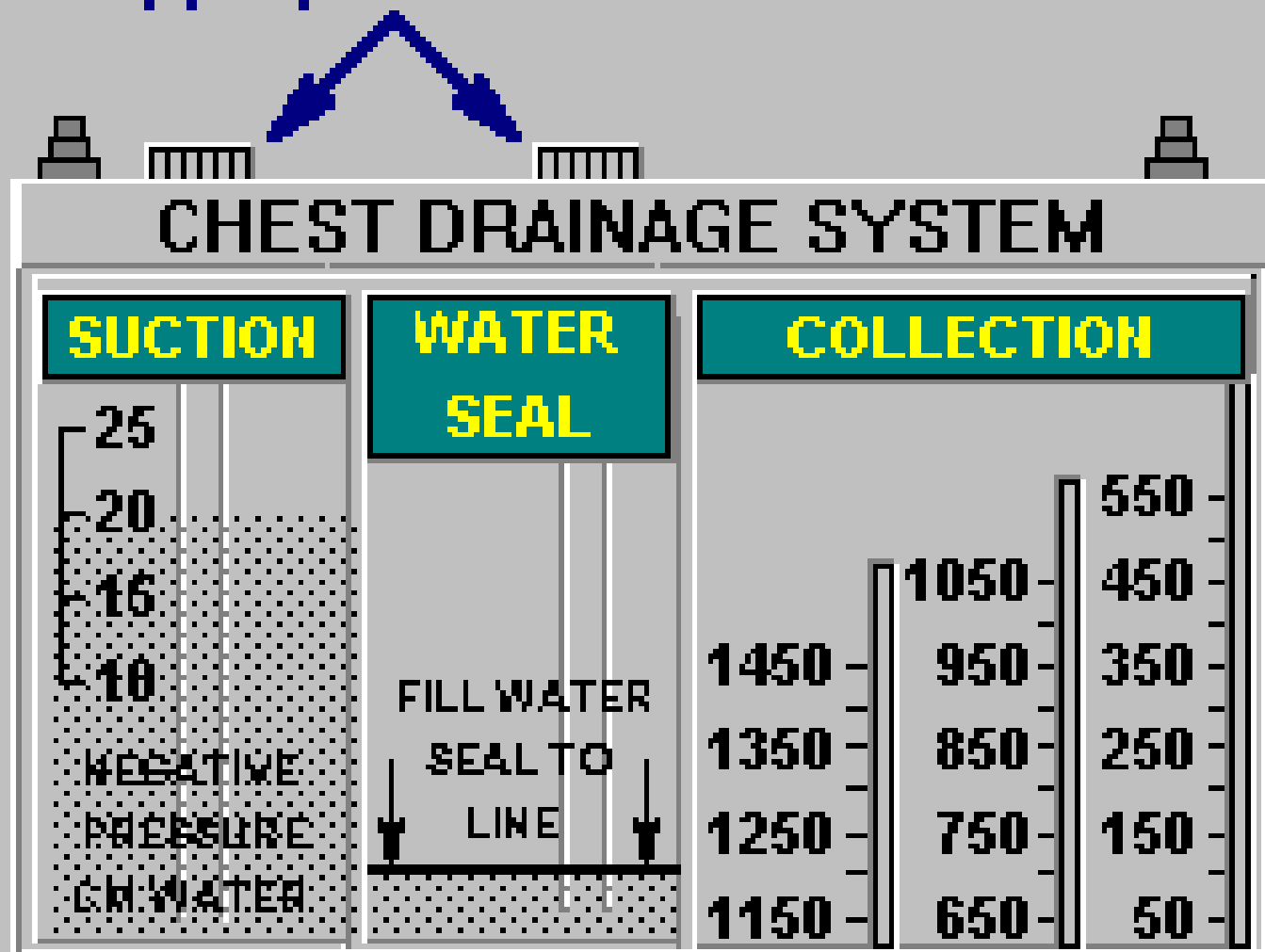
Air evacuated from
the patient's
pleural space:

Air drawn from room
to maintain added
suction at 20 cm

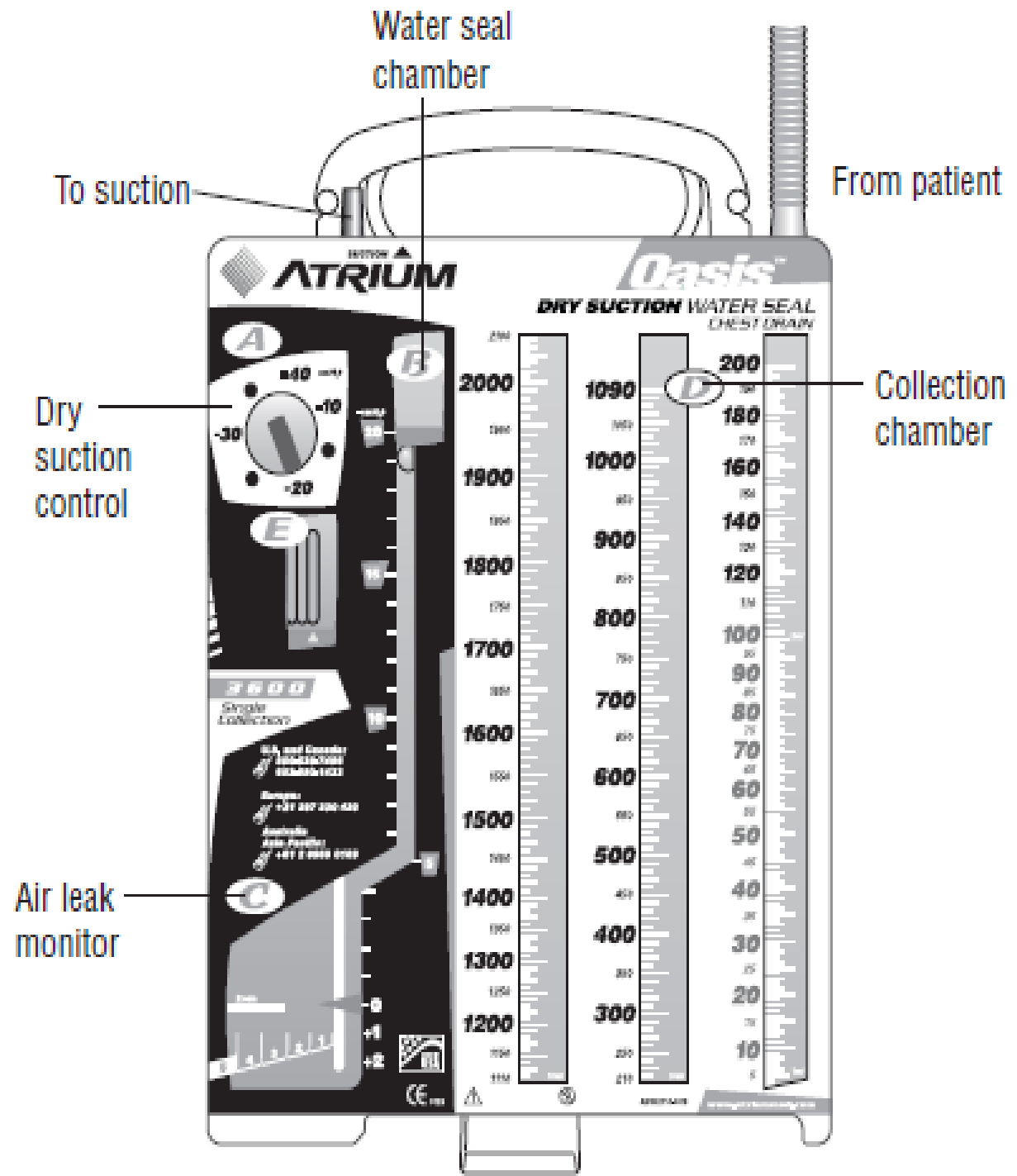
Sterile saline or
Sterile water

**Water seal
wet
suction
control**

Remove caps and fill to
appropriate level

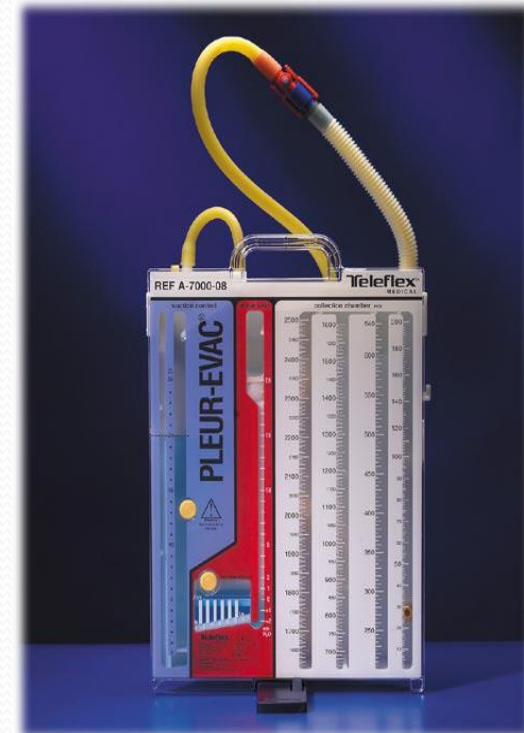


Water seal dry suction control



Dry seal - dry suction control

- An advantage of a mechanical one-way valve is that it does not require water to operate.



Nurse responsibilities:

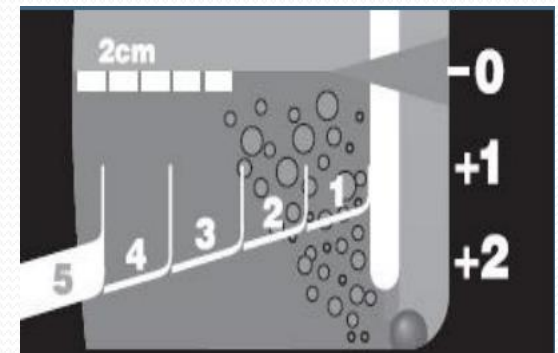
- Assess cardiopulmonary status of the patient and vitals every 2 hrs.
- Verify that all connection tubes are patent.
- Monitor characteristics of drainage fluid in color, amount, & consistency & marked significant increase or decrease in output.
- Keep system below the patient chest level.
- Observe the tube for any kink or clot that leads to obstructions.

Continue.. nurse responsibilities:

- Monitor fluctuations and volume at least q shift
 - 1-Fluctuates with breathing - tidaling
 - 2-water level should be at 2 cm mark
- Assess patient for pain.
- Assess actual chest tube insertion site for signs of infection.
- Change dressing every other day or when ordered
- Assess suction control system for air bubbling & at level ordered.

Continue.. nurse responsibilities:

- Monitor air leak: Water seal is a window into the pleural space. If air is leaving the chest, bubbling will be seen here
- Bubbling in water seal chamber may be present with pneumothorax
- If worsens (continuous) or occurs in absence of pneumothorax may indicate air leak



Question

- During your assessment, you note new bubbling in the water seal chamber. Describe what you would do to determine where this air leak is from.

Answer

- Clamp the chest tube momentarily, beginning at the patient. Look at the chamber to see whether the bubbling has stopped.
- If you clamp and the bubbling goes away, the leak is coming from the chest. **Action**: reinforce dressing with Jelonet, inform physician.
- If you clamp at the chest and the bubbling persists, the leak is between the clamp and the water seal chamber.

Action: change tubing

Clamping Chest Tubes

You will only clamp for the following reasons:

- Prior to removing chest tube to determine if patient can do without chest tube(s).
- Assessing for air leak (clamp only briefly)
- Changing the chest drainage unit (clamp only briefly)
- Performing physician-ordered procedure.
- Some instances when sudden large volumes of fluid are evacuated. **Warning:** Leaving chest tube clamped caused a tension pneumothorax and mediastinal shift.

Specimen Collection

- At time of chest tube insertion, collect drainage in sterile container
- If specimen required later:
 - cleanse with alcohol/chlorhexidine swab, let dry
 - crimp tubing below the port
 - use 20 gauge needle, withdraw drainage from port and transfer to sterile container
 - or kink tubing, cleanse, aspirate fluid with 20 gauge needle, the silicone tubing will reseal itself
- Gloves should be worn when collecting specimen

Activity and transport:

- Patient should be able to move comfortably in their room.
- If air leak detected & depending on the size of air leak, your
- patient may be required to be connected to suction at all times.
(obtain a portable suction)
- If no air leak, patients are able to leave their rooms and ambulate, without suction, provided a doctors order is received
- You will require a support for the chest drainage unit. DO NOT CLAMP the chest drainage system, as air needs to escape.
- • Ensure Atrium is below level of chest
- • If unsure of suction requirements with mobility, contact Physician

What to do if the Chest Tube Mistakenly Falls out???

- Cover site with dry sterile dressing
- Call physician
- If there is air leaking from site or the patient becomes distressed, leave one side of dressing open to allow air to escape and prevent tension pneumothorax
- Wear PPE

What to do if the chest tube becomes disconnected?

- Clamp tube
- Using PPE (gloves)
- Cleanse connector with Chlorhexidine 2%/70%
- Alcohol solution
- Reattach tube to system
- Unclamp tube
- Notify MD

ACUTE Complications:

- Hemothorax, usually from laceration of intercostals vessel (may require thoracotomy)
- Lung laceration (placed too deep).
- Diaphragm / Abdominal cavity penetration (placed too low)
- Tube placed subcutaneously (not in thoracic cavity)
- Tube placed too far (pain)
- Tube falls out (not secured)

LATE COMPLICATIONS:

- Blocked tube (clot).
- Empyema (collection of pus within a naturally existing anatomical cavity, such as the lung pleura)>> infection.
- Pneumothorax after removal (poor technique)

Contraindications:

- Coagulopathy.
- Diaphragmatic hernia.
- Scarring of pleural space (adhesion)

Indications of chest tube removal:

1. One day after cessation of air leak.
2. Drainage less than 50-100ml of fluid per day.
3. 1-3 days post cardiac surgery.
4. 2-6 days post thoracic surgery.
5. Hemoserus drainage from around the chest tube insertion site