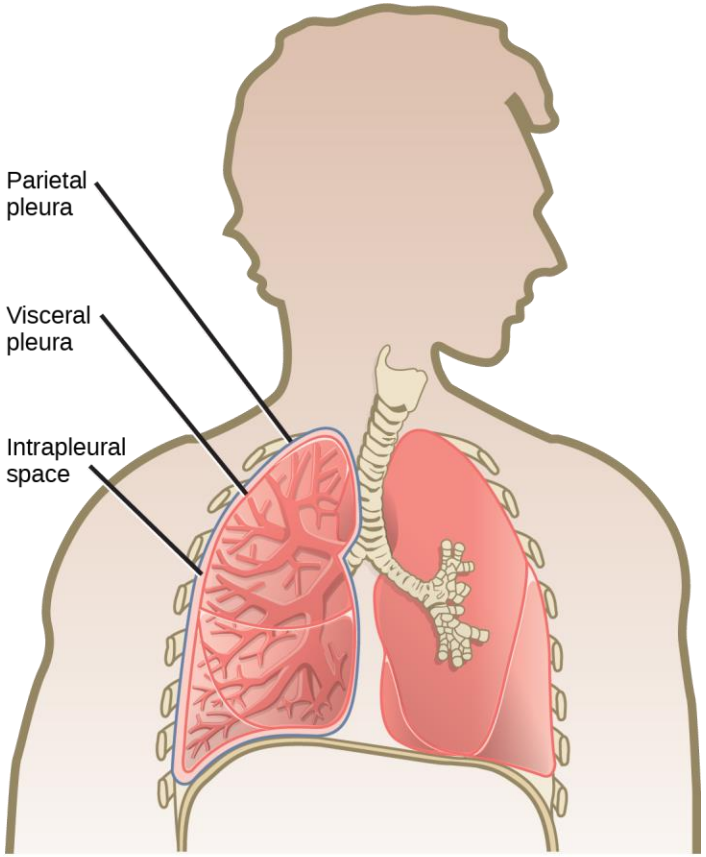
Chest Tube Drainage: Glass Bottles

November 17, 2021

When Normal Respiration Goes Wrong

- The lungs are surrounded by a pleural space composed of
  - Parietal pleura-lines the chest wall
  - Visceral pleura-lines the lungs
  - Lubrication-provided by 10-20 mL of pleural fluid
- The negative pressure created by the diaphragm is what allows inspiration
- Expiration is accomplished though natural recoil of the chest wall passively
- When air or excess fluid is introduced into the pleural space, the lungs' re-inflation (inspiration) is disrupted, negative pressure is lost and the mediastinal structures can shift to the opposite side of the thorax



Source: Merkle A & Candass R. Care of a chest tube. *StatPearls:* Treasure Island (FL) Available at: https://www.ncbi.nlm.nih.gov/pubmed/32310548 Accessed 11.17.2021

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Chest Tube Drainage Systems: The Basics

- The primary purpose of a chest tube drainage system is to drain the pleural space of air, blood, pus or lymph thereby restoring normal respiration
- There are three separate chambers to a chest tube system that each perform a specific function
  1. Collect the fluid and/or air drained from the chest
  2. Prevent air from entering the chest
  3. Control the level of suction being used to facilitate re-expansion of the lungs

Source: Frazer C. Managing chest tubes. Academy of Medical-Surgical Nurses; 21(12); 2021 Available at https://search.ebscohost.com/login.aspx?direct=true&db=rzh&AN=104531252&site=eds-live Accessed 11.17.2021

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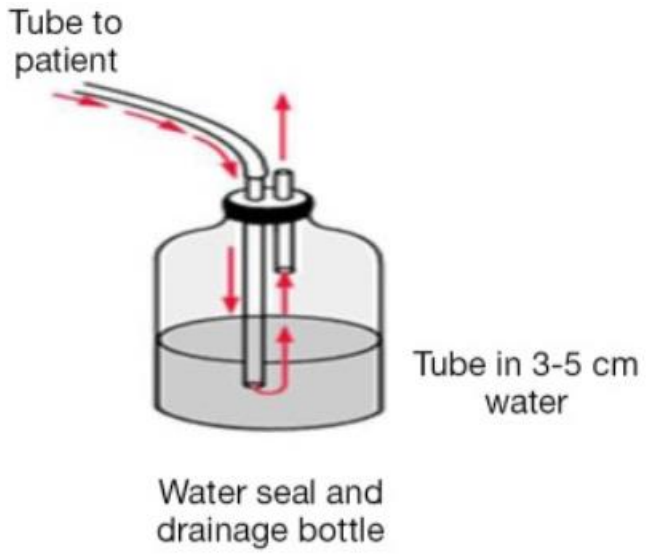
One Bottle Chest Drainage System

- Collects and holds fluid from the chest and allows removal of air
- Serves as water seal so air does not enter the chest
- Straw submerged 2 cm below the surface of water (saline solution) which is connected to the chest tube
- A second tube serves as a one-way valve (decompression vent) to remove excess air that is displaced by fluid or air from the chest
- This system is preferentially used only for removing air because as drainage is removed from the patient, the level of the water seal is increased, thus decreasing the ability of the lung to overcome the pressure of the excess fluid



Source: Zisis C, Tsirgogiani K, Lazaridis G et.al. Chest drainage systems in use. *Annals of Translational Medicine. 3(3):*2015 Available at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4356865/ Accessed 11.16.2021

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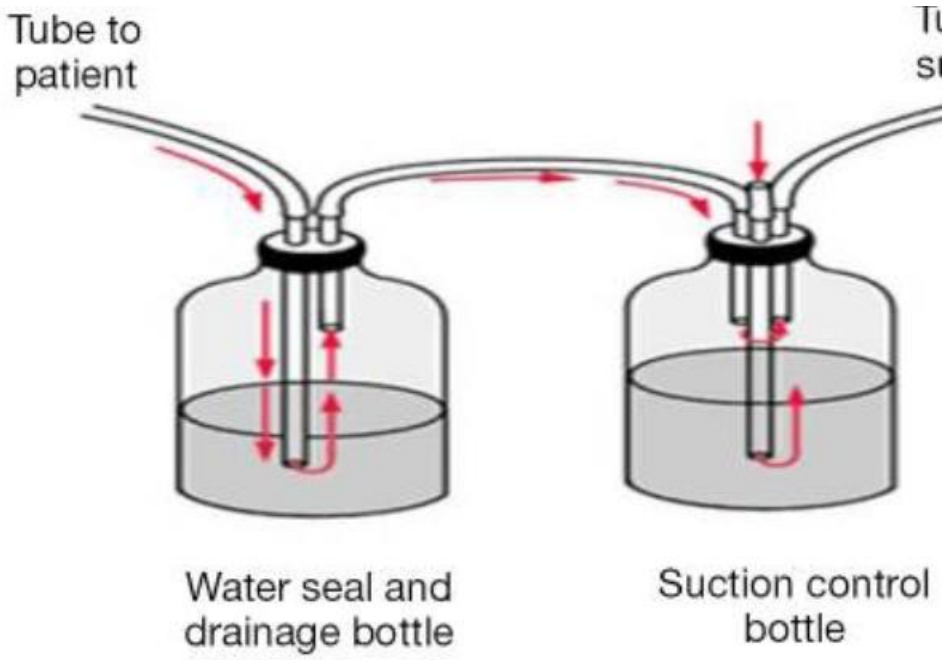
Two Bottle Chest Drainage System

- The bottle to the patient allows for removal of air and fluid with a tube inserted well into the bottle
- The second bottle serves as the water seal with a tube connecting to the first bottle and a water seal tube which is at 2 cm
- A third tube is a one-way valve serving as the decompression vent
- This can also be connected to a third bottle
- These systems are gravity dependent and must be maintained below the level of the chest
- Preferred for removal of larger amounts of fluid from the pleural space as it allows for fluid drainage without impacting the water seal
- If this system is not sufficient, a third bottle can be added to offer suction control



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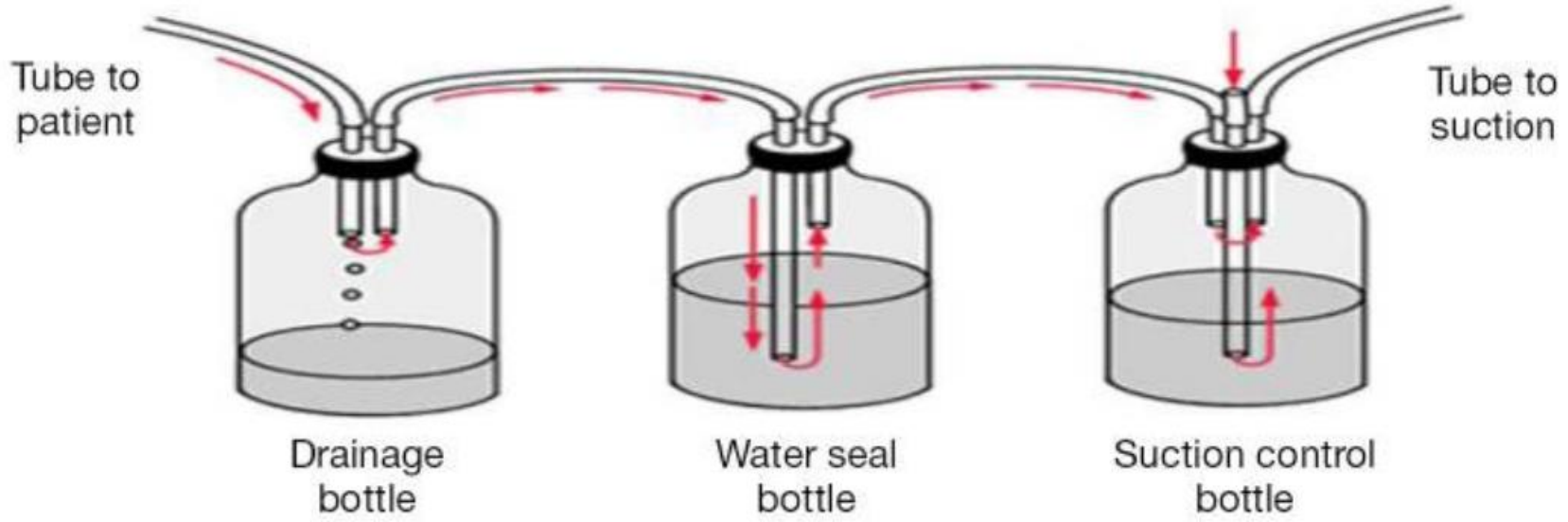
Three Bottle Chest Drainage System

- Can be used if gravity drainage is not sufficient
- The first bottle serves to collect air and drainage
- The second is the water seal which continues at 2 cm
- The third bottle is the suction control bottle which allows controlled application of suction
- The suction control bottle has a ridged straw which is submerged to control the suction typically set at 20 cm of water
- A third tube is connected to the suction on the wall



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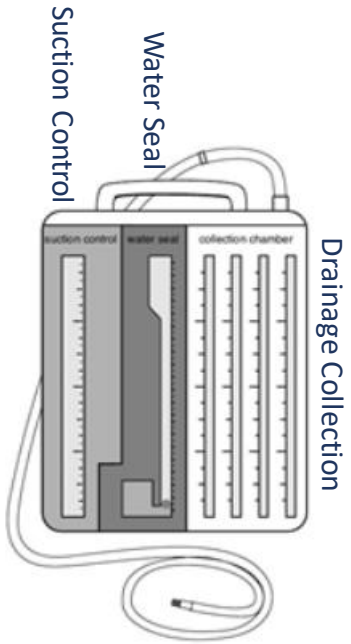
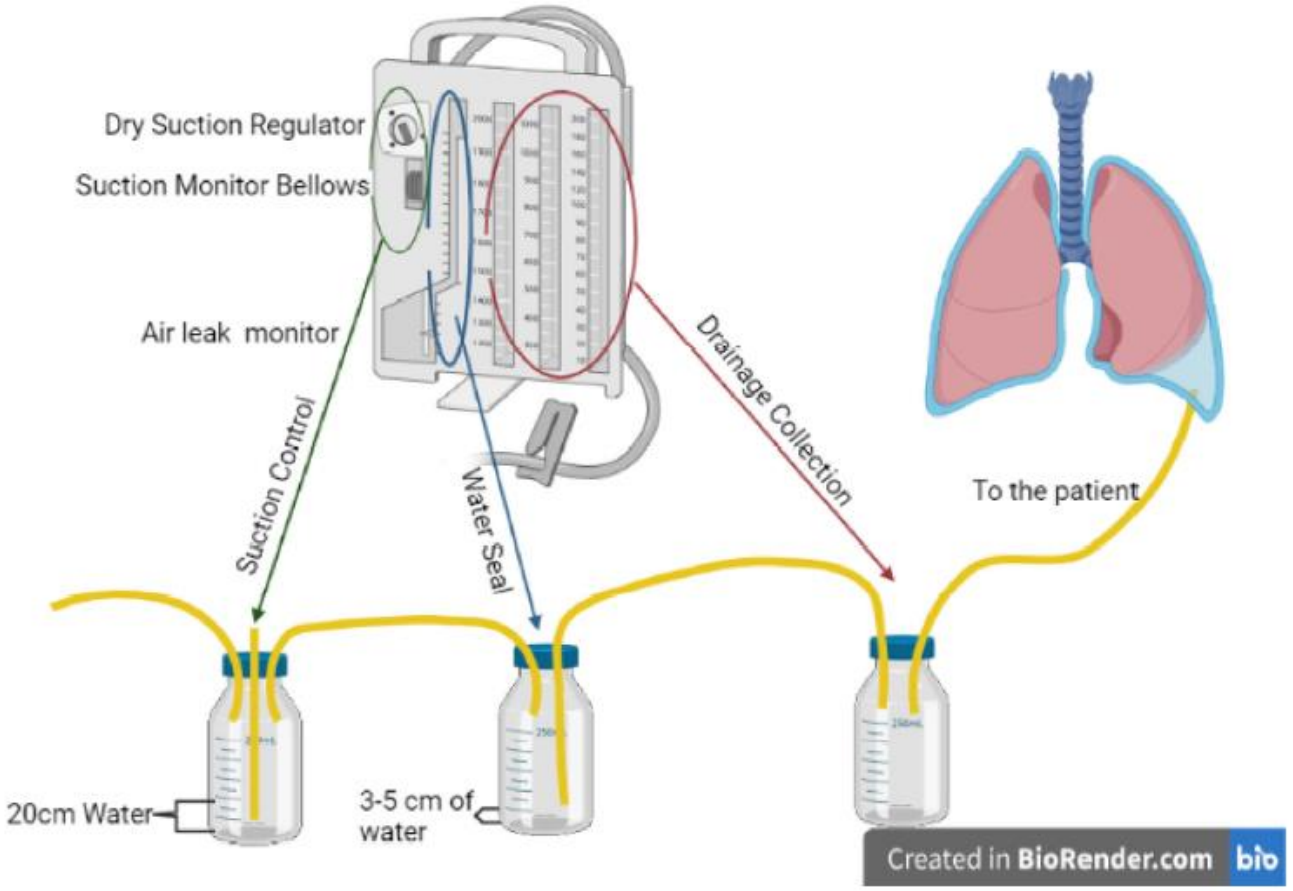
How Current Collection Systems Relate to Bottle Collection

Wet Suction Chest Drainage



Dry Suction Chest Drainage



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Dry Suction Chest Drainage Image: Adapted from "Chest tube drainage system", by BioRender.com (2021). Retrieved from https://app.biorender.com/biorender-templates Created 11.17.2021.

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Basic Care of Chest Tubes

The activity below should be done per individual hospital protocol

- Assess the patient's respiratory status (lung sounds, pulse oximetry, respiratory rate and respiratory effort)
- Monitor chest tube insertion (dressing, drainage and subcutaneous emphysema)
- Observe chest tubing(confirm tube connections and ensure tubing is free from obstructions and dependent loops)
- Check the amount and character of drainage
- Collection system check to ensure the following:
  - The system is secured in upright position
  - Presence or absence of air leak
  - Presence or absence of tidaling
  - Water level at appropriate level for water seal (typically submerged 2cm)
  - Suction level as ordered by physician (typically 20cm)
  - Apply continuous suction as ordered by the physician

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