Stepwise assessment of Chest Tube Function

**TUBE POSITIONING**

Look at the CXR: is the chest tube correctly positioned to drain air/fluid? Are **all six** of the side holes within the chest cavity? Has it moved since a prior CXR?
- If a chest tube is mal-positioned it may need to be removed/replaced.

**CHEST TUBE OUTPUT**

How much fluid output has there been in the last 24 hours? Check the **DRAINAGE** area of the chest drain.
- Generally, it is reasonable to remove a chest tube if the output is <200 ml/day.
- If a tube stops draining, **fibrinolytics can be used** to clear obstructions.

**TIDALING (RESPIRATORY VARIATION)**

Tidalindicates that the chest drain is within the pleura and transducing the pleural pressures. Look for **movement of the indicator ball** in the chest drain. Also look for **cyclic movement of fluid** in dependent loops of tubing.
- You can temporarily disconnect suction (bend the suction tubing to occlude it) to make it easier to evaluate tidalind.

**AIR LEAK**

**Air leak** is the presence of bubbles in the **WATER SEAL** chamber indicating that air is present within the chest (or a leak is present in the drainage system). **Intermittent air leak** occurring with the respiratory cycle (typically at end inspiration) indicates an injury to the lung or airways. Have the patient cough to see if air leak occurs with higher pressures. **Continuous air leak** – throughout the respiratory cycle suggests either a large injury to lung or airways or a leak in the tubing.

**SUCTION**

Is the drain connected to suction? How much **suction** is applied? Be cautious about applying suction to large effusions as rapid drainage can precipitate re-expansion pulmonary edema.

**CHEST TUBE SIZING & POSITIONING**

Tubes sized by internal diameter (1 Fr = 0.3 mm). Recommended size varies by indication:
- 14-22 Fr stable pneumothorax
- 24-28 Fr tension pneumothorax
- 28-32 Fr hemothorax/empyema
- Smaller pigtail drains placed by Seldinger technique may have equivalent outcomes.

Ideal direction where tube is placed:
- For air → anterior superiorly
- For fluid → posterior inferior

**WEANING A CHEST TUBE**

- Generally, chest tubes are initially placed on suction. This facilitates air/fluid removal from the thorax.
- Upon resolution of the pneumothorax or drainage of an effusion, suction can be discontinued (this is called “**being on water seal**”).
- **Clamping** a chest tube simulates removal. Though **usually unnecessary**, this is done prior to removal to ensure a pneumothorax does not recur. This can be useful if considering removing a chest tube while on positive pressure ventilation.

**Underwater chest drain system** combines **DRAINAGE**, a one-way valve (**WATER SEAL**), and allows a precise amount of negative pressure to be applied (**PRESSURE REGULATOR**). Modern systems provide the same functions.

The old **three bottle system** illustrates the functionality:

- **DRAINAGE** Collects and quantifies fluid draining from the thorax.
- **WATER SEAL** Allows air to escape from the thorax if the pressure rises above +2 cmH2O. Bubbles indicate the presence of air leak.
- **PRESSURE REGULATOR** Determines how much suction is applied.

A modern chest drain looks different but has the same functions:

- Accordion indicates if suction is applied. When deflated (not visible) no suction is connected.
- Indicator Ball moves up and down transducing the intra-thoracic pressure.
- Column markings quantify the degree of air leak: scored 1-7.