

### RURAL CRITICAL CARE — SELDINGER TECHNIQUE CHEST DRAINAGE

Participants will learn how to place chest tubes using Seldinger technique. There will be opportunity to practice this technique.

1.To list the indications for closed chest drainage 2.To recognize when Seldinger technique is appropriate 3.To demonstrate the technique in a model 4.To gain better interpretation of the use of 'underwater' drainage systems

# CHEST TUBES

Rural Critical Care Module

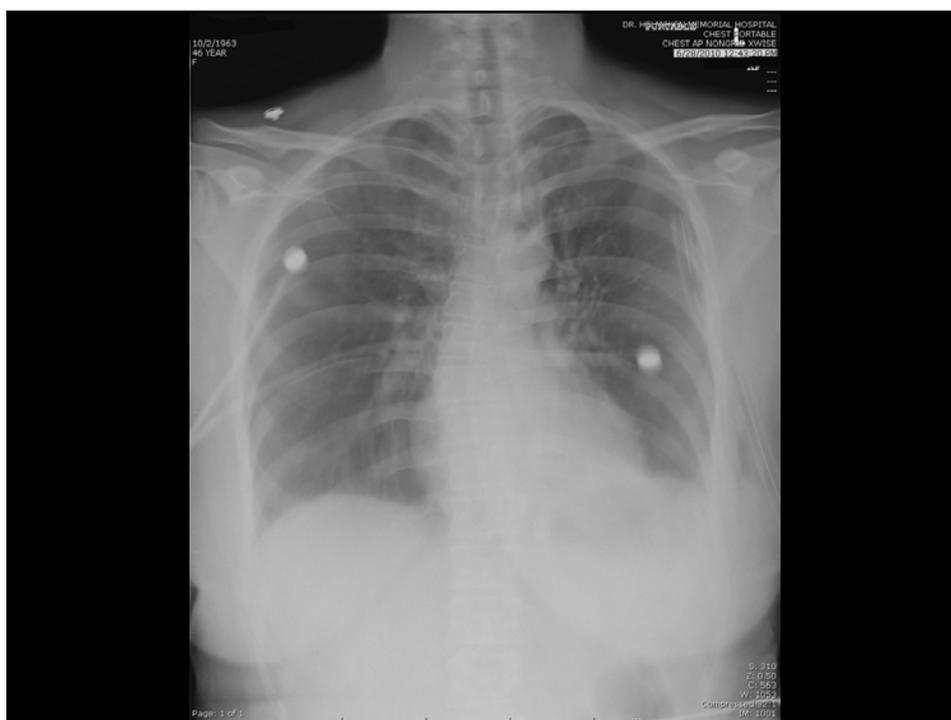
Rural and Remote,  
St. Johns 2018

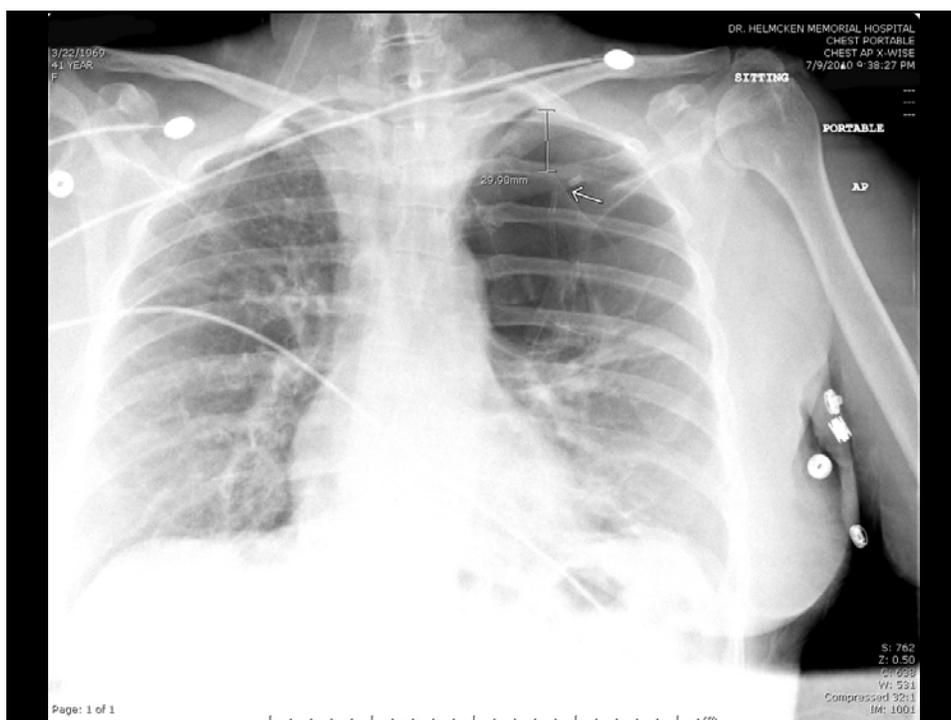
Dr. Sarah Mathieson  
Dr. John Soles

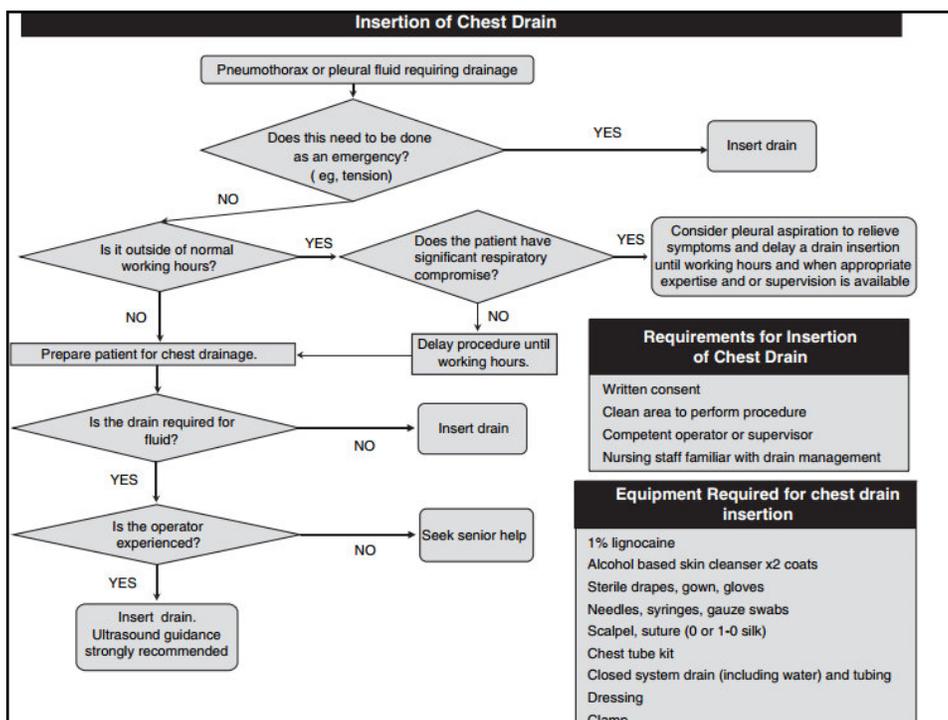
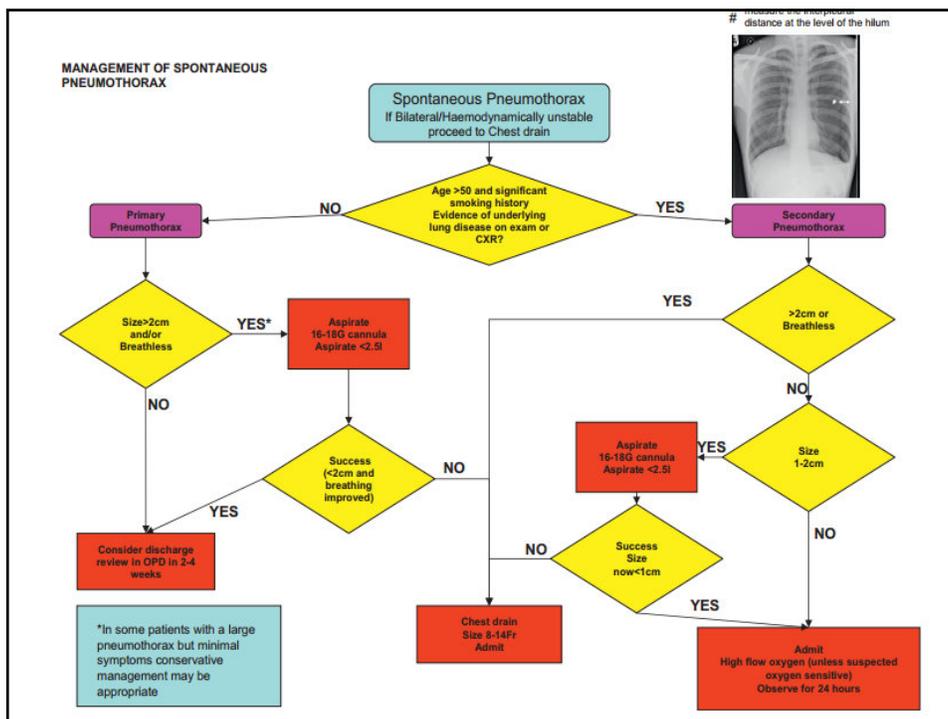
## Objectives

- ▣ -Indications for closed chest drainage
- ▣ -Contraindications
- ▣ Why Seldinger technique and small tubes
- ▣ Hands on practice
- ▣ How do “underwater” drainage systems work









## Indications for Chest Tube

- ▣ Pneumothorax
  - Any ventilated patient
  - Tension pneumo after initial needle relief
  - Persistent/recurrent pneumo after simple aspiration
  - Large secondary spontaneous pneumo > 50 yo
- ▣ Hemothorax
  - Chest trauma (blunt or penetrating)
  - Postop (thoracic / upper abdo)
- ▣ Pleural effusion
  - Sterile, infected (empyema/parapneumonic), malignant, chylothorax, other
- ▣ Pleurodesis

## Contraindications

- ▣ Relative
  - Anticoagulation / Coagulopathy / Bleeding diathesis
  - Transudative pleural effusions from liver failure
- ▣ Cautions
  - Blind insertion risky in pt with pleural adhesions (infection, pleurodesis, surgery) -> CT or U/S guidance

## Tube Selection

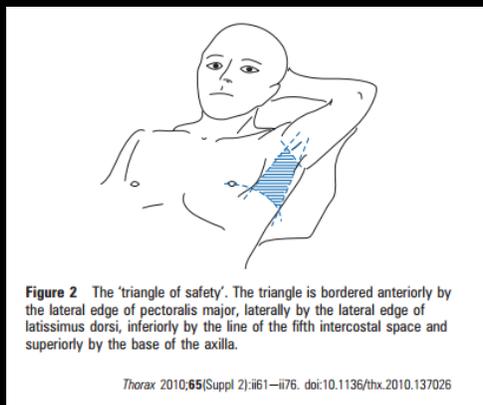
- ▣ French/3 = diameter in mm
- ▣ Spontaneous or iatrogenic pneumo = needle aspiration OR small bore (8-14 Fr)
- ▣ Large risk of air leak (i.e. mech vent) = larger bore (20-28 Fr)
- ▣ Hemothorax = 32 Fr or larger

## Technique Selection

- ▣ Large pneumothorax (> 2 cm rim at level of hilum) = Needle aspiration (NA) OR Seldinger technique without imaging
  - Safe entry into chest
  - As effective as larger chest drains with less pain
  - No RCTs comparing NA and Seldinger technique, but 30% NA fail and require further intervention
- ▣ Loculated collection = U/S or CT during placement

## Landmarks

- 4<sup>th</sup>-5<sup>th</sup> intercostal space, anterior axillary or mid-axillary line -- “triangle of safety”
  - Males = nipple line
  - Females = inframammary crease
- Pneumothorax -> direct tube apically and anteriorly
- Hemothorax -> inferiorly and posteriorly



## Seldinger Technique

- ▣ Chest tube placed over a guidewire
- ▣ Advantages
  - Simple, less pain
  - Fewer complications
  - Useful for placement of small tubes that drain air and nonviscous fluids
  - Can be done without imaging if lung significantly displaced from chest wall at entry site
- ▣ Disadvantages
  - Unable to assess for adhesions (bleeding risk, can pass into lung parenchyma)

## Steps

- ▣ Supine, arm abducted, elbow flexed
- ▣ Full barrier precautions, prep skin
- ▣ Consider IV midazolam or morphine
- ▣ Anesthetize 2-3 cm area of skin and subcutaneous tissue 1 intercostal space below space that tube will go (tunnel)
- ▣ Anesthetize periosteum of ribs and intercostal space
- ▣ Avoid lower rib margin (neurovasc bundle)

## Steps

- ▣ Insert introducer needle into pleural space (aspirate to confirm)
- ▣ Insert guidewire through introducer needle (no resistance, direct appropriately)
- ▣ Small skin incision parallel to intercostal space
- ▣ Pass dilators sequentially over guidewire (1 cm beyond pleura)
- ▣ Pass chest tube/dilator combination into pleural space
- ▣ Remove dilator and guidewire
- ▣ Suture into place, dress, connect drainage
- ▣ Repeat CXR to assess position and expansion

## Suction

- ▣ Suction not routine
- ▣ 2 drainage systems
  - Underwater -> easy to convert to suction
  - Unidirectional valve (Heimlich) -> more mobile
- ▣ No re-expansion
  - Suction at -10 to -20 cm H<sub>2</sub>O

## Complications

- ▣ Tube malposition or blockage
- ▣ Infection
- ▣ Organ injury
- ▣ Re-expansion pulmonary edema (up to 14%)
  - Most likely with young patient, rapid re-expansion of large pneumo
  - Minimize by: clamp if coughing, CP, SOB, O2 desat, limit fluid drainage to 1-1.5 litres initially

## Complications

**Table 2** Frequency of post-insertion complications for small drains ( $\leq 16$  F)

Complication	Total no.*	Calculated frequency	Range	Studies
Injury	582	0.2%	0–2%	44–51
Malposition	593	0.6%	0–9%	45–52
Empyema	395	0.2%	0–2%	45, 48–51
Drain blockage	341	8.1%	2–18%	45, 48–52

\*Total number of procedures performed from the studies found that quote this complication.

*Thorax* 2010;**65**(Suppl 2):ii61–ii76. doi:10.1136/thx.2010.137026

**Table 3** Frequency of post-insertion complications for large-bore drains ( $\geq 20$  F or stated 'large-bore drain')

Complication	Total no.*	Calculated frequency	Range	Studies
Injury	1572	1.4%	0–7.9%	44, 52–60
Malposition	1778	6.5%	1.1–31%	53–61
Empyema	1778	1.4%	0–2%	53–61
Drain blockage	115	5.2%	5.2%	52

\*Total number of procedures performed from the studies found that quote this complication.

## Removing Tubes

- ▣ Lung fully re-expanded
- ▣ Pneumo = no air leak, no accumulation off suction or when clamped
- ▣ Effusion = fluid less than 100-300 mL/ day

## Other Information

- ▣ Smoking cessation counselling is of utmost importance
- ▣ Patients can resume normal activity post pneumothorax (not associated with exercise/exertion)
- ▣ No diving
- ▣ No air travel until at least 1 week post full resolution (confirmed by imaging)

## References

- ▣ UptoDate “Placement and management of thoracostomy tubes”
- ▣ British Thoracic Society Pleural Disease Guideline 2010 “Management of spontaneous pneumothorax”
- ▣ [British thoracic society guidelines](#)
- ▣ [quick-reference-guide/](#)

- ▣ <https://www.youtube.com/watch?v=xsEanWSK8kE>

