Thoracostomy Procedure
Fuhrman Pleural/Pericardial Drainage Set®

Hospital for Sick Children
Acute Care Transport Services
Aims / Objectives

1. Cover theory of pigtail chest drain procedure

2. Review X-ray examples

3. Practical demonstration needle thoracocentesis and pigtail chest drain insertion

4. Practice needle thoracocentesis and pigtail chest drain insertion
Treatment Pneumothorax

• Tension pneumothorax with decompensation (respiratory and/or cardiovascular):
  – Needle thoracocentesis
    • Keep aspirating intermittently whilst setting up for chest drain
  – Chest drain
    • May be useful to let some air build up just before insertion

• Moderate – large pneumothorax with minimal decompensation:
  – Needle Thoracentesis +/- Chest drain

• Small – moderate pneumothorax with baby on minimal respiratory support:
  – May not require treatment – for discussion

• Pneumomediastinum alone does not normally require drainage
Pigtail Chest Drain

Rationale
To offer a less traumatic & more precise method of chest tube insertion

Indications
Evacuation of pneumothorax or pleural effusion recognized on chest radiography and by clinical examination

Potential Risks
Organ/ vessel perforation, deformity of breast tissue, suboptimal evacuation of air/ fluid, subcutaneous emphysema, infection
Breast Deformity due to Neonatal Chest Drain
Supplies

1. Sterile procedure:
   - Sterile gown, hat, mask & gloves

2. Equipment:
   - Sterile surgical drapes
   - Antiseptic skin preparation (chlorhexidine swabs)
   - Sterile gauze, steri-strips®
   - 3 ml syringe
   - 1ml syringe + needle for drawing up local, 25G needle for local administration
   - Local anaesthetic: 1% lidocaine (without epinephrine) (10mg/ml)
   - Fuhrman Pleural / Pericardial Drainage Set® 8.5 Fr

3. Dressing:
   - Tegaderm® x’ 2 (for ‘bridge’), sterile gauze, 1 large Tegaderm®

4. Collection system:
   - Chest tube drainage / collection set OR
   - One-way flutter valve (transport)
   - Position / hold baby + second scrubbed person to assist with stabilization of guide wire
Patient Preparation

1. Determine the location of the air / fluid collection by:
   - Physical exam
   - CXR

2. Complete ‘ Safe Procedural Checklist ’

3. Patient Preparation:
   - Provide a neutral thermal environment
   - Provide adequate ventilation
   - Monitor vital signs: HR, oxygen saturation
   - Position infant with arm of affected side extended above head and:
     - Affected side up ~ 60° for evacuation of air
     - Flat on back for drainage of fluid

4. Provide analgesia with (depends upon ventilation status):
   - Fentanyl 1-2 mcg / kg IV slow push
     or
   - Morphine 0.05-0.1 mg / kg IV push
Before proceeding verify:
- Patient’s Isolation Status
- Risk for bleeding assessed

1. BRIEFING/ TIMEOUT

**COMPLETE IMMEDIATELY PRIOR TO START OF PROCEDURE**

**PRIMARY CHECKLIST**
- 2 patient identifiers match name band (engage patient/family when appropriate)
- Parent/guardian informed / consent as appropriate
- Procedure verified
- Site marked
- Side confirmed
- Allergies
- Meds reviewed

**AREA SPECIFIC CHECKLIST**
- Anticoagulant Therapy (LMWH, Enox, therapeutic heparin)
- Diagnostic Imaging/Lab data/Reports reviewed
- Platelets <75
- Pain/Sedation plan
- Procedure specific emergency equipment/supplies/people
- HCT member role assignment (including room coverage)
- Special Considerations (IVH, VAP, Osteopenia, anatomical)

**QUESTIONS OR CONCERNS?**
- Environmental prep (screens, signage, families)

2. DEBRIEFING

**COMPLETE IMMEDIATELY AFTER PROCEDURE**

**PRIMARY CHECKLIST**
- ALL: Identify key concerns for recovery and management
- Communication with patient, parent/ guardian and team
- Verify requisitions (correct patient & test)
- Label specimens
- Intra-procedural issues
- Post-procedural orders
- Are discrepancies rectified?

**AREA SPECIFIC CHECKLIST**
- Documentation by appropriate HCT members
- Effective pain/sedation management
- Nurse/patient assignment reviewed
- Document Time Out

**ANYTHING DIFFERENT NEXT TIME?**

June 2016
Preparation of Supplies

• For **babies >1 kg**, measure 4 cm* from curled portion on the Fuhrman® catheter
  (last hole distal to insertion tip)

• For **babies ≤1 kg**, measure 2 cm* from curled portion on the Fuhrman® catheter

• Place steri-strip® to mark the location

* = rule of thumb – adjust as indicated
Landmarking

4th intercostal space – insertion site above rib
Insertion Site Preparation

- Drape surgical area, leaving a small opening at site for insertion
  - LEAVE HEAD AND NECK REGION VISIBLE

- Cleanse lateral chest wall with antiseptic *

- At incision site, infiltrate skin with 1% lidocaine
  - Do not use more than 0.45 ml / kg total dose (do not repeat within 2 hrs)
Needle Insertion

- Attach 3mL syringe+/- sterile water to needle in kit
- Landmark: 4th intercostal space in mid-axillary line
- Position needle over TOP of rib (to avoid intercostal artery and vein which lie at inferior margin of rib above)
- Enter chest perpendicularly
- Direct needle in direction of desired catheter placement:
  - Anterior/superior for evacuation air
  - Posterior/inferior for evacuation of fluid
- Gently advance needle while aspirating syringe until air/ fluid aspirates easily

DEPTH OF NEEDLE INSERTION SHOULD BE NO MORE THAN 2 cm (some exceptions)
Introduction of Guide Wire

- Insert guide wire into needle and gently advance it into pleural cavity

NOTE:
GUIDE WIRE SHOULD ADVANCE WITHOUT RESISTANCE

- Advance guide wire until silver mark on guide wire reaches pink hub of the needle
Removal of Needle

- Prior to removal of needle, stabilize guide wire to minimize displacement from pleural space.

NOTE:
A SECOND PERSON SHOULD BE SCRUBBED IN TO ASSIST WITH STABILIZATION OF THE GUIDE WIRE AS NEEDLE IS BEING REMOVED.

- Remove needle, leaving guide wire in place.

- Ensure that guide wire is stabilized at chest wall at all times, especially when needle is at point of clearing the skin.
Dilatation of Entry Site

- Thread the dilator over the guide wire to level of skin and soft tissue
- Holding dilator near the chest wall, gently push while twisting the dilator to dilate the skin, muscles and pleura
- Remove dilator, leaving guide wire in place
- Ensure that the guide wire is stabilized at chest wall at all times, especially when dilator is at the point of clearing the skin
Insertion of Chest Tube

- Thread chest tube over guide wire and advance chest tube to steri-strip marking

- Try to aim pigtail *anteriorly* for pneumothorax by placing holes of pigtail *upwards*

- Try to aim pigtail *posteriorly* for pleural effusion by placing holes *downwards*
Removal of Guide Wire and Tubing Connections

- Remove guide wire while securing pigtails at skin so as not to displace
- Attach multipurpose adapter to the chest tube
- Secure with dressing
- Connect to chest drainage system
  OR
  one way flutter valve and observe for bubbling of water with drainage system, or flutter of valve in chest drain valve
Post-insertion Care

• Verify correct positioning of chest tube:
  - AP and lateral CXRs

• Document procedure (date, time, size, site, by who, any complications)

• Monitor infant’s pain control and vitals as per unit protocol
Case 1: Post-insertion Xray
Case 2: CXR
– What does it show?

Pneumomediastinum

Who would drain this?
Case 2 –
The XR we hope never to see...
What does it show?

R tension pneumothorax

What would you do now?
Case 2 – CXR post drain insertion

What does it show?

Near resolution of pneumothorax and pneumomediastinum. Drain not in good position.

What would you do if there was deterioration / reaccumulation of air?
Case 3: CXR – What does it show?

- Pneumomediastinum
- Left pneumothorax
- Thymus
Case 4: CXR – What does it show?

Pleural effusion
Case 4: Post-chest tube insertion

Migrated PICC
Case 5: CXR – What does this show?

Pneumopericardium + pneumothorax with chest drains
Case 6: CXR – What does it show?

Large R pneumothorax with mediastinal shift

Note despite under tension, lung not well collapsed as is stiff from underlying RDS
Case 7: CXR – What does it show?

- Migrated PICC
- Pleural effusion
Case 8: CXR – What does it show?

Bilateral pneumothoraces – under tension. Note flattened diaphragms and small heart.
Question....

What would you do if a chest drain you have just inserted is draining frank blood?
Needle Thoracentesis

**Indications:**
- tension pneumothorax
- decompensating scenario (low saturations, hypotension, bradycardia)

**Equipment:**
- 18 – 20 gauge percutaneous catheter-over-the needle device (preterm/term neonate, infant, child) source: NRP 2017 & PALS 2015 (options are BD non-safety angiocath® or introcan device®)
- For extreme preterm population consider using # 23 or # 25 butterfly surshield long extension tubing device® (consider/assess chest wall thickness)
- 3 way stopcock, 20 -60 mL syringe
- large bore extension tubing
- chlorohexadine swab, collection bottle, H2O

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Needle Thoracentesis

Thoracentesis Device:

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Needle Thoracentesis Procedure:

- Patient position supine; may use roll to elevate affected side
- Identify suspected/confirmed site of tension pneumothorax (left vs. right thorax)
- Ensure audible VSS monitoring
- Landmark:
  - second intercostal space; mid-clavicular line
- Cleanse site
- $90^\circ$ angle to entry site; over top of rib, direct catheter upward for air leak(s)
- Once in pleural space; remove needle of cannula, attach 3 way stop-cock or extension tubing /then stop cock (*dexterity of attaching stop cock directly to cannula hub)
- May use butterfly if IV cannula not available

23 gauge butterfly

3 way stopcock

IV cannula – add appropriate size extension tubing at catheter hub then attach stop cock (to facilitate ease of use)

underwater seal – optional

Drainage system below chest level

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References


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