HEALTH HOLDING

HAFER ALBATIN HEALTH CLUSTER
MATERNITY AND CHILDREN HOSPITAL

Department:	Pediatric Intensive Care Unit (PICU)		
Document:	Multidisciplinary Policy and Procedure		
Title:	Chest Tube Insertion and Removal in Pediatric Patient		
Applies To:	All Pediatric Intensive Care Unit Staff and X-ray Technicians		
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1. PURPOSE:

1.1 To facilitate evacuation of accumulated air and/or fluid from the pleural cavity (liquid, serous fluid, blood, pus, chyle) either for therapeutic or diagnostic purposes.
1.2 To restore the negative intrathoracic pressure needed for lung re – expansion after surgery or trauma and restoring breathing mechanics.
1.3 To prevent drained air and/or return to the chest cavity.

2. DEFINITIONS:

2.1 **Chest Tube** – is a catheter inserted through the thorax to remove air and fluids from the pleural space and to re-establish normal intra – pleural and intra – pulmonic pressure.
2.2 **Chylothorax**: Collection of lymph fluid in the pleural space
2.3 **Haemothorax**: Collection of blood in the pleural space
2.4 Pneumothorax :Collection of air in the pleural space
2.5 **Tension Pneumothorax**: One-way valve effect allowing air to enter the pleural space, but not to leave. Air builds up forcing a mediastinal shift. This leads to decreased venous return to the heart and lung collapse/compression causing acute life-threatening respiratory and cardiovascular compromise.
2.6 **Pleural effusion**: Exudate or transudate in the pleural space
2.7 **Under Water Seal Drain (UWSD) System**: Drainage system of 3 chambers consisting of a water seal, suction control & drainage collection chamber. UWSD are designed to allow air or fluid to be removed from the pleural cavity, while also preventing backflow of air or fluid into the pleural space

3. POLICY:

3.1. **INDICATIONS:**
- 3.1.1 Pneumothorax (spontaneous, tension, iatrogenic, traumatic)
- 3.1.2 Pleural collection
- 3.1.3 Pus (empyema)
- 3.1.4 Blood (hemothorax)
- 3.1.5 Chyle (chylothorax)
- 3.1.6 Malignant effusions (pleurodesis)

3.2. Postoperative
- 3.2.1 Thoracotomy, post cardiac surgery
- 3.2.2 Video-assisted thoracic surgery (VATS)

3.3 CONTRA-INDICATIONS
- 3.3.1 The need for emergent thoracotomy is an absolute contraindication to tube thoracostomy.
- 3.3.2 Relative contraindications include the following:
  - 3.3.2.1 Coagulopathy
  - 3.3.2.2 Pulmonary bullae
  - 3.3.2.3 Pulmonary, pleural, or thoracic adhesions
  - 3.3.2.4 Loculated pleural effusion or empyema
  - 3.3.2.5 Skin infection over the chest tube insertion site

3.3.4 Indications for chest-tube removal include:
- 3.3.4.1 Improved respiratory status
- 3.3.4.2 Symmetrical rise and fall of the chest
- 3.3.4.3 Bilateral breath sound
- 3.3.4.4 Decreased chest-tube drainage
- 3.3.4.5 Absence of bubbling in the water-seal chamber during expiration
- Resolution of chest X-ray findings

3.4 Insertion of chest tube shall be performed by physician with a written order, and assisted by a competent staff nurse who passed the competency assessment on chest tube management – assisting in insertion.

3.5 Informed consent is necessary for the procedure and has to be obtained prior to the scheduled date of operation and after procedure details has been explained to the patient or responsible person/family by the physician.

3.6 Aseptic technique is maintained at all times.

3.7 Standard precaution is observed.

3.8 Provide patient's safety by adhering to the universal protocol, wrong site, wrong procedure and wrong person surgery. Promote and maintained patient's comfort throughout the procedure.

3.9 Chest tube should be removed upon physician's order. Removal of tube is done by the physician and assisted by a competent staff nurse who passed the skill competency assessment on chest tube management – assisting in removal.

3.10 Strict sterile techniques should be maintained at all times to promote patient's safety.

3.11 Always ensure correct patient's identification (4 names for the Saudi and complete name for the Non – Saudi and Medical Record Number) and correct site.

3.12 If more than one tube is inserted, the appropriate tube to be removed must be identified by the physician according to the chest x – ray.

4. PROCEDURE:

4.1 Verify physician written order for the procedure.

4.2 Identify patient correctly using two identifiers (4 names for the Saudi and complete names for the Non – Saudi and Medical Record Number) via identification band and verify with another staff.

4.3 Staff nurse may act as a witness in securing informed consent for medical, surgical and interventional procedure by the physician after explanation of the procedure has been provided to and understood.

4.3.1 Under certain circumstance where the consenting guardian is not present or in emergency situation, two physicians must sign for the said consent and must be witnessed properly.

4.4 Reinforce explanation to the parents the reason for the procedure. Simple straight forward language is most effective. Psychological preparation of the patient to establish trust, provide support and give explanation in easy to understand terms.

4.5 Inquire for allergy to latex and Iodine. Inform physician if patient is sensitive to these products.

4.6 Assess patient for presence of respiratory distress such as tachypnea, retractions, grunting, flaring, cyanosis and poor perfusion.

4.7 Ensure chest x – ray was done per physician's order for clinical confirmation before the procedure.

4.8 Perform hand hygiene.

4.9 Prepare and organize all the equipment and supplies needed on the trolley and bring it to the patient's bed side.

4.10 Provide privacy throughout the procedure.

4.11 Verify right patient and right location and procedure.

4.12 Administer pre – medication as ordered.

4.13 Position the patient according to physician's preference, usually The patient should be positioned supine or at a 45° angle. (Elevating the patient lessens the risk of diaphragm elevation and consequent misplacement of the chest tube into the abdominal space or avoid diaphragmatic trauma.

4.13.1 The arm of the affected side should be abducted and externally rotated, simulating a position in which the palm of the hand is behind the patient's head.A soft silk tape can be used to secure the arm in this location. Make sure that good blood flow to the hand is present.

4.14 Monitor vital signs closely. Note any change in skin color. Connect to cardio – respiratory monitor and to the oxygen source.
4.15 Put on cap, mask, sterile gown and gloves for both the physician and the nurse.
4.16 Set up the water seal drainage system.
  4.16.1 Fill the water seal chamber with sterile water to the level specified by the manufacturer if using a chest drainage system with a water seal. Do not overfill.
  4.16.2 Fill the suction control with sterile water to the 20cm level or as prescribed when using suction in the drainage system with a wet water seal. The water level determines the degree of suction applied.
4.17 Open sterile equipment and place on sterile surface.
4.18 Adhere to the "time out" procedure.
4.19 Assist the physician on the following procedure:
  4.19.1 Select the site of insertion. The 5th intercostal space in the mid – axillary line is generally used for most situations.
  4.19.2 Assist physician on donning complete personal protective equipment (PPE) – wear mask, cap,sterile gown and sterile gloves.
  4.19.3 Surgically prepare the area
  4.19.4 Check for patient sensitivity to the prepping solution by requesting known allergy information or testing on a small area of skin away from the proposed insertion site.
  4.19.5 Press sponge against skin, and apply chlorhexidine solution using a back-and forth friction scrub for at least 30 seconds.
  4.19.6 Allow antiseptic solution time to dry completely before puncturing the site . Cover the patient by sterile large drape from head to toe, expose the insertion site only.
  4.19.7 Infiltrate the area with 0.5 – 1% Lidocaine. Make a small incision in the skin over rib just below the intercostals space where the tube is inserted.
  4.19.8 Select the appropriate size I.C.C. and remove stylet.
  4.19.9 "Blunt dissect" (using an artery forcep) down to the pleura, enter the pleural space, and then widen the hole by opening the forceps.
  4.19.10 Sweep the pleural space with a gloved finger to widen the hole and push the lung away from the hole (only possible in older children, beware of rib fractures in injured child).
  4.19.11 Hold the tip of the catheter with a curved artery clamp and advance it into the pleural space,directing the catheter posteriorly and superiorly.
  4.19.12 Advance so that all apertures of the tube are in the chest and not visible
  4.19.13 Once the chest tube is inserted, connect to water – seal drainage system.below the patient's chest level Watch for "swinging" of water in tube connection.
4.20 Ensure that all connections are tight and securely taped.
4.21 Apply dry sterile 4 x 4 gauze and adhesive tape over the chest tube site.
4.22 Label the dressing with signature, employee number, date and time after each change.
4.23 Dispose properly the materials and equipment used according to infection control policy and procedure.
4.24 Perform hand hygiene.
4.25 Adhere to the required "time out" documentation.
4.26 Obtain a chest x – ray to confirm tube position and assess lung expansion, and monitor the initial drainage from the tube as ordered by the physician.
4.27 Mark the level of drainage every shift (date and time) from the collection chamber with the tape on the outside of the drainage unit.
  4.27.1 Monitor in the intake and output chart the amount of fluid drain.
  4.27.2 Note the type and character of the drain.
4.28 Monitor vital signs every hour or as per physician order.
  4.28.1 Chest tubes are painful as the parietal pleura are very sensitive. Patients require regular pan relief for comfort, and to allow them to complete physiotherapy or mobilize.
  4.28.2 Conduct pain assessment regularly and document.
4.29 Observe the patient for the following:
  4.29.1 Signs and symptoms of mediastinal shift.
    4.29.1.1 Dyspnea

4.29.1.2 Chest Pain
4.29.1.3 Tracheal Deviation
4.29.1.4 Decrease Blood Pressure
4.29.1.5 Increased Pulse Rate
4.29.1.6 Cool and Mottled Skin
4.29.1.7 Changes in air entry either decreased or absent
4.29.1.8 Bleeding from the site of insertion

4.30 Ensure the drainage tubing does not kink, loop, or interferes with patient movement.
4.31 Encourage the patient to assume comfortable position with patient movement.
4.32 Encourage the patient to assume comfortable position with good body alignment. With the lateral position, make sure that the patient's body does not compress the tubing. Positioning must be performed and provide adequate analgesia as ordered.
4.33 Provide range of motion exercises for the affected arm and shoulder must be provided several times daily.
4.34 Always place chest drain below the patient's chest in an upright position. To help avoid accidental knock – over, place the unit on the floor or hang it beside with the hangers provided.
4.35 Make sure there is fluctuation ("tidaling") of the fluid level in the water – seal chamber or check the air leak indicator for leaks. Fluid fluctuations in the water seal chamber or air leak indicator area will stop when:
4.35.1 Lung has re – expanded.
4.35.2 The tubing is obstructed by blood clots, fibrin or kinks.
4.35.3 A loop of tubing hangs below the rest of the tubing.
4.35.4 Suction motor or wall suction is not working properly.
4.36 Monitor presence of air leak within the chest tube.
4.36.1 If a continuous air leak (constant bubbling in the water seal chamber) is observed (both inspiratory and expiratory) assess for a possible mechanical air leak.
4.36.2 If air is leaving the chest, bubbling is observed in the water seal chamber and thus intermittent bubbling in the water seal is normal, but continuous bubbling on this chamber indicated air leak.
4.37 Monitor adequacy of operation in the wet suction control chamber.
4.37.1 Verify physician's order for the pressure desired when using a negative pressure suction source. Water controlled suction and calibrated up to 20cmH_2O.
4.37.2 Fill with the desired amount of water in the suction control chamber. The amount of water filled (adding or removing water) determines the suction imposed on the patient. The lower the water content, the lower the imposed suction. The higher the water level, the higher the imposed suction.
4.37.3 Observe for the constant, moderate bubbling in the optimal characteristic of bubbling in this chamber.
4.38 Apply a gentle squeeze and release motion to small segments of the chest tube between your fingers. Milking of chest tubes to maintain patency is no longer recommended. Milking will excessively increase intrathoracic pressure.
4.39 Always place the drainage system below the chest level (as close to the floor as possible) prevent backflow of fluid into the pleural space at all times and whenever the patient has to be transported to another area. Never clamp the chest tube an order from the physician.
4.39.1 If the tubing disconnects, cut off the contaminated tips of the chest tube and tubing, insert a sterile connector in the cut ends and reattach to the drainage system.
4.39.2 If the chest tube is inadvertently disconnected from the drainage system, a temporary water seal can be established by immersing the chest tube's open end in a bottle of sterile water.
4.40 Keep padded clamp at bedside, ready at all time.
4.41 Inform the physician immediately for any abnormality identified.
4.42 Request daily chest x – ray as ordered by the physician.
4.43 Change the chest tube dressing (sterile technique) daily or when become soiled.
4.44 Observe condition of site, assess the suture and check the level of chest tube (centimeters) from insertion site.
4.45 Write nursing care plan according to identified patient's problem though nursing process approach. Refer to nursing clinical practice guidelines.
4.46 Document in the Nurse's Notes the following:

4.46.1 Time of chest tube insertion.
4.46.2 Name of physician who performed the procedure.
4.46.3 Site, size of chest tube used and level of chest tube from insertion site.
4.46.4 Presence or absence of fluctuation.
4.46.5 Character and initial amount of drainage.
4.46.6 Time the chest x – ray done.
4.46.7 Patient's tolerance to procedure.

4.47 **Chest tube removal**

4.47.1 Verify physician written order for the procedure.
4.47.2 Identify patient correctly using two identifiers (4 names for the Saudi and complete name for the Non – Saudi and Medical Record Number).
4.47.3 Explain the procedure to the patient/parent.
4.47.4 Prepare and organize all needed equipment on the trolley and bring it to the patient's bed side.
4.47.5 Verify the correct site and location of the procedure.
4.47.6 Provide privacy throughout the procedure and position patient comfortably. Reinforce explanation to the patient/parents the procedure to be done.
4.47.7 Connect to cardio – respiratory monitoring.
4.47.8 Perform hand hygiene.
4.47.9 Assist in clamping the chest tubes by the physician.
4.47.10 Administer pain medication as ordered before removal of the chest tube.
4.47.11 Don gloves.
4.47.12 Assist the physician in the performance of the procedure:
- 4.47.12.1 Prepare dressing to be placed on the chest tube site after removal.
- 4.47.12.2 Remove chest tube dressing. Leave sternal incision dressing intact.
- 4.47.12.3 The chest tube is clamped and ensure suction is disconnected – double check with assisting nurse. If there are multiple drains in-situ, clamp all drains before removal. Once the required drains are removed, unclamp remaining drains
- 4.47.12.4 Place sterile towel under tubes
- 4.47.12.5 Clean around catheter insertion site and 1-2cm of the tubing with Use 2% Chlorohexidine gluconate in 70% alcohol and let it dry.
- 4.47.12.6 Remove suture securing drain
- 4.47.12.7 Instruct patient to exhale and hold if they are old enough to cooperate; if not, time removal with exhalation
- 4.47.12.8 Pinching the edges of the skin together, remove the drain using smooth, but fast, continuous traction

4.47.13 Apply pressure with sterile gauze to the wound site.
4.47.14 Cover the wound with clear, occlusive dressing, making sure all sides are securely attached to the skin for an airtight seal.
4.47.15 Monitor the site for drainage, bleeding and infection.
4.47.16 Request for chest X – ray after removal of the chest tube as ordered by physician.
4.47.17 Discard all supplies including chest tube and drainage bottle in a bio – hazardous garbage bag.
4.4.18 Observe patient for signs of respiratory distress caused by loss of negative intra pleural pressure or tension pneumothorax.
4.47.19 Change dressing aseptically every 24 hours.
4.47.20 Document in the nurses notes all nursing care rendered, all treatment given, time of chest tube removal, name of physician who performed the procedure and patient's condition and tolerance to procedure.
4.47.21 Signs and symptoms of mediastinal shift.
- 4.47.21.1 Dyspnea
- 4.47.21.2 Chest Pain
- 4.47.21.3 Tracheal Deviation
- 4.47.21.4 Decrease Blood Pressure
- 4.47.21.5 increased Pulse Rate
- 4.47.21.6 Cool and Mottled Skin

4.47.21.7 Changes in air entry either decreased or absent
4.47.21.8 Dyspnea

5. MATERIALS:

5.1 Basic Procedure Set
5.2 Chest Tube Size 8 – 12 French
5.3 Water – Seal Drainage System
5.4 Resuscitation Trolley
5.5 Oxygen Source
5.6 Suction Apparatus
5.7 Cardio – Respiratory Monitor
5.8 Cap, Mask, Gown and Sterile Gloves
5.9 2/0 Or 3/0 Silk Sutures
5.10 Povidone – Iodine Solution
5.11 Alcohol Swabs
5.12 Gauge 25 Needle and 3ml Syringe
5.13 Lidocaine 1% or Sedative as Ordered
5.14 Scalpel No. 11 or 15
5.15 4 X 4 Gauze
5.16 Sterile Water
5.17 Adhesive Tape
5.18 Padded Clamp
5.19 Chlorehexidine
5.20 Eye Protection

6. RESPONSIBILITIES:

6.1 Physician
6.2 Nurses
6.3 Radiologist

7. APPENDICES:

7.1 Nurses Progress Notes

8. REFERENCES:

8.1 Kingdom of Saudi Arabia, Ministry of Health Baish General Hospital, 2018.
8.2 https://www.rch.org.au/rchcpg/hospital_clinical_guideline_index/Chest_Drain_Management/updated 2022
8.3 MCH,king salman medical city ,almadinah helath cluster ,MANUAL FOR PICU ROTATION,,2023

9. APPROVALS:

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Reviewed by:	Dr. Tamer Mohamed Naguib	Medical Director		January 19, 2025
Approved by:	Mr. Fahad Hazam Al Shammari	Hospital Director		January 26, 2025

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Ministry of Health

Hospital: _____ مستشفى:

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Dept./Unit: _____ القسم/الوحدة:

MRN: | | | | | | | | | | | رقم الملف الطبي:

Name: _____ الاسم:

Nationality: _____ الجنسية:

Age: _____ ☐ سنة Years ☐ شهر Months ☐ يوم Days العمر:

Date of Birth: ___/___/14___ H ___/___/20___ تاريخ الميلاد:

Gender: ☐ Male ☐ Female الجنس:

NURSES PROGRESS NOTES FORM

DATE &TIME	NURSES NOTES (D-data A-action R-response)	REGISTERED NURSE INITIAL WITH ID NUMBER

Note: Write the time in each entry & affix your initial at the end of each paragraph. Document your complete Name, Initial, Job number, Date & Time at the closure of your documentation. Draw a line across empty spaces.

Name: الاسم:	MRN: رقم الملف الطبي:

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