Chest Drain Insertion & Management

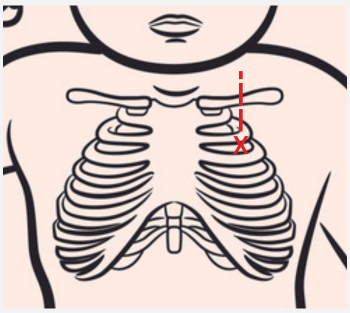
Patients who have suffered blunt or penetrating chest trauma may develop a pneumothorax, a haemothorax or both (pneumohaemothorax). Some patients may even develop an atraumatic spontaneous pneumothorax. When identified early, an intercostal catheter (ICC) may be inserted to assist with the drainage of air or fluid from the pleural cavity. If left untreated, a tension pneumothorax may develop, which is a life threatening condition requiring urgent decompression through needle thoracocentesis or finger thoracostomy.

ALERT

Tension pneumothorax is a life-threatening condition. Expanding air in the pleural space can displace the heart and lungs impairing venous return and compromising cardiopulmonary function. If left untreated, a patient with a tension pneumothorax will deteriorate into cardiac arrest. Signs include hypotension, tachycardia, shortness of breath, dyspnoea, cyanosis, tracheal deviation, elevated jugular venous pressure or altered level of consciousness. Treatment for tension pneumothorax is URGENT DECOMPRESSION.

Urgent Decompression via Needle Thoracocentesis

Insertion Site Identification



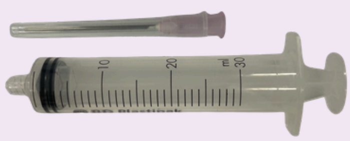
Ideal insertion site is identified as the "X" on the diagram.

Site selection of the needle thoracostomy is determined by the intersection of the midclavicular line and the second intercostal space on the affected side of the pneumothorax.

1 GATHER

Antiseptic swab or solution

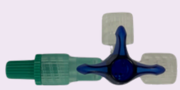
2 x Tegaderm



30mL Leur Lock and drawing up needle

Sodium Chloride 0.9%

14G or 16G non-retractable cannula



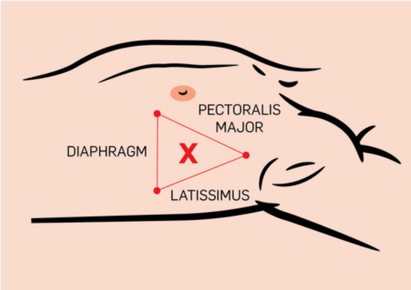
Three-way-tap

2 PROCEDURE

Video - Needle Thoracocentesis

Urgent Decompression via Finger Thoracostomy

Incision Site Identification



Ideal incision site is identified as the "X" on the diagram.

This site is described as the mid axillary line in the centre of the "Triangle of Safety", which is bound by the lateral border of the pectoralis major muscle anteriorly, latissimus dorsi muscle posteriorly, the fifth intercostal space inferiorly and the base of the axilla superiorly.

1 GATHER

Antiseptic swab or solution

Lignocaine

Scalpel

Artery forceps

Sterile window drape

5mL syringe with needle

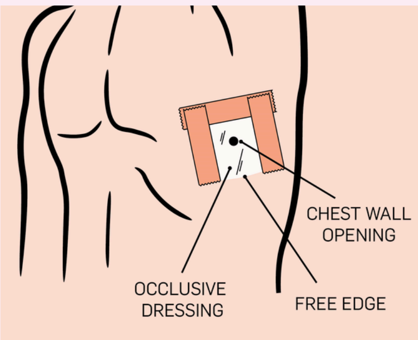
2 PROCEDURE

Video - Finger Thoracotomy

Management of Finger Thoracostomy or Sucking Chest Wound

A sucking chest wound (also referred to as an open pneumothorax) requires rapid identification and management. Patients with a sucking chest wound or finger thoracostomy wound who are not receiving positive pressure ventilation should have an ICC inserted immediately. Due to the size of the injury or wound, the patient is pre-disposed to a tension pneumothorax. This is due to the rapid influx of air into the pleural space during inspiration, as the negative pressure within the chest cavity draws air into the pleural space via the wound. In both instances, if insertion of an intercostal catheter is delayed, it is vital that a three sided occlusive dressing is applied.

Three Sided Dressing

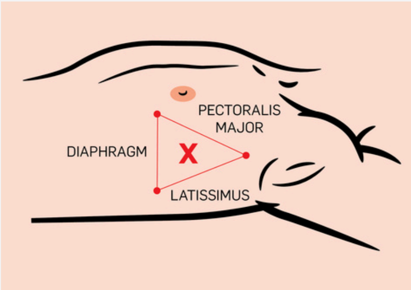


Place the plastic side of a sterile gauze packet to the chest over the finger thoracostomy incision or sucking chest wound site. Secure in place with sleek tape or other durable tape on the top, left and right borders of the plastic packet - leave the bottom border unsecured. This can also be achieved with a large transparent dressing with sterile gauze placed at the bottom border of the dressing.

This will form an occlusive seal on inspiration, and allow trapped air out of the base of the dressing on expiration.

Insertion of Intercostal Catheter (ICC)

Insertion Site Identification



Ideal insertion site is identified as the "X" on the diagram.
This site is described as the mid axillary line in the centre of the "Triangle of Safety", which is bound by the lateral border of the pectoralis major muscle anteriorly, latissimus dorsi muscle posteriorly, the fifth intercostal space inferiorly and the base of the axilla superiorly.

Insertion within the "Triangle of Safety" results in minimised risk of neurovascular and organ injury.

Intercostal Catheter Size Selection

Tegue, Amarakone & Quinn's Rule of Four's has simplified chest tube insertion sizing in paediatrics.

The chest tube size can be calculated using:

4 x ETT size = ICC Size in FG

The ETT size can be calculated by (Age / 4) + 4

In paediatrics, it is typically recommended to round down if your patient is between sizes. You can also see the suggested weight based sizing recommendations on the CREDD in the intubation section.

1a GATHER

- ☐ Procedure trolley
- ☐ Sharps container
- ☐ 2% Chlorhexidine in Alcohol 70%
- ☐ 21G needle
- ☐ Drawing up needle
- ☐ 5mL syringe
- ☐ Local anaesthetic
- ☐ Drape
- ☐ 4 packs of sterile gauze swabs
- ☐ Scalpel and blade (appropriately sized)
- ☐ Suture pack
- ☐ 2.0 silk suture
- ☐ Forceps
- ☐ Intercostal catheter

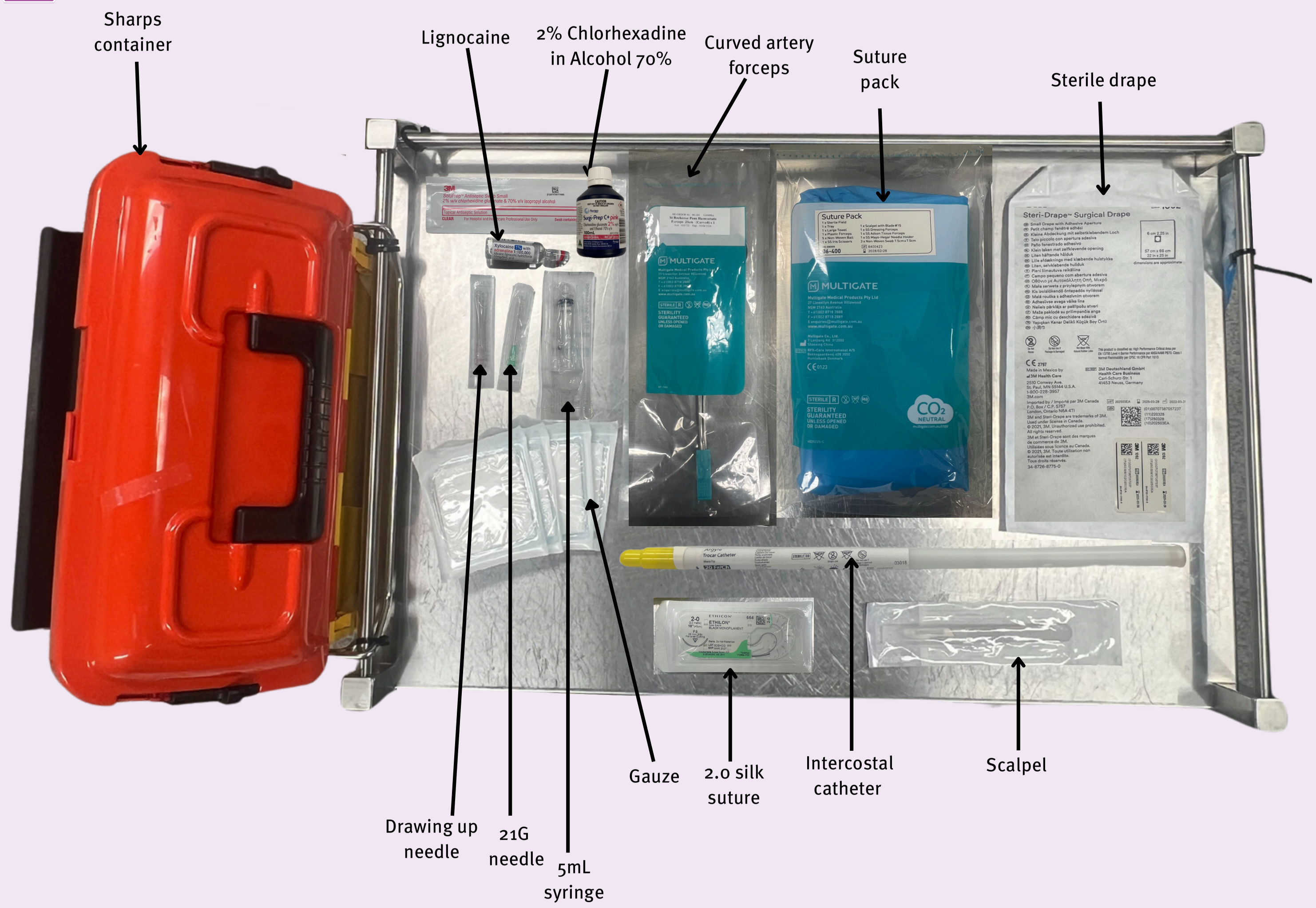
DRESSING

- ☐ Split chest drain dressing
- ☐ Dressing (eg. 2x large transparent dressings)
- ☐ Non-stretch tape (eg. leukofix, leukosilk, sleek)

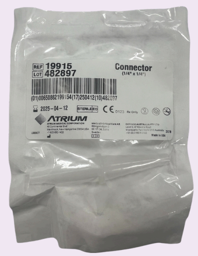
Please note: each Hospital and Health Service will have different procedure pack, forceps, dressing and suture preferences. Please check with your local team as to which dressings to use in your health facility.

Chest tube insertion is a sterile procedure. Refer to your workplace for specific PPE.
Ensure appropriate PPE is worn both to protect the patient and the staff involved.

1b



2 x Transparent dressings



ICC connector

Split gauze

Leukoplast Sleek Tape

Underwater seal drain

Underwater Seal Drain Set Up:

Ensure that correct chest drain is set up according to the manufacturer's instructions and ready to connect. For information on setting up the Getinge Atrium Oasis Systems, review the manufacturer's instructions. Getinge's set up and operation video is available from this link (13 mins): https://www.getinge.com/int/insights/academy/?p=10845

Atrium Underwater Seal Drain (UWSD) Set Up

This skill sheet features a step-to-step guide on the set up of the Atrium UWSD, as this is the most commonly used brand. Always follow the manufacturer's instruction for the equipment in used in your workplace.

2 PREPARE

Don PPE as per local policy. Perform hand hygiene and don clean non-sterile gloves.

3

Open sterile packaging onto clean procedure trolley.

4

Remove tubing from back of the drain and keep in packaging. Swing foot stand and set into upright position.

5

Remove ampoule of sterile water from the back of the drain. Twist open and add water to the water seal chamber through the port.

6

Fill the water seal chamber to the 2cm fill line. UWSD should always have 2cm of water in the seal chamber.

7

Check USWD pack for connector. Ensure it is the correct connector to connect the UWSD to the intercostal catheter (ICC) as there are two sizes available.

8

The UWSD is now ready for connection to the ICC following insertion.

ALERT

Chest tube insertion can be distressing and painful, even with the use of topical and local anaesthetic. Ensure that the appropriate level of analgesia and/or sedation has been considered prior to the commencement of the procedure.

9 PROCEDURE

The doctor will insert the intercostal catheter (ICC) as per local policy. Watch video here.

10

Once the the intercostal catheter has been inserted, insert the ICC connector into the ICC.

11

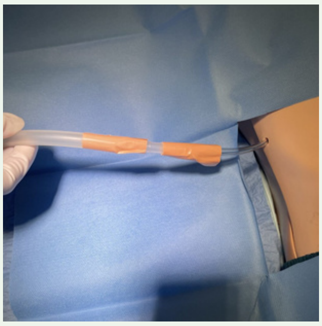
Remove protective cap from end of drain tubing and pass to doctor.

12

Connect ICC to ICC connector then the chest drain and ensure connections are tight.

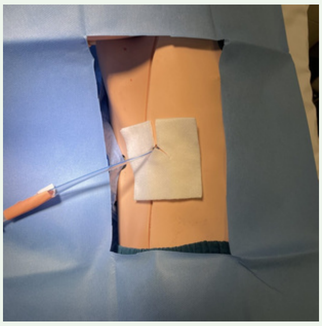
13

Use sleek tape to further secure connections between ICC and ICC connector, ICC connector and chest drain tubing.



14

Doctors may then further secure the ICC with sutures. After suturing is completed, apply split dressing to the insertion site.



15

Apply lower half of the transparent dressing to the chest and the upper half of the transparent dressing to the ICC.

16

Repeat on the opposite side of the transparent dressing to create a "sandwiching" closure and securement of the ICC.

17

Remove the drape carefully and place the UWSD either on the floor or hanging from the bed. Apply suction settings as ordered.

Caution

It is important to have the appropriate equipment readily available in case of accidental disconnection. In the event of accidental disconnection, immediately clamp the drain and cover the end of the drain with sterile gauze to prevent contamination and colonisation of the ICC. Replace UWSD as soon as possible to minimise time the drain is clamped.

If the drain is disconnected and not clamped, it allows for rapid infiltration of air back into the pleural space resulting in a worsened pneumothorax or tension pneumothorax.

Two tubing clamps (without teeth) and sterile gauze must be checked and remain at bedside at all times as well as accompany patients for transfer.

Care of the Underwater Seal Drain (UWSD)

Suction

The typical suction pressure for paediatric patients is -10 to -20 cmH2o. However, this can vary and is dependent upon clinician preference and the clinical condition of the patient. Follow the documented prescription for suction pressure. Not all chest drains are required to be connected to wall suction. See instructions below for checking and applying suction pressure.

1

The applied suction pressure can be seen in Window A and changed using a dial at the back of the UWSD.

2

If requiring more than -20cmH20, the UWSD must be connected to wall suction. Connect the suction tubing to the suction inlet.

3

Connect suction tubing to suction cannister. Turn suction on to "REG" and apply at least 80mmHg of suction to the UWSD.

4

Ensure bellows in Window E are expanded to the triangle at the bottom. If not expanded, increase the wall suction until it is achieved.

Chest drain Observations and Monitoring

Observations to be recorded:

- Hourly vital signs including blood pressure, respiratory assessment and pain score are to be completed.
- If the patient is ventilated, document ventilator settings and measurable observations hourly.
- Hourly review of drainage, bubbling and swinging (see below for more information)
- Commence strict fluid balance chart
- Continuous monitoring of at minimum continuous pulse oximetry

DRAINAGE	Drainage is observed and measured in Window D. Observe colour, consistency and volume of what is draining. Sudden changes must be escalated immediately and losses replaced. Massive haemothorax is defined as: Greater than 20mL/kg immediate loss OR Greater than 5mL/kg in one hour (or 200mLs in one hour for patients over 50kg) OR Greater than 3-4mL/kg for subsequent 2-4 hours
BUBBLING	Bubbling is observed in Window C and represents the presence of an air leak. This is observed as bubbles moving from right to left side of Window C with air leak severity assessed against the graduated range of 1 (low) to 5 (high). Continuous: bubbling is present at all times. This indicates a persistent air leak from the patient's thoracic cavity or tube connection. Intermittent: bubbling with mild float ball oscillation at the bottom of Window C indicates an intermittent air leak. It may occur on expiration or cough and indicates a resolving pneumothorax. Nil: no bubbling and minimal float ball oscillation may indicate no air leak or resolved air leak.
SWINGING	Swinging (also referred to as tidalling) reflects the change in intrathoracic pressure during breathing. Swinging can only be assessed when the patient is not on wall suction, to assess suction must be turned off momentarily. Swinging can be observed in the water seal chamber. During inspiration, fluid is drawn up into the water seal chamber and during expiration fluid moves down the water seal chamber. Note: if the patient is intubated, this will be reversed.

ALERT

If the patient is presenting as though they have a large pneumothorax but there is minimal to no bubbling or swinging, check that the drain is functioning correctly. If there is concern for drain blockage or malfunction - escalate to medical team for immediate review and consider replacement of UWSD or increasing the applied suction.

For further information:

Video: Atrium Underwater Seal Drain Set Up
Video: Needle Thoracocentesis
Video: Finger Thoracostomy
Video: Intercostal Catheter Insertion

References:

This Queensland Paediatric Skill Sheet was developed by the Emergency Care of Children working group (funded by the Queensland Emergency Department Strategic Advisory Panel) with the help of the following resources:

Advanced Life Support Group (ALSG). (2024). Advanced Paediatric Life Support, Australia and New Zealand: The Practical Approach (7th ed). Wiley-Blackwell.

Children's Health Queensland. (2024). Guideline: Paediatric chest trauma. Retrieved 16 October 2025 from https://qheps.health.qld.gov.au/__data/assets/pdf_file/0023/3226325/GDL-80149.pdf/_nocache

Children's Health Queensland. (2024). Procedure: Intercostal Catheters: Nursing assessment, management and removal. Retrieved 16 October 2025 from https://qheps.health.qld.gov.au/__data/assets/pdf_file/0033/2129973/proc-10010.pdf/_nocache

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Skill Sheet Disclaimer