



CHEST DRAIN INSERTION AND UNDERWATER SEAL DRAIN (UWSD) MANAGEMENT - SGH

1. Purpose	A guideline for staff to safely manage patients requiring an UWSD drain and chest drain insertion
2. Risk Rating	Medium
3. National Standards	1 – Clinical Governance 3 – Preventing and Controlling Healthcare Associated Infections 4 – Medication Safety 5 – Comprehensive Care
4. Employees it Applies to	All Nursing and Medical staff managing patients with an Underwater Seal Drain and all Medical staff inserting chest drains.

5. PROCESS

ABBREVIATIONS / TERMS

Chylothorax – lymphatic fluid in the pleural space

Hemothorax- blood in the pleural space

Hepatic hydrothorax - is suspected (presence of pleural effusion in a patient with cirrhosis, likely secondary to passage of ascites fluid via diaphragmatic defects)

Pneumothorax - collapse lung, air in the plural space between the lungs and the chest wall

Pyothorax- presence of inflammation or pus within the chest cavity

UWSD- under water seal drain

5.1 ROLES

5.1.1 The Nurse’s role is to:

- Ensure resuscitation trolley available
- Ensure the required equipment is present
- Monitor patient’s vital signs and observe for evidence of patient deterioration throughout the procedure and during the management of the UWSD
- In the event of patient deterioration follow Between the Flags escalation process assist and maintain optimal patient position
- Ensure a sterile field is maintained throughout the procedure
- Observe the proceduralist to ensure no deviation from correct insertion procedure
- Provide patient advocacy
- ‘**Call Stop**’ if unwarranted risks are observed before or during the procedure and escalate for assistance.

5.1.2 Medical Officer (MO) Training

All doctors expected to be able to insert a pleural drain should be trained using a combination of methods including:

- An initial theoretical component describing the risks and techniques
- Simulated practice
- Direct supervision from a consultant or advanced trainee registrar who is already accredited at SGH to do chest drains of practice until considered competent.
- See [ACI Pleural Drain in Adults: A Consensus Guideline](#)



5.2 INDICATIONS FOR PLEURAL DRAINS

- Pneumothorax: tension pneumothorax (following emergency needle decompression), persistent or recurrent pneumothorax, large spontaneous pneumothorax, pneumothorax in any ventilated patient.
- Pleural effusion: malignant, para-pneumonic or other non-malignant causes e.g. liver failure.
- Traumatic haemothorax or pneumothorax.
- Empyema or pyothorax (the approach to management of a pleural drain for treatment of empyema may vary).
- Post-operative: thoracic, cardiac, oesophageal or spinal surgery.

RELATIVE CONTRAINDICATION - Hepatic hydrothorax

If a hepatic hydrothorax is suspected (presence of pleural effusion in a patient with cirrhosis, likely secondary to passage of ascites fluid via diaphragmatic defects), chest tubes should be avoided AND/OR should be discussed with respiratory and gastroenterology prior to proceeding. Placement of chest tubes can result in massive protein, electrolyte and fluid depletion as well as posing an infection risk. In patients who are symptomatic due to their effusion despite optimising their medical therapy (sodium restriction, diuretic therapy, ascites drainage etc.), periodic therapeutic thoracentesis can be considered. A multidisciplinary discussion with respiratory and gastroenterology should occur (to decide on choice of procedure, location of procedure, drainage limits and speed, post-procedural care instructions) prior to any pleural intervention. If a drain is inserted, close monitoring of drain output is required (patient should be assessed after every 500mL of fluid removal) with a view for early drain removal.

5.3 GOALS OF CARE

5.3.1 Patient

- The lung will be fully re-expanded
- Pain will be controlled to a level acceptable to the patient
- Blood/fluid/air drained
- Gas exchange optimised

5.3.2 Nursing/Medical

- Patient Safety is maintained – 2 Howard Kelly Clamps available per intercostal drain
- Connections correctly secured, suction on low pressure (for Atrium Oasis see appendix 1), UWSD is intact
- The nurse caring for the patient is able to state action in the event of accidental disconnection of UWSD
- Accurate interpretation of UWSD observations



5.3.3 Documentation

- The management plan is documented in the eMR and handover Nursing Care Plan
- Evaluative statements are recorded each shift in the eMR
- The Chest drain/UWSD Observation Chart is implemented

5.4 INSERTION OF INTERCOSTAL CATHETER (ICC)

5.4.1 Indications for ICC

- Traumatic or spontaneous pneumothorax present either clinically and or on chest X-ray (CXR)
- Haemothorax following injury
- Pleural effusion
- Following Thoracic Surgery

5.4.2 Equipment Required for ICC insertion (Table 1)

- Intercostal tray and kit
- Betadine or chlorhexidine solution
- 1 bottle sterile water
- 1 incontinence sheet
- 1 pair of Howard Kelly clamps
- Scalpel
- Disposable/Sterile gown
- Chest drain suture kit or disposable sterile forceps, scissors and tweezers
- 3.0 black silk suture with cutting edge (curved)
- 2 pieces of elastoplast or hyperfix
- Leukoplast tape
- Sterile gloves
- Pre cut gauze (key hole)
- Facial protection
- Disposable/Fenestrated drape
- Disposable large drape
- UWSD tubing & bottle set
- Intercostal catheter without trocar
- 1 low pressure suction gauge & suction tubing
- Lignocaine 1% , or lignocaine with adrenaline 1:100,000
- 2 x 10mL syringes
- 2 x 18g, 21g & 25g needles

5.4.3 Preparation of Patient for ICC Insertion

- Medical officer inserting the ICC is to obtain the patient's written consent prior to the procedure
- A Clinical procedure safety checklist level 2 must be completed by Medical/Surgical Officer and a Registered Nurse (RN). Place the checklist in the patient's medical record
- When completing "Clinical procedure safety checklist level 2 check and/or test for patients INR level. **If performing drainage of a diagnostic effusion, INR must be less than (<) 1.5**

- **Also check platelets and albumin and when the last anticoagulant were administered**
- Ultra Sound Guided marking of the site is essential ie.to locate the collection of pleural fluid or air prior to ICC insertion Or use TRIANGLE OF SAFETY (figure.1)
- Obtain most recent chest x-ray
- Clip chest hair if necessary
- Ensure Intravenous access is present prior to commencement of procedure
- Administer analgesia as prescribed
- Position the patient in the most comfortable and safe position for the insertion. Position suggestions include either on the edge of the bed with feet on a stool and leaning over the bed side table or sitting in the bed in a high semi fowler position with arm support above head on the side the drain is to be inserted (Figure 2).
- Baseline set of observation including Temperature (Temp), Blood Pressure (BP), respiratory rate (RR), pulse (P) and Oxygen Saturation (SaO2)

Figure 1. Triangle of Safety

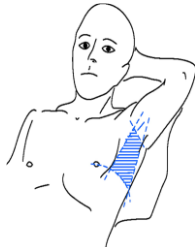
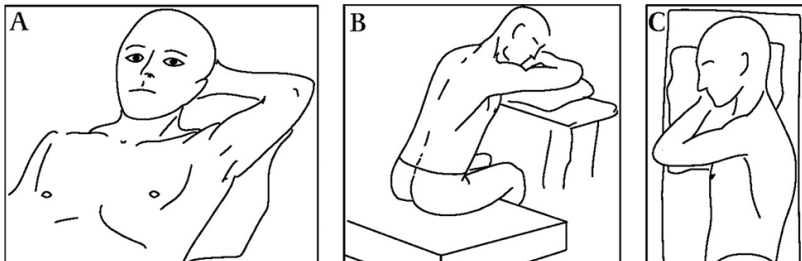


Figure 2. Positioning of patient



5.4.4 Procedure for ICC Insertion

- 1) A Registered Nurse (RN) must be present to assist the patient and Medical Officer (MO) during the procedure and closely monitor the patient's observation throughout the procedure.
- 2) Continuous pulse oximetry and supplemental oxygen is required throughout the procedure.
- 3) Local anaesthetic is administered:
 - Lidocaine / Lignocaine 1 % without adrenaline Maximum dose is 3 mg / kg
 - 50 kg adult - 150 mg - 15 mL
 - 70 kg adult - 210 mg - 21 mL
 - 90 kg adult - 270 mg - 27 mL
 - Lidocaine / Lignocaine 1 % with adrenaline (1:100 000) Maximum dose is 7 mg / kg
 - 50 kg adult - 350 mg - 35 mL
 - 70 kg adult - 490 mg - 49 mL
 - 90 kg adult - 630 mg - 63 mL

Lidocaine / Lignocaine 2% should not be used

- 4) An incision is made, then Spencer Wells forceps are used to enlarge the tract
- 5) Consequently, a clamp is used at the proximal end of the ICC to guide insertion of the intercostal catheter into the pleural space

5.4.5 Securing the ICC

- 1) The ICC is secured to the skin by a stay anchor and mattress suture (formerly a purse suture was used, see figure 4 below) and connect to UWSD immediately,
- 2) Before connecting the ICC to the UWSD bottle, be sure to remove the sterile drape
- 3) Before connecting the ICC ensure that the:
 - Tubing within the UWSD bottle is at least 2 cm below the level of the water, but not in contact with the bottom of the bottle
 - Ensure screw top lid is secure
- 4) Air vent outlet must be open to the air at all times, unless suction is being applied
- 5) A split gauze dressing is placed around the catheter insertion site, and 2 x elastoplast secured with Mefix dressing or split dressing and Mefix or elastoplast are placed over gauze dressings (refer to table 3, point 3.3). One piece of tape must be above the drain and one piece below the drain to ensure that the drain remains in the plane it was inserted. Transpore or leukoplast tape is placed around the connections to secure the connections (see figure 3)
- 6) **If transpore or leukoplast is used** 2 strips go down the side of the tube and 2 around the tube above and below the connection
- 7) The ICC is secured once more to the skin using Mefix or elastoplast (depending on allergies) with a loop so that it does not pull directly on the anchor suture.
- 8) Chest Xray **MUST** be performed within 1 hour of ICC insertion and viewed within 4 hours to confirm position of ICC within the pleural space.



Figure 3 – (left) Method of taping

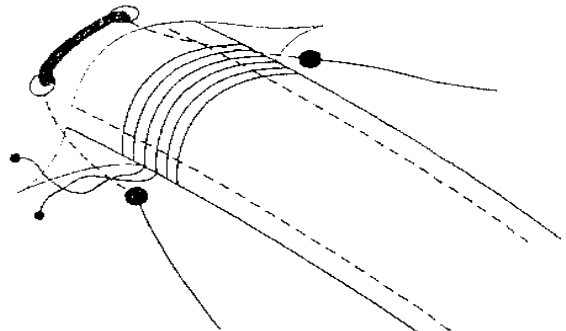


Figure 4 – (above) Mattress string and anchor suture

5.5 PLEURAL PIGTAIL CATHETER (PPC) INSERTION

Pleural self-retaining pigtail drains are inserted in radiology

5.5.1 Indications for Insertion of a PPC

Traumatic or spontaneous pneumothorax that present either clinically or on Chest X-ray (CXR)

Pleural effusions as follows:

- Transudate in nature
- Haemoserous collection



- Lymphatic fluid – chylothorax
- Infected (empyema) – this is done under x-ray control.

5.5.2 Equipment Required for PPC Insertion

As for [ICC](#) except include a pleural pigtail catheter and clear occlusive dressing in the equipment set up (refer to Table 1).

5.5.3 Preparation for and Insertion of PPC

As for [ICC](#).

5.5.4 Procedure for Insertion

- 1) The PPC is inserted by a MO.
- 2) Local anaesthetic is administered
- 3) Insert needle into pleural cavity
- 4) Aspirate fluid or air
- 5) Put wire through needle, remove needle
- 6) Cut skin and put grey dilator over wire
- 7) Remove dilator and thread PPC with obturator inside over wire. PPC MUST not be advanced into pleural cavity until wire is seen at the non-insertion site of the drain (skin) beyond the 3 way tap.
- 8) Remove wire and obturator turn the three way tap off to the patient [to prevent air entering and pleural fluid escaping the pleural place]
- 9) Suture the catheter in place
- 10) Attach The extension tubing and once UWSD is attached turn 3 way tap on to neutral position allow drain and air drain from the patient into the UWSD bottle
- 11) Secure all connections as for ICC
- 12) Apply a clear occlusive dressing over insertion site
- 13) Check all standard UWSD observations, especially oscillation to ensure patency
- 14) Ensure 3 way tap is left outside the dressing so it can be manipulated if clamping is required
- 15) Ensure 3-way tap remains in neutral position

5.6 POST INSERTION OF ICC OR PPC

- Record vital signs 1/24 for 4 hours- 4/24 for 24 hours as indicated by clinical condition
- Listen for bilateral air entry and observe for bilateral chest movement
- Observations of air leak, swing (oscillation), drainage, patency of drain, Air entry and surgical emphysema must be documented on the Chest drain chart and recorded hourly for four hours and then 4/24. They are continued 4/24 if satisfactory until catheter is removed (refer to 4.7)
- ***Patients on mechanical ventilation must have observations recorded 1/24 until a clinical decision is made and documented by the ICU team for reduction in observations.***
- Each tube must be labelled according to its position eg apical or basal, or using numbers – do not use A & B as this can lead to confusion
- CXR (usually portable) taken immediately after insertion & viewed by MO within 4 hours to check the position of the ICC/PPC
- The patient should be encouraged with deep breathing and coughing exercises



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- Adequate analgesia should be administered frequently as this is a painful procedure
- Patients should be encouraged to sit out of bed if his/her general condition allows
- 2 Howard-Kelly clamps are per drain must remain near ICC drains, for immediate use if tube disconnection occurs. When PPC is insitu the 3 way tap is used as the alternative
- ***In the event that patient is receiving Positive Pressure Ventilation, clamps are not required and three way tap should not be turned to off.***
- For PPC – if the drain requires occluding, turn the 3 way tap to the off position ie: facing “off” to the patient end of the tube.

5.7 NURSING CARE POST INSERTION OF ICC AND PCC

Equipment required at bedside:

- 2 Howard Kelly clamps for **each ICC**
- Bottle frame or carrier
- UWSD observation chart
- Transpore tape or leukoplast tape to secure all connections.

5.7.1 When receiving a patient with UWSD always check the following;

- Check all connections and ensure that they are reinforced with transpore **or** leukoplast tape
- Ensure the tubing is long enough to allow the patient to move comfortably without pulling on the tube
- Ensure that there is enough water in the bottle so the rod is immersed below the water level. See appendix 1 for Atrium drain alternative
- **The blue cap on the air vent must be removed and the air vent is not to be occluded unless Low Wall Suction is ordered and applied**
- If ordered, drainage tubing must be connected to **low** pressure suction, usually at 3-5 kpa (refer 5.6)
- Label each drain to identify apical or basal drain.

5.7.2 Transferring a patient with an UWSD

- All patients being transported from theatre, X-ray or ED with an UWSD bottle must have a RN escort
- **Never** clamp UWSD tube while transporting a patient
- UWSD bottle needs to remain below the patient chest at all times
- Medical Officer must document if a patient can come off suction for transfer and duration of procedure, otherwise a portable Chest xray will be required
- For patient showering, extension tubing may be applied to existing tubing

5.8 SUCTION

- Only **low pressure suction is to be applied to UWSD** usually at 3-5 kpa. See appendix 1 for Atrium drain
- When the drain is attached to suction check the gauge every time the observations are completed
- *Suction must be ordered by a MO.*



5.9 OBSERVATIONS OF UWSD

5.9.1 Limitations for practice

RN or EN (EN must be specifically instructed in the procedure, the RN remains responsible for interpretation of data).

Constant accurate observation of escape of air, respiratory swing [oscillation] and drainage is essential. Neglect or inaccurate observations may lead to serious complications.

5.9.2 Air leak: Indicated by bubbling in UWSD bottle

- ++++ Large amount, bubbling all the time eg: large pneumothorax, large excessive intrathoracic pressures on inspiration and expiration
- +++ Moderate amount, bubbling on every spontaneous expiration, or positive ventilated breath, {mechanical ventilation}
- ++ Minimal amount, bubbling when talking or small air leak, occasionally on spontaneous or ventilated breath [mechanical breath]
- + Bubbling on forced expiration eg: cough
- Nil No Bubbles

5.9.3 Oscillation (Respiratory Swing)

- Indicates respiratory swing & reflects changes in intrathoracic pressure, seen as movement of fluid in the tube
- Oscillation does not occur when suction is applied (UNLESS patient has had major thoracic surgery with large intrathoracic volumes)
- Check tube patency by removing suction once a shift. Oscillation should be present. ***Do not break suction if drain is oscillating***
- Frequent disconnection breaks the seal and may delays patient progress
- Measuring of fluid level in UWSD must be performed on suction and documented as such

5.9.4 Absence of Oscillation

- If the Respiratory swing is absent, it may mean one of three things:
 - The patient is lying on the tube, leading to occlusion of the drain
 - The tube is blocked (see 4.12). If examination reveals no kinking and changing the patient's position does not rectify the problem, the absence of a swing must be reported to the medical officer
 - The lung has re-expanded fully

5.9.5 Air Entry and Auscultation

- Presence of breath sounds must be assessed each time the observations are completed by auscultation of the chest with a stethoscope to determine presence of air entry. (see figure 4.13)
- The finding should be documented as R=L, R>L, L>R



5.9.6 Drainage (Table 2)

Amount of drainage	Drainage type
<ul style="list-style-type: none"> - Level above the 0 ml marking on the bottle - Amount is accumulative - Total drainage returns to 0 mL when bottle is changed - Should decrease over a 48 hour period - <i>> 100 mL of blood drained post-surgery in 1-2 hours is very significant must be reported to an MO; the loss may need to be replaced</i> 	Record appearance HS = Haemoserous HP = Haemopurulent P = Purulent S = Serous

Note: When draining a large metastatic or pneumonic pleural effusion. The effusion should be drained in volumes of 500 – 1000mL [BTS guidelines Maximum amount 1500mL], with the amount being dependant on patient weight and physical condition. As documented by the medical officer in the Clinical notes.

- Greater drainage than the amount prescribed for the specific patient may lead to re expansion pulmonary oedema. Typical clinical signs of re-expansion pulmonary oedema include shoulder tip pain, coughing, and sudden drop of blood pressure and/or oxygen saturations and increased respiratory rate and distress.
- Nursing staff are to drain the documented predetermined amount then clamp drain or turn off 3 way tap for 15 minutes and check blood pressure if not hypotensive unclamp and continue to drain at the predetermined amount.
- Where possible, the drain should not be left clamped over prolonged periods of time with haemorrhagic or pus effusion, containing clots or fibrinous material, as it may lead to a blocked drain.

5.9.7 Tube patency

- Ensure adequate tube length to allow safe movement but avoid dependant looping of tubing which could lead to a "fluid lock" in the tube
- Check tubing for presence of clots or fibrinous material each time observations are performed
- Ensure the patient does not lie on the tube

5.9.8 Connections

- Must all be checked each time the observations are performed, to ensure the tube has not dislodged and that all connections are secure and taped. [Check all the way from the insertion site to UWSD].

5.9.9 Surgical Emphysema

- Surgical emphysema is the presence of air under the subcutaneous layer of the skin and is often present in patients with a pneumothorax
- It is characterised by the feeling of “crackling” or “rice bubbles” on palpation
- Surgical emphysema starts at the site of insertion of the drain and can spread
- Tracing a line around the border of the Surgical emphysema is advised to enable accurate assessment and progression or resolution
- Surgical emphysema must be checked for each time UWSD observations are performed and reported to a MO immediately if newly present or enlarging
- Surgical emphysema may be life threatening: it can cause upper airway obstruction

- May be treated conservatively, or a new chest tube may be inserted.

5.10 CHANGING DRAINAGE BOTTLES AND TUBING FOR ICC

5.10.1 Limitations for practice

Two RNs who have been instructed in the procedure.

5.10.2 Frequency

Bottle change should occur when the bottle is 3/4 full.

5.10.3 Equipment Required for Bottle Change Only

Plastic apron, Sterile UWSD bottle, sterile water, Facial protection and non sterile gloves.

5.10.4 Procedure

- 1) Wash hands and using clean technique, add sterile water to bottle
- 2) Clamp ICC above the connection and exchange drainage bottles.
- 3) Do not Clamp if the patient has an airleak

In the event that patient is receiving Positive Pressure Ventilation, DO NOT clamp ICC; as this may cause a tension Pneumothorax

If there is an air leak as indicated by bubbling in the UWSD do not clamp the catheter, ask the patient to hold their breath while changing the set-up.

5.10.5 Disposal of drainage

- UWSD drainage bottles are disposable
- Do not empty prior to disposal
- Ensure drainage bottle is sealed to prevent leakage prior to disposal in a yellow contaminated waste bin.



Figure 5 – Correct UWSD Set-Up

5.11 INSERTION SITE DRESSING

5.11.1 Limitation for Practice

RN



5.11.2 Frequency

In accordance with ward protocol Medical Officer instructions and clinical indication



5.11.3 Equipment

- Dressing pack
- 0.9% sodium chloride sachet
- Keyhole gauze dressing
- Elastoplast 7.5cm x 2
- Mefix, IV 3000 or hyperfix tape.

5.11.4 Procedure Table 3

1. Pre-cut two pieces of 7.5cm elastoplast, hyperfix, or mefix approx 10 - 15cm in length	
2. Clean around insertion site with 0.9% sodium chloride, then dry well	
3. Place keyhole dressings around the tube One over and one under the tube A small combine may be positioned below the tube exit site to cushion the tube away from the patient and collect discharging ooze.	
4. Place 7.5cm elastoplast/mefix x2 over the keyhole dressing. One piece over and one piece under the tube so that the tube exits from the <i>middle</i> of the dressing	
5. Secure the tube to the patient's side allowing some extra length (slack) for movement. This is to prevent accidental removal or dislodgment of the tube.	

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<p>6. Secure connections, with leukoplast x3 strips or transpore tape.</p> <p><i>Please note that the <u>connections must be visible at all times.</u></i></p>	
<p>7. PPC Dressing</p> <ul style="list-style-type: none"> • Apply a clear occlusive dressing over the insertion site • Reinforce with a 2nd clear occlusive dressing over the remainder of the exposed tubing • 1-2 more clear occlusive dressings may be required to ensure the tubing is securely anchored • Ensure gauze is placed under 3 way tap (see picture) to protect skin from pressure ulcer/skin tear • Secure connections as for ICC (point 6) 	 <p>Position of gauze under 3-way tap. Note use of transpore tape to secure the connection (as described in point 6).</p>

5.12 OBTAINING A SPECIMEN FOR PATHOLOGY (pleural effusion no air leak)

5.12.1 Limitations for Practice

2 RNs who have been instructed in the procedure.
Medical request for specimen.

5.12.2 Equipment

- PPE, Non sterile gloves and eye protection, Blue sheet
- Howard Kelly clamps for ICC or 3 way tap for PPC
- 2 Sterile specimen jar (yellow lid)
- Heparinised Cytology jar obtained from anatomical pathology (optional)
- Blood gas syringe, blood culture bottles, purple and red blood tubes (optional)
- Sterile catheter tip 50mL syringe for ICC
- Sterile 50mL syringe for PPC.

5.12.3 Procedure

- 1) Wash hands
- 2) Place blue sheet under catheter connection
- 3) Follow surgical ANTT
- 4) Following collection of the specimen according to method below.



- **ICC**
 - a) Clamp ICC near patient Disconnect UWSD tubing and connect catheter tip syringe to ICC
 - b) Unclamp and aspirate 30mL – 50mL of fluid from the ICC tubing
 - c) Re-clamp and connect to UWSD
 - d) Remove clamps.

- **PPC**
 - a) Turn 3 way tap off to the patient
 - b) Connect a 50mL syringe and turn 3 way tap to neutral position
 - c) Aspirate fluid, turn 3 way tap off to patient and disconnect syringe
 - d) Return tap to neutral position.

EXCEPTIONS may be made in the event if patient is receiving Positive Pressure Ventilation.

5.13 FLUSHING OF PPC TO MAINTAIN PATENCY

5.13.1 Indications

- To maintain PPC patency in patient with pleural effusion or empyema ONLY
- Flushing of PPC for any other conditions is CONTRAINDICATED
- Flush must be ordered on the medication chart by an MO and administered by an RN competent in the procedure
- PPC may be flushed on medical instructions with 10mL 0.9% normal saline 6 hourly.

5.13.2 Contraindications

- Pneumothorax the UWSD bottle are to have a label affixed which is clearly marked “Not to be flushed”

5.13.3 Equipment

- PPE – non-sterile gloves and facial protection
- Howard Kelly clamps for ICC, 3 way tap for PPC
- 1 x sterile 50mL luer lock syringe loaded with 10mL 0.9% sodium chloride for irrigation
- Large dressing pack.

5.13.4 Procedure

- 1) Turn 3 way tap off to the patient and TOWARDS the Pleural Pigtail Drain
- 2) Connect a 50mL luer lock syringe loaded with 10mL 0.9% sodium chloride
- 3) Turn the 3 way tap off to the UWSD (ie: turned on to the patient)
- 4) Gently aspirate and then instil the 0.9% sodium chloride into the PPC ie: towards the patient
- 5) Turn the 3 way tap off to the patient and disconnect syringe
- 6) Replace bung if required
- 7) Return tap to neutral position
- 8) Document the procedure and outcome in the clinical notes and document the additional 10mL of 0.9% sodium chloride on the UWSD chart – ensure the entry is made across the line so that the flush is clearly documented



- 9) If the UWSD is not oscillating post flushing, inform the doctor and wait for instruction on unblocking procedure.

5.14 UNBLOCKING AN ICC OR PPC

5.14.1 Indications

- Blocked ICC or PPC in patient with pleural effusion or empyema ONLY
- Flushing of ICC and PPC for any other conditions is CONTRAINDICATED
- Medical request for unblocking of ICC or PPC must be documented in the clinical notes prior to attempting the unblocking procedure.

5.14.2 Contraindications

- Do not attempt unblocking if the patient is receiving Positive Pressure Ventilation (patient may require a new chest tube)

5.14.3 Equipment

- PPE - non sterile gloves and facial protection
- Howard Kelly clamps for ICC, 3 way tap for PPC
- ICC - 3 x sterile catheter tip syringes each loaded with 30mL 0.9% sodium chloride for irrigation
- PPC - 3 x sterile 50mL luer lock syringes each loaded with 30mL 0.9% sodium chloride for irrigation
- Large dressing pack.

5.14.4 Procedure

- **ICC**

- 1) Clamp ICC near patient above connections.
- 2) As per ANTT guidelines
- 3) Disconnect UWSD tubing and connect catheter tip syringe loaded with 0.9% sodium chloride
- 4) Unclamp and gently aspirate the tube, then instil the 0.9% sodium chloride
- 5) Gently aspirate the 0.9% sodium chloride from the ICC
- 6) Clamp the tube and remove the syringe
- 7) Reconnect to UWSD
- 8) Remove clamps
- 9) Repeat the process with another 0.9% sodium chloride loaded syringe if indicated
- 10) Document the procedure and outcome in the clinical notes.

- **PPC**

- 1) Turn 3 way tap off to the patient
- 2) Ensure there is a bung attached to the 3 way tap port
- 3) Disconnect the bung and connect a 50mL luer lock syringe loaded with 10mL 0.9% sodium chloride
- 4) Turn 3 way tap to neutral position
- 5) Gently aspirate the PPC, then instil the 0.9% sodium chloride
- 6) Gently aspirate the 0.9% sodium chloride from the PPC



- 7) Turn the 3 way tap off to the patient and on to the drain, push the fluid into the drain
- 8) Turn the 3 way tap off to the patient and disconnect syringe
- 9) Connect new bung and return tap to neutral position
- 10) Repeat the process with another 0.9% sodium chloride loaded syringe if indicated
- 11) Document the procedure and outcome in the clinical notes and document the additional 30mL of 0.9% sodium chloride on the UWSD chart.

5.15 REMOVAL OF ICC

5.15.1 Indication

- Cessation of bubbling and oscillation (Pneumothorax)
- Minimal amount of drainage (effusion/empyema)
- Re-expansion of lung has been confirmed by CXR

5.15.2 Limitations for Practice

- RNs who have not performed this procedure before must:
 - Have completed appropriate education (contact CNC Respiratory or accredited Clinical or Nurse Educator if in doubt)
 - Have observed ICC removal by another RN or MO
 - Perform the procedure under strict supervision until a safe level of competency is achieved (determined by the supervising RN).

5.15.3 Equipment

- PPE, Dressing pack, sterile gloves, Facial protection
- 0.9% Sodium Chloride sachet
- 2 Howard Kelly clamps
- Stitch cutter
- Materials for an occlusive dressing, either:
 - Gauze or elastoplast
 - Transparent occlusive dressing

5.15.4 Procedure

If there is no mattress suture insitu it is recommended that the MO be consulted and a mattress suture is considered.

- 1) Two RNs must be present for this procedure - one to remove the drain and the other to close the skin or pull the mattress suture.
- 2) The Treating Medical Officer (MO) must document confirmation for removal in the notes
- 3) Confirm need for ICC removal by removing suction from the bottle and observing - no bubbling, swinging or significant drainage should be present
- 4) Complete a "Clinical procedure safety checklist level 2
- 5) Ensure INR <1.5 or platelets >50 x10⁹/L
- 6) Confirm MO written order and presence post chest CXR is ordered. Chest X-ray to be completed within 2-4hrs
- 7) Ensure patient receives appropriate pain relief.
- 8) Explain procedure and reassure the patient throughout the procedure



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- 9) Have the patient practice breath holding several times prior to the procedure – as the patient to take 3 deep breaths hold it, advise patient when to exhale
- 10) Clean insertion site using ANTT. If there are two tubes to be removed, remove the basal first then the apical.
- 11) Clamp the chest drain above the connection with 2 Howard Kelly clamps. **DO NOT clamp the ICC if patient is receiving Positive Pressure Ventilation. In this case, remove drain on the most positive pressure cycle of ventilation (end inspiration).**
- 12) Cut anchor suture - if mattress suture is insitu, cut it at the distal end
- 13) Place the occlusive dressing near to insertion site prior to removal of tube
- 14) Have the patient practice breath holding again
- 15) Remove the tube in a smooth and expedient manner
- 16) If a mattress suture is in place the other RN will immediately tie both distal ends in a firm knot close to the skin before applying the dressing
- 17) If there is no mattress suture the second RN will simultaneously apply the dressing and aim to ensure the site is sealed and airtight
- 18) Apply direct pressure to the site

5.15.5 Post removal procedure

- Perform vital signs hourly for 4 hours and then 4hourly for 24 hours post procedure as per BTF
- Observe for complications – haemorrhage, subcutaneous emphysema and the redevelopment of pneumothorax (pain, shortness of breath, increased respiratory rate and decreased air entry, reduced oxygen saturations)
- Signs for redevelopment of pneumothorax may not be obvious
- Ensure post removal X-ray is taken between 2 – 4 hours of removal unless clinically indicated due to deterioration of the patient post removal of the drain and prompt review by medical officer
- Dispose of drain and bottle in the contaminated waste receptacle
- Document removal and outcome in clinical notes.

5.16 REMOVAL OF PPC

5.14.1 Limitations for Practice

Accredited RN as per ICC

5.16.2 Equipment

As for ICC, no clamps required.

5.16.3 Procedure

- 1) Confirm no bubbling, swinging or significant drainage
- 2) Confirm Treating MO orders and CXR had been ordered
- 3) Administer pain relief as clinically indicated
- 4) Complete a Clinical procedure safety checklist level 2
- 5) Ensure INR <1.5 or platelets >50 x10⁹/L
- 6) Explain procedure to patient
- 7) Ensure 3-way tap is in the neutral position and suction is disconnected



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- 8) Have the patient practice breath-holding before procedure – ask patient to take 2-3 deep breaths and hold it, advise the patient when to exhale.
- 9) Clean insertion site as per ANTT
- 10) Cut anchor suture
- 11) Have the patient take 2 deep breaths and ask patient to hold
- 12) Using a smooth motion remove the pleural pigtail catheter at the same angle in which it was inserted, have the patient exhale
- 13) Place an occlusive dressing over insertion site.
- 14) Apply direct pressure to site.

5.16.4 Post Removal

- As for ICC

5.17 REMOVAL OF SELF RETAINING PPC

Refer to [SGH-TSH CLIN 040 Pigtail Drain- Insertion, Removal and Care of the Radiologically Placed](#)

6. Cross References	<p>NSW Health PD2017_032 Clinical Procedure Safety ACI Pleural Drain in Adults: A Consensus Guideline SGH-TSH CLIN 040 Pigtail Drain- Insertion, Removal and Care of the Radiologically Placed ACI Training Video Insertion of a Pleural Drain via Seldinger Technique</p>
7. Keywords	Respiratory, Underwater Seal Drain, UWSD, Chest drain
8. Document Location	Respiratory
9. External References	<p>ACI Pleural Drain in Adults: A Consensus Guideline, 2014 British Thoracic Society, Pleural Disease Guidelines, 2010 Ekpe, E.E., Uduma, F., Umoh, V., Ikpe, M.C., Eyo, C. and Akpan, A.F., 2019. Comparison of Large-bore Intercostal Catheter and Small-Bore Ambulatory Pleural Drain in the Management of Pleural Effusion. <i>International Journal of Innovative Research in Medical Science (IJIRMS)</i>, 4(05). Jany, B. and Welte, T., 2019. Pleural effusion in adults—etiology, diagnosis, and treatment. <i>Deutsches Ärzteblatt International</i>, 116(21), p.377. Malik, V., Kiran, U., Chauhan, S. and Makhija, N., 2018. Transcutaneous nerve stimulation for pain relief during chest tube removal following cardiac surgery. <i>Journal of anaesthesiology, clinical pharmacology</i>, 34(2), p.216. Menegozzo, C.A.M. and Utiyama, E.M., 2018. Steering the wheel towards the standard of care: proposal of a step-by-step ultrasound-guided emergency chest tube drainage and literature review. <i>International Journal of Surgery</i>, 56, pp.315-319. Millar, F.R. and Hillman, T., 2018. Managing chest drains on medical wards. <i>Bmj</i>, 363. Tran, Q., Mizumoto, R. and Mehanna, D., 2018. Management of extensive surgical emphysema with subcutaneous drain: a case report. <i>International journal of surgery case reports</i>, 44, pp.126-130. Van Miert, C., Dwan, K., Hill, R., Hoenig, M.R., Gruen, R.L. and Semple, M.G., 2017. Suction versus no suction for chest drain management. <i>The Cochrane</i></p>



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	<p><i>Database of Systematic Reviews, 2017(11).</i></p> <p>Walker, S.P., Keenan, E., Bintcliffe, O., Stanton, A.E., Roberts, M., Pepperell, J., Fairbairn, I., McKeown, E., Goldring, J., Maddekar, N. and Walters, J., 2021. Ambulatory management of secondary spontaneous pneumothorax: a randomised controlled trial. <i>European Respiratory Journal</i>, 57(6).</p> <p>Zhou, J., Chen, N., Hai, Y., Lyu, M., Wang, Z., Gao, Y., Pang, L., Liao, H. and Liu, L., 2019. External suction versus simple water-seal on chest drainage following pulmonary surgery: an updated meta-analysis. <i>Interactive cardiovascular and thoracic surgery</i>, 28(1), pp.29-36.</p>
10. Consumer Advisory Group (CAG) approval	Not applicable
11. Implementation and Evaluation Plan	<p>Implementation: Revised document published on the intranet and communicated to staff via the CPIU Clinical Governance Documents report.</p> <p>Evaluation: Incidents reviewed on a case by case basis and IIMS monitored for adverse events.</p>
12. Knowledge Evaluation	<p>Q1. What equipment is required by the bedside post insertion? A1. Equipment required at bedside:</p> <ul style="list-style-type: none"> •2 Howard Kelly clamps for each ICC •Bottle frame or carrier •UWSD observation chart •Transpore tape or leukoplast to secure all connections. <p>Q2. How often should observations be attended? A2. Outlined in section 6.6</p> <p>Q3 <i>What procedure must take place before insertion of UWSD and who should be involved</i> A3 <i>Complete clinical procedure safety checklist 2</i> <i>Dr and Nurse involved throughout the procedure</i></p> <p>Q4. <i>How much lignocaine 1% without adrenaline should a patient receive</i> A 4. <i>Lignocaine 1% at a maximum of 3mg/kg</i></p>
13. Who is Responsible	<p>Directors of Nursing Director of Medical Services</p>



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Approval for: UNDERWATER SEAL DRAIN (UWSD) MANAGEMENT AND CHEST DRAIN INSERTION SGH			
Nurse Manager	Meredith Birth, Nurse Manager Medicine Date: 29.09.2022		
Medical Head of Department	Dr Alexandra Smith, Respiratory HoD Date: 29.09.2022		
Safe Use of Medicines Committee (SGH)	Chairperson: A/Prof Winston Liauw Date: 16.11.2021		
Executive Sponsor	Dr Heidi Boss, Director of Medical Services SGH Date: 09.11.2021		
Contributors to CIBR development	<table border="0"> <tr> <td>Mary Dunford Respiratory CNC Non Bennett CT CNE Sarah Jones ICU CNC Gary Fermanis, Cardiothoracic HOD Steven Lindstrom, Respiratory HOD Ben Kwan, Respiratory Medicine Kelly Wright, CNC ED TSH Maria Burrow, NE Respiratory</td> <td>Ben woods ICS CNC Sausa Sadanandan Respiratory CNS2 A/Professor Amany Zekry, HoD Gastroenterology Dr Yizhong Zheng, Respiratory Physician</td> </tr> </table>	Mary Dunford Respiratory CNC Non Bennett CT CNE Sarah Jones ICU CNC Gary Fermanis, Cardiothoracic HOD Steven Lindstrom, Respiratory HOD Ben Kwan, Respiratory Medicine Kelly Wright, CNC ED TSH Maria Burrow, NE Respiratory	Ben woods ICS CNC Sausa Sadanandan Respiratory CNS2 A/Professor Amany Zekry, HoD Gastroenterology Dr Yizhong Zheng, Respiratory Physician
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Revision and Approval History

Revision and Approval History				
Revision Date	Revision number	Reason	Coordinator/Author (Position)	Revision Due
Jun 2006	3	New	Nursing Practice Committee with CNC Respiratory, SGH in collaboration with Director of Anaesthetics and Director Respiratory Medicine	
Aug 2011	5	Review	CNC Respiratory SGH	Aug 2014
Sep 2015	6	Review	CNC Respiratory SGH Dr Ben Kwan, Respiratory Medicine	Oct 2018
Jun 2018	7	Review	CNC Respiratory SGH Dr Ben Kwan, Respiratory Medicine	Jul 2021
Jul 2021	8	Review	CNC Respiratory	Jul 2021
Nov 2021	9	Update and review of clinical practice	Mary Dunford, CNC Respiratory	Nov 2024
Sep 2022	10	Relative contraindication updated	Mary Dunford, CNC Respiratory	Nov 2024

General Manager's Ratification	
Name: Paul Darcy (SGH)	Date: 26.11.2021



APPENDIX 1: ATRIUM OASIS DRY SUCTION DRAIN FOR UNDERWATER SEAL DRAINAGE

Process

- Atrium Oasis dry suction drains may be used as an alternative to traditional UWSD.
- Following open heart surgery Atrium Oasis dry suction chest drain may be attached to pleural, pericardial and mediastinal drains.

Assessment & documentation

- UWSD observation chart is commenced on all patients who are attached to Atrium Oasis Dry suction chest drain
- Following open heart surgery the Cardiothoracic Intensive Care Unit (CICU) flow chart is used to document hourly drainage from the pleural, pericardial and mediastinal drains. Hourly for the first 24 hours and then 2nd hourly for a further 24 hours or until removed.

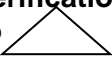
Indications

- Re-establishing normal vacuum pressures by removing air and fluid in a closed one way system thereby restoring normal pressures within the lung.
- Following open heart surgery and chest trauma chest drains are required to remove any pooling of blood in the mediastinal cavity, which may cause cardiac distress or tamponade.

Contraindications

N/A

Equipment

- Personal Protective equipment (PPE).
- Howard Kelly clamps.
- Pre- packaged ATRIUM oasis dry suction chest drainage system.
- Low or high wall suction (**Suction source should provide a minimum vacuum pressure of -80mmHg for a single drain and greater than -80mmHg when more than one drain is connected to a single suction source. To ensure correct and adequate suction, verification is made via the orange suction monitor bellows. The bellows must expand to  or beyond.**)
- **Low** wall suction gauges are to be used as the majority of low wall gauges at St George hospital reach level of -180mmHg (ensure the low suction gauge reaches -180mmHg).
- If high wall suction is requested by a senior member of the treating medical team it must be clearly documented in the clinical notes.
- **Atrium Oasis dry suction chest drain system may be used with high or low wall suction. However because St George Hospital uses other UWSD systems which are only used with low wall suction, maintaining the use of low wall suction on all chest drains eliminates error and facilitated patient safety.**

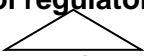
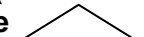
Method

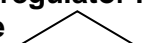
- Procedure explanation to the patient
- Don PPE.



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- Remove Atrium Oasis drain from protective bag.
- Swing the floor stand open ready for set up.
- Add 45mL of sterile water via the blue suction port located on top of the drain. (Pre packaged water supplied within the package located on the back of the Atrium drain). Fill to the 2cm water seal line.
- Liquid will become tinted blue (to improve visibility). Additional water may be added via the grey grommet port at the back of the drain to keep water seal level at 2cm.
- Connect the Atrium Oasis drain to the patient's catheter (prior to initiating suction).
- Ensure blue tubing clamp is open.
- Always place chest drain below the patient's chest in an upright position.
- If suction is required, attach suction tubing to the blue suction port situated on the top of Atrium chest drain.
- Turn on suction source to -80mmHg or higher.
- The **suction control regulator** dial is located on the side of the drain and can be adjusted to any suction level documented in patients notes from -10cmH₂O to -40 cm H₂O

If the suction control regulator is set at -20cmH₂O or above. The orange bellows must expand to the  mark or greater, (when the suction is in use). If this does not occur increase the wall suction until the  has been reached.

If the suction control regulator is set at -10cmH₂O the orange bellows does not need to expand to the  mark (only slight expansion is required).

- Alternatively Atrium Oasis chest drain can be left on gravity or free drainage i.e. not attached to a suction source.
- Secure connections with tape. (figure 3)

Clinical issues

- **Air leak-** A patient air leak is confirmed when air bubbles are observed going from right to left in the air leak monitor.
 - **Continuous bubbling** in the bottom of the water seal air leak monitor will indicate a persistent air leak.
 - **Intermittent bubbling** with float ball oscillation will indicate an intermittent air leak.
 - **No bubbling** with minimal float ball oscillation at the bottom of the water seal will indicate no air leak is present.
- **Connections-** All connections must remain secure at all times.
- **Drainage-** View drainage through the graduated window panelling. Remove drain from suction source once per shift to ascertain correct fluid level, oscillation and bubbling.
- **Verifying water seal:** Water seal must be checked and maintained to a level of 2cm. Water may be added to a self-sealing diaphragm (gray grommet) by a 20 gauge or smaller needle attached to a luerlock syringe. The diaphragm or gray grommet is located on the back of the Atrium Oasis chest drain.
- **Observing changes in patient pressure:** Patient pressure will equal the suction control setting plus the calibrated water seal column level. If patient is on gravity (no suction) patient pressure will equal the calibrated water seal column only.
- **Patient tubing clamp-** Blue clamp on patient tubing must remain open at all times when system is connected to the patient.

- **High negativity float valve** enables any thoracic patient to draw as much intrathoracic pressure as is required for each respiratory cycle. During prolonged episodes of extreme negative pressure the Atrium Oasis drain will automatically relieve excess vacuum to a lower pressure level.
- **Positive pressure release valve-** is located on the top of the drain and will open instantly to release accumulated positive pressure i.e. this valve will automatically prevent tension pneumothorax during accidental suction line occlusion. The valve is tamper-resistant and offers maximum air flow. **DO NOT** obstruct the positive pressure valve.
- **Manual high negativity vent-** When patient is on suction, use this vent to lower the patient pressure or lower the height of the water seal column (this may be used when patient suction has been reduced from -40cmH₂O to -20cmH₂O)
DO NOT use if patient's drain is on gravity or when suction is not operating.
- **Sampling patient drainage-** samples can be taken in accordance with the approved hospital infection control policy. A leur port can be found on the patient tube connector. Alcohol swab the leur port, attach luerlock syringe (needleless), and withdraw fluid sample.

