



ACI NSW Agency
for Clinical
Innovation

CONSENSUS GUIDELINE

Pleural Drains in Adults

ACI Respiratory Network



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Cover image: Preparing a patient for insertion of the pleural drain in the triangle of safety

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The Agency for Clinical Innovation (ACI) recognises the unique position of Aboriginal people in the history and culture of NSW. The ACI would like to acknowledge the traditional owners of the lands referred to in this report. We would also like to acknowledge and pay respect to elders of the communities covered in this report.

Firstly we would like to express sincere thanks to the large number of people involved in consultations for this project who gave willingly of their time, experience and stories so that this report can truly reflect consensus for safe practice and support clinicians and acute facilities to implement improved care processes for management of adults with a pleural drain.

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Thanks also to the Department Respiratory Medicine, Western Sydney Local Health District for permission to include Pleural Procedures Training Form as an appendix.

The Agency for Clinical Innovation (ACI) is the lead agency in NSW for promoting innovation, engaging clinicians and designing and implementing new models of care.

All ACI models of care are built on the needs of patients, and are underpinned by extensive research conducted in collaboration with leading researchers, universities and research institutions.

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Introduction

The *Pleural Drains in Adults – Consensus Guideline* has been developed with the aim to improve the care provided to adult patients with a pleural drain in NSW acute hospital facilities. The recommendations contained within this document may also be suitable for older adolescents requiring pleural drain insertion. The need for this consensus guideline has arisen from concerns raised by respiratory clinicians related to instances of suboptimal and unsafe clinical management of adult patients with pleural drains within NSW acute facilities. The clinician concerns were substantiated through a Clinical Excellence Commission review of 185 pleural drain related incidents reported in NSW (2010/11) which showed that two thirds were attributed to suboptimal clinical management.

The Agency for Clinical Innovation (ACI) Respiratory Network convened a Pleural Procedures group comprising respiratory physicians and respiratory clinical nurse specialists in 2012. The ACI Pleural Procedures Group identified the need for appropriate and safe care of patients with a pleural drain to be detailed in a consensus guideline. The guideline describes aspects of clinical care, clinician skills and processes within a facility that if followed will reduce the risks associated with the insertion of pleural drains (non-emergency), ongoing management, trouble shooting and removal of pleural drains in adult patients.

The British Thoracic Society Pleural Disease Guidelines 20101-8 are widely accepted by respiratory clinicians as the key evidence based guidelines for the investigation and management of pleural disease including specific pleural drain procedures in adults. The ACI Pleural Drains in Adults – Consensus Guideline describes aspects of care that fall outside the Pleural Disease Guidelines.

The recommendations for clinical care outlined in this consensus document are available to be incorporated into local clinical resources with the aim to support health care professionals and facility managers within NSW Local Health Districts to provide safe and effective care of adults with a pleural drain.

Exclusion

Indwelling Pleural Catheters or Tunnelled Catheters are specialised procedures which are performed in dedicated units and as such are considered outside the scope of this document.

Be Aware of the Risks Associated with Pleural Drains

Pleural procedures which involve the insertion of intercostal catheters into the pleural cavity incur a high risk of adverse outcomes including death.

The NSW Clinical Excellence Commission has identified 185 reported incidents related to pleural procedures in NSW from January 2010 to October 2011.

Of the 185 pleural procedure incidents there were Severity Assessment Code (SAC) 1 (n=6) and SAC 2 (n=5) adverse events.

Clinical management was attributed as the principal incident type in 69% of all incidents reported.

Incidents related to pleural drains occurred in both metropolitan and regional facilities and within operating theatres, critical care units, emergency departments, specialised surgical and medical wards, general wards and medical imaging departments.

Ten Pleural Drain Risk Reduction Strategies

1. Do not insert a pleural drain out of hours except in an emergency.
2. Do not proceed with any pleural drain procedure if you do not feel fully confident.
3. Do not proceed with pleural drain insertion without further imaging if air (in the case of pneumothorax) is not confirmed at the time of local anaesthetic infiltration, including at the time of needle decompression if a suspected tension pneumothorax.
4. Do not insert a pleural drain
 - for **pleural effusion** outside the triangle of safety without ultrasound guidance
 - for **pneumothorax** in a position other than 5th intercostal space in the mid axillary line or 2nd intercostal space in the mid clavicular line without ultrasound guidance.
5. Do not proceed with insertion of a pleural drain without ultrasound guidance if fluid (in the case of an effusion) is not aspirated at the time of local anaesthetic infiltration.
6. Do not insert a pleural drain through breast tissue.
7. Do not use force when the guide-wire or intercostal catheter is not moving easily during insertion.
8. In the event of accidental dislodgement or removal of pleural drain - do not re-insert the same tube or a new tube into the previous site .
9. Do not clamp a pleural drain when transporting the patient.
10. Do not clamp a bubbling pleural drain.

Pleural Drains Golden Rules

Clinicians

- In the event that any aspect of a pleural drain procedure starts to go wrong or not as expected, stop immediately and escalate for assistance.
- Thoracic ultrasound should be available and used where intercostal catheters are inserted for drainage of pleural fluid.
- Mandate a 'Time out' period prior to insertion to confirm the correct side and site both clinically and radiologically.
- Check coagulation profile prior to insertion or removal of a pleural drain. Insertion or removal of pleural drain should be avoided in anticoagulated patients until international normalized ratio (INR) <1.5 or platelets >50 x10⁹/L is achieved.
- Ensure that a post insertion chest X-ray is performed within one hour of insertion and reviewed promptly by the Medical Officer (MO) who inserted the pleural drain.

Facilities

- Each facility should reduce to a minimum the number of designated clinical areas where a pleural drain can be inserted.
- Each facility and the relevant clinical location should have a designated 'stop person' whose role is to prevent an inexperienced operator from attempting or continuing to perform a pleural drain procedure without appropriate supervision. This designated 'stop person' should be either a senior or respiratory specialist nurse within the relevant ward or unit.
- Facilities should audit the range of pleural intercostal catheters, drainage systems and equipment that they stock for insertion and after care. There is a prima facie case that reducing the variety will reduce the risk of human error and incorrect equipment being used.
- Facilities are encouraged to reduce to a minimum the numbers of non-critical care areas in which patients with a pleural drain in situ are cared for. It is better to move the patient to a ward where the pleural drain nursing expertise exists (exceptions if patients require care in specialised units e.g. oncology).

Background

The *Pleural Drains in Adults – Consensus Guideline* has been developed by respiratory clinicians with the aim to support clinicians and facility managers to provide a safe standard of care that aims to ensure that optimal patient outcomes are achieved irrespective of where a patient with a pleural drain is being managed within an acute hospital facility.

The insertion of a pleural drain and the ongoing care of patients with a pleural drain in situ carries the potential for significant morbidity and mortality especially when insertion does not proceed as expected or complications occur.

The procedure of inserting a pleural drain into the pleural cavity to drain air or fluid may be performed as a life-saving emergency procedure, as a planned procedure post surgery or as part of the medical management of patients with pleural disease.

Over recent decades this has led to an expanded number of health care professionals from multiple specialties who may be required to insert a pleural drain and provide ongoing care of adult patients with a pleural drain within a variety of settings across acute facilities.

To ensure optimal outcomes for patients with a pleural drain, care needs to be provided by appropriately skilled staff who maintain close vigilance of the patient, pleural drain and under water drainage system and implement appropriate action in the event that complications arise.

The care processes and strategies described in the consensus guideline are available for NSW Local Health Districts to incorporate into local pleural drain protocols or procedure documents.

Section 1

Pre insertion of a pleural drain

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.

Skilled Operators

Medical Officer (MO) Training

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

- an initial theoretical component describing the risks and techniques
- simulated practice
- directly observed supervised practice until considered competent*.
- the trainee should ensure each insertion procedure is documented in their log book and signed by the experienced trainer (Appendix 5: Pleural Procedures Training Form, an extract from the Western Sydney Local Health District Pleural Procedure Log)

- The procedures of inserting a Small Bore Intercostal Catheter by Seldinger technique and Large Bore Intercostal Catheter by blunt dissection should be performed by operators who have competency in the specific insertion procedure and its indications, risks and complications (See Appendix 6 Guidance for assessing competency in pleural procedures for advanced trainees and specialist nurses)
- In the anticipated absence of fluid or air at the time of insertion (e.g. prophylactic drains) the intercostal drain should only be inserted by operators who have been deemed competent in the specific procedure and its indications, risks and complications.

Pleural Drain Endorsed Nurse

A facility endorsed pleural drain nurse (one with prior experience assisting in the insertion of intercostal catheters and the management of pleural drains and UWSD) is present throughout the procedure. See Appendix 6 Guidance for assessing competency in pleural procedures for advanced trainees and specialist nurses.

A procedure safety checklist level 2 is undertaken by MO operator and nurse

- Check correct patient
- Check the correct site both clinically and radiologically
- Consent
- Allergies
- Check anti coagulation status.

*The MO performing the procedure will have been deemed competent through having performed supervised insertions of pleural drains (large bore and/or small bore intercostal catheters) based on operative credentialing systems in place at their respective facility.

OR

MO will have previously witnessed one such insertion AND has present a MO credentialed in large bore and/or small bore intercostal catheter (ICC) insertion (as applicable) **directly supervising the procedure** throughout.

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
- 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.

Thoracic ultrasound guidance

Real time bedside thoracic ultrasound guidance is gold standard for the insertion of non-emergency pleural drains for management of pleural fluid.

Pre-insertion risk assessment

The admitting consultant should be informed prior to the procedure and again informed if there are any complications resulting from the procedure.

The decision to use needle aspiration or pleural drain should consider the operator's experience/ competence in each of these procedures.

Check correct patient, correct site clinically and radiologically.

Obtain written consent (may waiver in emergency situations and critical care areas).

Safe environment

- Insertion of non-emergency pleural drains should not take place out of normal day time working hours
- Pleural aspirations and pleural drains should be inserted in a clean area using full aseptic technique.
- Patient privacy should be respected and wherever possible insertion of a pleural drain should be performed in a specifically dedicated procedure room (as defined by NSW Ministry of Health) or for isolated patients within their isolation room.

Underlying abnormal lung pathology

- Needle aspiration for management of pneumothorax is not recommended as first line management in a patient with underlying abnormal lung pathology
- Differential diagnosis between a pneumothorax versus bullous disease or complete lung consolidation versus large pleural effusion requires careful radiological assessment
- Drainage of a pleural space that has had prior surgical intervention must only be performed after consultation with the patient's cardiothoracic surgeon/consultant physician
- Lung that is densely adherent to the chest wall throughout the hemi thorax is an **absolute contraindication** to pleural drain insertion.

Haemorrhage

- There is significant risk of haemorrhage when inserting a pleural drain in any patient with a coagulopathy or platelet deficiency
- In non-emergency situations, coagulopathy should be corrected prior to insertion of a pleural drain or pleural aspiration
- Insertion of a pleural drain or pleural aspiration should be avoided in anti-coagulated patients until international normalized ratio (INR) <1.5 or platelets >50 x10⁹/L. It is recommended not to give heparin/clexane on the day of insertion or if already administered, to delay insertion until six hours after delivery of the last dose.

Infection

- Antibiotic prophylaxis is not recommended for non-trauma patients requiring a pleural drain
- Antibiotic prophylaxis should be considered for trauma patients requiring pleural drains, especially after penetrating trauma.
- A single dose of cephazolin 2g, given intravenously, provides adequate antimicrobial cover. Where cephazolin is contra -indicated, a single dose of vancomycin 15mg/kg, given by intravenous infusion, is recommended.

Non invasive ventilation (NIV)

In the presence of a pneumothorax, the use of NIV is not contraindicated once the patient has an intercostal catheter inserted with a patent pleural drain which is oscillating and connected to an under water seal drainage system (UWSD) bottle.

Consent and pre-medication

Explain the procedure and associated risks to the patient.

Obtain written consent for the procedure (may waiver in emergency situation and critical care areas).

Consider the need for intravenous (IV) access prior to commencing the procedure.

Record baseline observations – temperature, blood pressure, respiratory rate, pulse and oxygen saturation.

To reduce the pain associated with insertion of a pleural drain, analgesia should be administered as a premedication if required, and should be prescribed for all patients with a pleural drain in place.

Pre-medication

Pre-medication should consist of an opioid to achieve adequate analgesia prior to the commencement of the procedure and if required benzodiazepine for reducing anxiety unless there are contraindications to use. Aim to avoid giving further opioids once benzodiazepine has been administered.

Where both an opioid and benzodiazepine are used, the procedure and immediate post insertion care is recommended to occur in a close observation unit or critical care area.

Sedation

If formal sedation is to be used during the procedure, this should be given in line with recommendations of the Australian and New Zealand College of Anaesthetists for conscious sedation which includes the need for IV access, adequately trained staff and monitoring including oximetry throughout the procedure⁹.

Sedation minimum requirements:

- Patient triage and risk assessment
- Someone to monitor the airway
- Some with bag and mask ventilation skills

<https://www.anzca.edu.au/resources/professional-documents>

Local anaesthetic

- Lignocaine 1% with or without adrenaline, should be infiltrated prior to the procedure paying particular attention to the skin, periosteum and the pleura. Do not exceed the maximum volume of lignocaine
- 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
- 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
- Lignocaine 2% should not be used
- Particular care should be taken in relation to the dose of lignocaine where a pleural drain is required soon after another procedure for which local anaesthetic has been used (especially bronchoscopy or fine needle airway biopsy)
- Infiltrating local anaesthetic. Make sure the patient has no allergies. Using 2-5mls infiltrate the area where the skin incision is to be made. Then pass the needle vertically over the top of the rib (so as to avoid the intercostal nerve/neurovascular bundle), while maintaining a negative pressure on the plunger, until air or fluid is aspirated into the syringe. Withdraw the needle slowly until air or fluid just stops being aspirated. The tip of the needle is now in the extrapleural plane. Withdraw the needle slowly injecting the remaining local anaesthetic as you go. Allow sufficient time for local anaesthetic (LA) to take effect before commencing insertion.

Confirm the site for drain insertion

The marking of a site using thoracic ultrasound for subsequent remote aspiration or pleural drain insertion is not recommended.

Real time bedside ultrasound imaging, wherever available, should be used to select the appropriate site for pleural drain placement.^{3, 10}

A CXR must be available at the time of drain insertion unless the patient is in shock or has haemodynamic compromise from the tension pneumothorax. In this instance, an urgent CXR should be obtained after needle decompression.

A pleural drain should not be inserted without further image guidance if:

- the expected free air (in case pneumothorax) or fluid (in case of pleural effusion) cannot be aspirated with a needle at the time of inserting the local anaesthesia
- the expected free air is not evident at the time of needle/cannula decompression of suspected tension pneumothorax.

Triangle of safety

Insertion of a pleural drain should be made within the triangle of safety (Figure 1) with the following potential exceptions:

- where breast tissue covers the triangle of safety and insertion would require the drain to pass through breast tissue
- when an ultrasound assessment has defined a better position for access to a pleural effusion
- the mid clavicular line is considered more appropriate for management of pneumothorax.

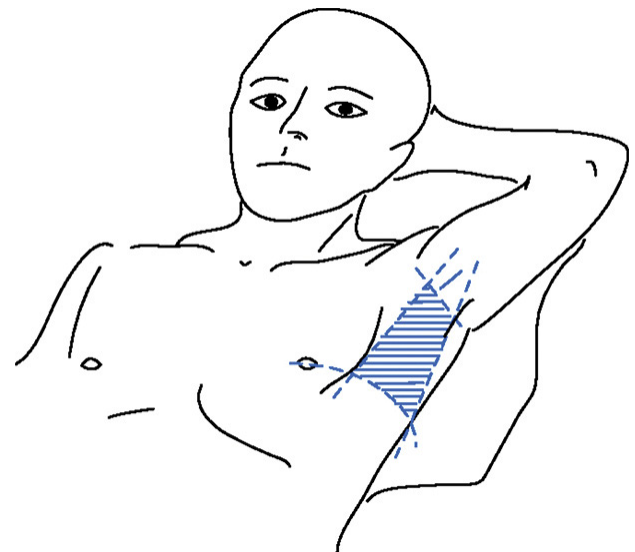


Figure 1: Triangle of Safety

Havelock T et al. Thorax 2010;65:i61-i76

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Position the patient

The preferred position for standard pleural drain insertion is on the bed, head and trunk elevated 30-45 degrees and slightly rotated, with the arm on the side of the lesion behind the patients head or on the hips to expose the lateral decubitus position. (Figure 2).

An alternative is for the patient to sit upright leaning over an adjacent table with a pillow under the arms or in the lateral posture.

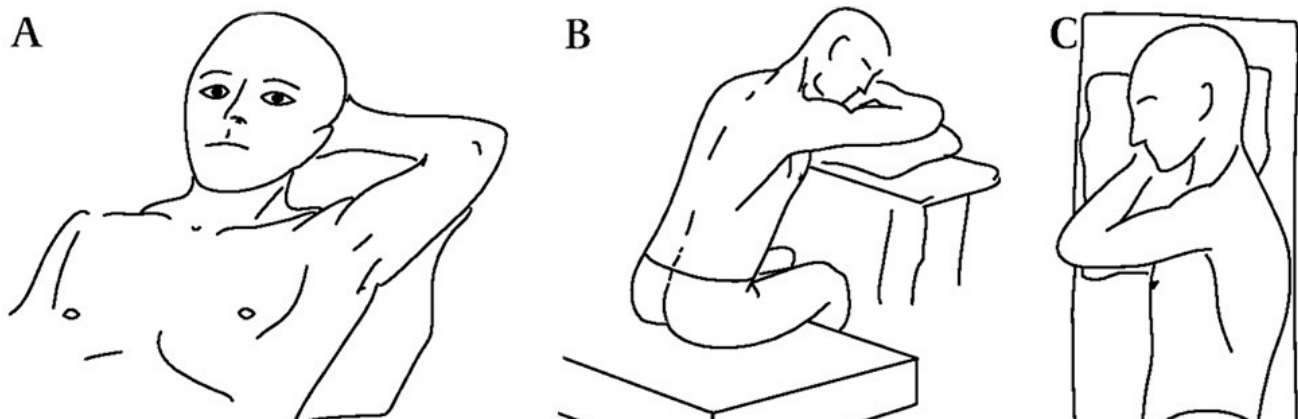


Figure 2: Common patient positions for chest drain insertion

Havelock T et al. Thorax 2010;65:i61-i76. Copyright © BMJ Publishing Group Ltd & British Thoracic Society.

Tube selection

Tube selection for non-emergency pleural drains should be made in consultation with the admitting medical officer.

Types of Pleural Drains

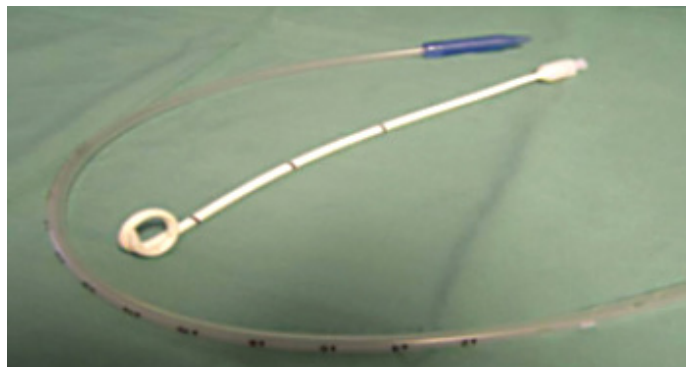


Figure 3: Large Bore Intercostal Catheter and Pleural Pigtail Catheter

Small Bore Pleural Catheters +<20Fr

Indications: spontaneous pneumothorax: free flowing pleural effusions or empyema¹¹⁻¹³.

Small bore catheters may include straight catheters or pigtail catheters with or without an indwelling tension mechanism.

The procedure is less painful for the patient but there is increased risk of tube blockage and failed drainage

Large Bore Intercostal Catheter (ICC) >20Fr

Indications: haemothorax, acute trauma, open thoracostomy, post cardiothoracic, oesophageal or spinal surgery.

Exclusion

Indwelling Pleural Catheters or Tunnelled Catheters are a specialised procedure that is performed in dedicated units and therefore considered outside the scope of this document.

Pleural Pigtail Catheters have a variety of locking mechanisms.

Facilities should ensure that information related to type of pigtail drain and locking mechanism in use is available for relevant clinicians.

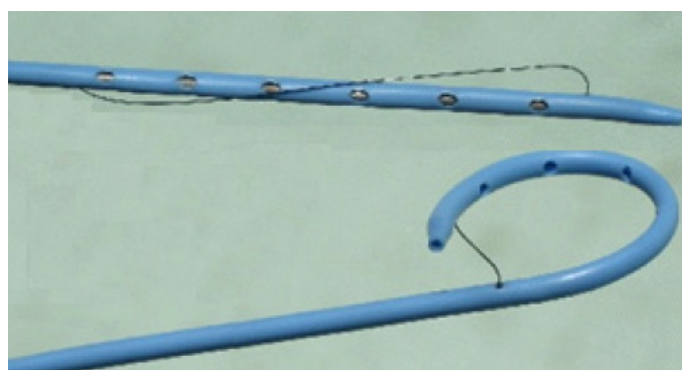


Figure 4: Pigtail drain with thread formation of pigtail shape

Table 1: Tube Selection in adults

Pleural Drain Insertion Technique	Haemothorax	Pleural Effusion	Pneumothorax	Pyothorax Empyema
Blunt Dissection Large Bore	Size >20 Fr	Size >20 Fr	Size 24 Fr traumatic only	Size >20 Fr
Seldinger Technique Small Bore	Not applicable	Fine bore tube for low viscosity effusions only	8-14 Fr or Small bore only	Size ≥14 Fr

Section 2

Insertion of a pleural drain

Equipment required for pleural drain insertion

- Large or small bore kit as applicable
- Sterile gloves and gown
- Skin antiseptic solution (e.g. iodine or 2% chlorhexidine in 70% alcohol)
- Sterile drapes
- Gauze swabs
- A selection of syringes and needles (19-25 gauge in adults)
- Local anaesthetic (e.g. lignocaine 1%)
- Scalpel and blade
- Suture kit
- Suture (stout and non-absorbable /1.0 - 2.0 silk or prolene)
- Instrument for blunt dissection if required (curved clamp)
- Guide wire and dilators for Seldinger technique
- Chest tube
- Connecting tube
- Closed drainage system (including sterile water if UWSD is being used)
- Dressing equipment may also be available in a kit form
- Chest tube clamps (required for small or large bore catheters in the absence of 3 way tap).

Seldinger Technique

Small Bore Intercostal Catheters ≤ 20 Fr

Includes straight pleural catheters or flexible pigtail catheters.

(*New intercostal catheters > 20 Fr which may be inserted with Seldinger technique are available for use in a limited number of facilities. In this instance, operators should follow local facility protocols and specific manufacturer's instructions.)

- Due to the need to insert a needle into the pleural space blindly, it should only be inserted into the pleural space at a site known to be free of underlying lung or cardiac structures
- Do not proceed without further imaging if air (pneumothorax) or fluid (pleural effusion) is not confirmed at the time of local anaesthetic infiltration.

Immediately prior to the procedure ensure:

- Time Out check has been completed
- Baseline observations including SpO₂ are taken and recorded
- Supplemental oxygen is administered
- The patient has received adequate analgesia
- SpO₂ continuous monitoring is in place
- The small bore catheter kit is present.

Summary Flowcharts

- Appendix 1: Insertion of Chest Drain (Havelock T et al. Thorax 2010; 65:i61-i76)
- Appendix 2: Diagnostic algorithm for the investigation of a unilateral pleural effusion (Hooper C et al. Thorax 2010; 65:ii4-ii17)
- Appendix 3: Management of Spontaneous Pneumothorax (MacDuff A et al. Thorax 2010; 65:ii18-ii31)

Insertion site

Wherever available the choice of insertion site for a pleural drain should be made based on real time ultrasound guidance. This may be done immediately prior to the procedure at the bedside (as long as the patient's position during the chest drain insertion remains the same as during the ultrasound) or ultrasound may be performed during the procedure if the machine is appropriately set up before hand and a sterile sleeve is used for the ultrasound probe.

The marking of a site using thoracic ultrasound for subsequent remote aspiration or pleural drain insertion is not recommended.

Where real time ultrasound guidance is not used, the insertion site should only be

- within the triangle of safety
- above the mid-clavicular line in the second intercostal space (pneumothorax only).

Sterile procedure

Perform hand hygiene: aseptic technique requires operator to use mask, sterile gown and gloves. Apply aseptic skin prep widely around the insertion site and allow three minutes to dry. Drape widely.

Local anaesthetic

- Infiltrate local anaesthetic widely around the insertion site and down to the pleural space
- Injection of local anaesthetic into the pleura (also allowing confirmation of the presence of air/fluid) is advisable
- Do not inject again into the tissues once pleural fluid has been aspirated into the local anaesthetic syringe
- Allow at least five minutes for local anaesthetic to work.

Insertion Procedure

(Note: some aspects of insertion will depend on the specific kit used).

- Attach the needle to the stop syringe
- Insert the needle firmly and confirm the position is within the pleural space by aspirating air (pneumothorax) or fluid (effusion). Then proceed to pass the guidewire through so at least half the wire is in the pleural cavity. Avoid insertion of excess guidewire as this may increase the risk of kinking
- Remove the assembly needle and pass an 8-14 Fr dilator over the wire to create a tract
- Be aware that a standard dilator fully inserted can reach mediastinal structures and therefore the dilator should be inserted over the wire only so far as to allow its greatest diameter to have passed through the full chest wall. Chest wall width can and should be measured by real time bedside ultrasound or can be estimated at the time of instilling the local anaesthetic or the kit needle (using the depth of insertion at which fluid or air is aspirated)
- Remove the dilator (leaving the wire in situ) and pass the catheter over the wire into the pleural cavity. Ensure all drainage holes of the catheter are completely within the pleural cavity. Consider utilizing the markers on the catheter to estimate how far the catheter will need to be inserted as this may avoid kinking of the catheter and the subsequent need for removal of sutures and withdrawal of the catheter
- Remove the guidewire and close the stop cock to ensure that no air enters the pleural cavity
- Secure to the skin with suture. Use a silk 0 or 1-0 suture. Place a 'stay' suture to close the skin incision at the site of insertion which includes adequate skin and subcutaneous tissue to ensure it is secure
- The ends of this suture are left long, then wrapped tightly and repeatedly around the chest tube and tied securely. The sutures must be tied tightly enough to avoid slippage
- Secure the drain by taping to the skin at another site. This does not replace the need to stitch the drain firmly in place

- Dress with water permeable transparent dressing so the insertion site is visible at all times
- A suture to close the wound is not usually required for small bore pleural drain
- When the tube is inserted to drain fluid, inclusion of a three-way tap is possible for some drain types which will facilitate sterile flushing of the catheter
- Observe the five moments of hand hygiene.
- Do not insert pleural drain through breast tissue
- Mark the 5th intercostal space in the mid axillary line (or use the site identified by real time ultrasound). As a rule of thumb in male adults, use a hand's breadth lateral to and no lower than the nipple
- Trocars should not be used.

Confirm drain position

A chest x-ray should be performed within 1 hour and reviewed by the inserting MO within four hours to confirm the tube position and successful drainage of air/fluid.

Document the procedure in patient's medical record and medication chart

- Sedation given and total volume local anaesthetic instilled
- Depth of insertion and any complications
- Type of tube inserted including serial number and bar code
- Method of drain fixation and wound closure
- Suture or locking mechanisms for removal / to be disabled before removal

Blunt Dissection

Large Bore Intercostal Catheter >20 Fr

- Large Bore Intercostal Catheters should only be inserted by operators who have specific competency in this technique
- The technique of 'finger sweep' to confirm the absence of pleural adhesions is unreliable in inexperienced hands and should be only be performed by experienced operators
- Thoracic ultrasound should be utilized to confirm the position of the pleural collection/ pneumothorax. This may be done immediately prior to the procedure at the bedside (as long as the patient's position during the chest drain insertion remains the same as during the ultrasound) or ultrasound may be performed during the procedure if the machine is appropriately set up before hand and a sterile sleeve is used for the ultrasound probe

Immediately prior to the procedure ensure that:

- Time Out check has been completed
- Baseline observations including SpO2 are taken and recorded
- The patient has received adequate analgesia
- SpO2 continuous monitoring has commenced.

Blunt Dissection Procedure

- Perform hand hygiene
- Aseptic technique – everyone in the room should wear a mask. The operator requires, sterile gown and gloves in addition to a mask
- Clean the skin and apply 2% chlorhexidine skin prep or equivalent from at least the nipple line to the posterior axillary line. Allow the prep to dry fully. Drape widely
- Infiltrate local anaesthetic widely around the incision site and down to the pleural space. Allow five minutes for local anaesthetic to work. If insufficient analgesia, obtain a new syringe of local anaesthetic and re-inject to a maximum of 20mL of 1% solution (healthy 70kg adult male)
- Do not inject into the tissues once fluid has been aspirated into the local anaesthetic syringe
- Do not proceed without further imaging if air/fluid is not confirmed at the time of local anaesthetic infiltration in the pleural space
- Incise the skin (along the rib or perpendicular to the rib) to a sufficient length to allow passage of finger or tube
- Place two sutures in the optimal position in preparation for securing the drain following insertion

- Blunt dissect tissue to pleural space using Harrison-Cripp forceps. When dissecting, it is helpful to imagine where you want the tip to lie once it is placed, and to make your dissection in that direction as the tube will generally follow the tract that you have prepared for it
- It is difficult to anaesthetise the parietal pleura. Addition of more clean local anaesthetic (total within the maximum volume limit) at this point may be required
- Blunt dissect into the pleural space. Take care at this stage to ensure that you are dissecting towards the same intercostal space. It is easy for the skin to ride up or down one space
- Insert the tube into the tract formed by blunt dissection. It may help to clamp the tube using the distal part of the forceps to achieve insertion. In spontaneous breathing patients clamping the UWSD end of the tube may also be helpful to prevent loss of fluid or air whilst securing the connections
- Insert the tube to ensure the most distal tube hole is within the pleural space. If possible, direct the tube tip basally to collect fluid or apically to collect air but this is not critical if there are no areas of loculation
- Attach the tube to an UWSD which has been set up per manufacturer's instructions
- Release the clamp (if used) from the distal tube once connected to UWSD
- Suture the skin to close any gaping. A mattress suture or sutures across the incision are usually employed and, whatever closure is used, the stitch must be of a type that is appropriate for a linear incision. Complicated purse string sutures are not to be used as they convert a linear wound into a circular one that is more painful for the patient and may leave an unsightly scar
- A horizontal mattress suture straddling the tube should be tied loosely with a significant length of suture
- The tube should be secured using a separate deep suture tied at the skin
- The ends of this suture are left long, then wrapped tightly and repeatedly around the chest tube and tied securely. The sutures must be tied tightly enough to avoid slippage
- Secure the drain by taping to the skin at another site. This does not replace the need to stitch the drain firmly in place
- Include adequate skin and subcutaneous tissue to ensure it is secure
- In the case of a pleural effusion, fluid may be collected for diagnosis:
 - pH - Blood gas syringe
 - Blood culture - 2x Blood Culture bottles
 - Cytology - 2x Heparinised cytology bottles
 - Microbial culture and sensitivity (MC&S) - 2x MC&S yellow jars 1 red, + purple/yellow blood tubes
- Apply a sterile occlusive dressing
- Secure all connections with zinc tape or equivalent
- Observe the five moments of hand hygiene.

Confirm drain position

A chest x-ray should be performed within one hour and be reviewed by the inserting MO within four hours to confirm the tube position, exclude new pneumothorax and confirm the successful drainage of air or fluid.

Document procedure in patient's medical record and medication chart

- Sedation given and total local anaesthetic instilled
- Depth of insertion and any complications
- Type of tube inserted including serial number and bar code
- Method of fixation and wound closure
- Sutures that are required to be removed before tube removal.

Pleural drain complications

- Tension pneumothorax
- Trauma to intrathoracic structures, intra-abdominal structures and intercostal muscles
- Re-expansion pulmonary oedema
- Haemorrhage
- Incorrect tube position
- Blocked tube
- Pleural drain falls out
- Subcutaneous emphysema
- Infection.

Preventing a pleural drain from falling/pulling out

- Insert chest drain so the proximal holes are well inside the chest wall
- Secure drain with a deep suture to skin, wrapped tightly around the tube to prevent slippage
- Secure the drain at a second site by taping to the skin
- Ensure adequate length of tubing to the under water drain to minimise traction on the chest tube
- Care when transferring patient from bed to bed/ bed to chair
- Patient education.

Drain malposition

- If malposition of a pleural drain is suspected, a CT scan is the best method to determine position. If access to urgent CT scan is not available, arrange an urgent repeat CXR and urgent review
- A chest drain may be withdrawn to correct a malposition but should never be pushed further in.

Re-expansion pulmonary oedema

- Typical clinical signs of re expansion pulmonary oedema include shoulder tip pain, coughing, a sudden drop of blood pressure and/or oxygen saturations and increased respiratory rate and distress
- A maximum fluid drainage of 1.0 -1.5 litres per hour is recommended to reduce the risk of re-expansion pulmonary oedema
- In patients of small stature or those with complex comorbidities, provision should be made for setting the maximum aspiration volume at less than one litre, or specify an initial volume, clamp and wait time before proceeding to drain
- Define and document maximum anticipated hourly fluid drainage based on the individual clinical need for a pleural drain. The MO should be notified if maximum output is exceeded over two consecutive hours

Recommended actions if haemodynamic instability or severe hypoxemia suspected to be related to re expansion pulmonary oedema are present:

- Prevent further air or fluid drainage
- Administer high-flow oxygen
- Place a rapid response call.

Drainage systems

A pleural drain should be connected to a drainage system that contains a valve mechanism to prevent fluid or air from entering the pleural cavity. This may be an UWSD, Heimlich valve or other recognised mechanism.

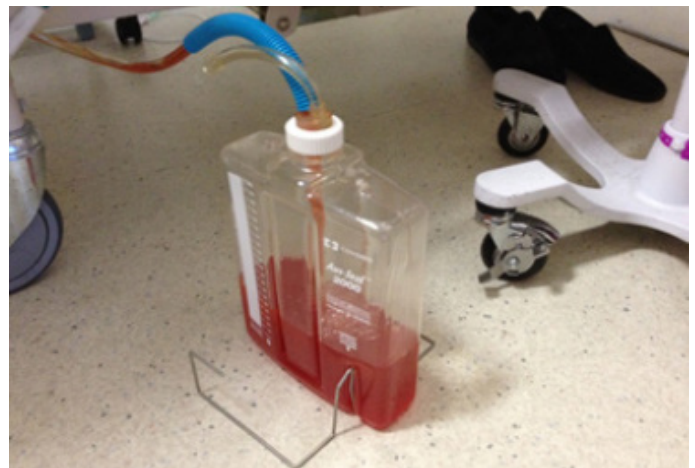


Figure 5: Underwater seal drain

Immediate care post insertion of pleural drain

Observations

Frequency

Commence immediately post insertion.

Continue frequently (< 30 minutes) until the patient is stable and drainage volumes are within specified limits.

Then continue every 30 minutes for two hours.

Then hourly for four hours.

Once stable continue observations 4/24.

Patient observations

Closely observe respiratory status for signs of respiratory distress.

Check that air entry is equal and the trachea is midline

Blood pressure (BP), Temperature, pulse, respiration (TPR), SpO₂

Pleural drain observations

Drainage: oscillation: air leak: suction (if applicable) and insertion site (Full description – see Section 3)

In adults >100mls of blood drained within 1-2 hours is very significant and must be reported to MO as the loss may need to be replaced.

Record pleural drain observations on an UWSD chart

Secure the drain and connections

The drain itself should be secured with a suture after insertion to prevent it from falling out. The chosen suture should be stout and non-absorbable (silk or prolene) and it should include adequate skin and subcutaneous tissue to ensure it is secure.

Commercially available dressings which fix to the skin and then attach to the drain may also be used. It should be emphasized that, whilst these dressings are useful for stabilizing the drain at the skin and preventing kinking at the skin surface, they do not replace the need to stitch the drain firmly in place.

The use of an omentum tag of tape or specific device (Flexitrak) is recommended as this allows the tube to lie a little away from the chest wall which will prevent the tube kinking and reduce the pain experienced by the patient due to tension or dragging at the insertion site.

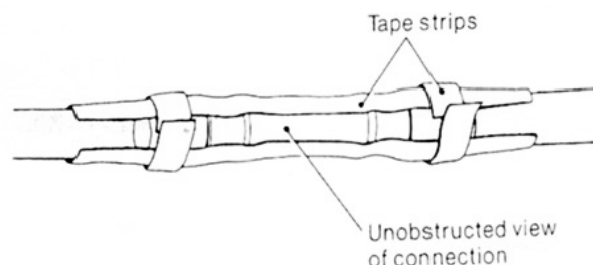


Figure 7: Connecting intercostal catheter to drainage tubing

The connections between the intercostal catheter and drainage tubing should be secured with non-stretch tape to prevent dislodgement. Taping should be applied to allow the connection point/s to be clearly visible.

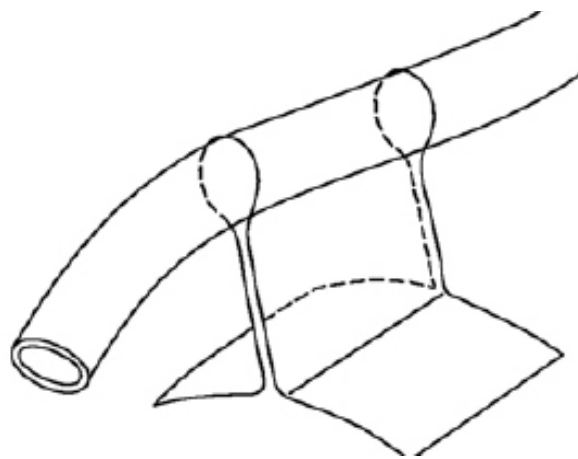


Figure 6: The omental tape technique
Havelock T et al. Thorax 2010;65:i61-i76.
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Insertion site dressing

Large amounts of tape and padding to dress the site are unnecessary and may restrict chest wall movement and/or increase moisture collection. A transparent dressing allows the wound site to be inspected by nursing staff frequently for leakage or infection. (See Figure 10: Insertion site dressings in Section 3.)

Section 3

Management and trouble shooting of pleural drains

If multiple drains are present, label each drain so that they can be easily identified (e.g. apical or basal drain).

- All patients with a pleural drain should be cared for by a medical or surgical team experienced with intercostal catheter management and nursed on a ward familiar with the care of intercostal catheters and drainage systems
- The UWSD should be kept below the level of the patient's chest at all times
- Reassure the patient frequently and reinforce their need to adhere to the correct UWSD position
- Provide adequate pain relief whilst a pleural drain is in situ.

Equipment required at bedside

- Clamps (for emergency use only) – the type and number as per facility or unit protocol (Howard Kelly: smooth angle bladed clamps)
- Bottle frame or carrier (if not inbuilt in the UWSD system)
- UWSD observation chart
- Non stretch tape to secure all connections.

Receiving a patient with an UWSD

Always check the following:

- Ensure the system is set up according to manufacturer's guidelines to accommodate both wet and dry suction systems
- Check all connections and ensure that they are visible and reinforced with non-stretch tape
- Ensure the tubing is long enough to allow the patient to move comfortably without pulling on the tube
- If using a wet seal system, ensure that the underwater seal is activated i.e. that the water level is set as per system instructions, and that the rod is immersed 2cm under the water

- The outlet from the UWSD must be open to the atmosphere to promote escape of any air present within the pleural space. Occluding the outlet can cause tension pneumothorax. The only exception is when low wall suction is applied to the UWSD outlet to restore negative pressure to the pleural space and to promote lung re-expansion
- **Alert Suction.** Set suction control according to the specific drainage system instruction. In the absence of an inbuilt suction control mechanism, use low pressure wall suction 3-5 kpa and set to the correct pressure as ordered
- In hospitals where high level wall suction gauges are available, these should be changed to low suction gauges before any suction is applied to an UWSD system which requires low range 3-5 kpa.



Figure 8: A low wall suction unit which displays both mmHg and Kpa.

Low wall suction refers to 20mmHg or 3 Kpa.

Staff should take care to accurately read suction pressure when selecting low wall suction pressure as mmHg or Kpa on the dial.

Transferring a patient with an UWSD

Transfer of Care must be in line with bedside handover requirements and include verbal and written documentation.

All patients being transported from Operating Theatre, Radiology or Emergency Department with an UWSD bottle must have a RN escort or Enrolled Nurse (EN) who is accredited to care for UWSD.

- **Never** clamp an UWSD tube while transporting a patient
- The UWSD bottle/s needs to remain below the patient's chest at all times
- MO must document if a patient can come off suction for transfer to and the duration of a procedure. In the case of CXR – a portable CXR will be required unless removal of suction and adequate time off suction has been documented by MO
- If suction is required during a procedure – arrangements must be made for suction to be set up prior to transfer
- For showering a patient, extension tubing may be applied to existing tubing or a MO must document that suction may be paused during showering
- Large bore catheter attached to UWSD must have clamp(s) available on transfer – note for use only in an emergency situation
- Small bore catheter can use the three way tap (if present) or locking mechanism for use in an emergency situation during transfer
- Provide handover including instructions on care of the specific UWSD.

Observations

Patient Observations

Frequency – minimum four hourly

Physical assessment to include particular attention to the respiratory status:

- observe for the development of respiratory distress
- chest auscultation to listen for bilateral air entry
- RR, SpO₂, HR, BP, temperature and capillary refill
- pain assessment
- record baseline observations of the drainage system
- bowel motions when narcotic and codeine based analgesia is ordered.

Observation of UWSD

Regular and accurate observation of air leak, oscillation and drainage which is documented on an UWSD chart is essential.

Limitations for Practice. Observations are performed by an RN or EN (an EN must be specifically instructed in the procedure and the RN remains responsible reviewing the observations and for interpretation of measurements). See Appendix 6 Guidance for assessing competency in pleural procedures for advance trainees and specialist nurses.

- Observations are recorded on UWSD Chart (See Appendix 7, Chest drain observation chart)
- Frequency recommended hourly
- Check insertion site and tube for dislodgement each time UWSD observations are performed to ensure patient safety
- Measure and record depth of ICC insertion at the skin 4/24
- If suction is applied – check suction is set at the correct pressure

Air leak

Air leak is indicated by bubbling in UWSD bottle.

A sudden large volume air leak may indicate bronchopleural fistula.

Sudden cessation of air leak may indicate malfunction of UWSD system – look for tube occlusion, tube disconnection, patient sitting on the tube or kinking.

Documenting air leak

++++	Large amount, bubbling all the time e.g. large pneumothorax, large excessive intra thoracic pressures on inspiration and expiration.
+++	Moderate amount, bubbling on every spontaneous expiration, or positive ventilated breath in patients receiving mechanical ventilation.
++	Minimal amount, bubbling when talking or small air leak, occasionally on spontaneous or ventilated breath (mechanical breath).
+	Bubbling on forced expiration e.g. cough.
Nil	No Bubbles.

Oscillation (Respiratory Swing)

Oscillation reflects changes in intrathoracic pressure during breathing and is indicated by movement of fluid in the tube.

Oscillation is observed when the patient is NOT on suction.

Record oscillation as present - it is not necessary to quantify oscillation.

When suction is applied:

- Removal of suction for observations should only be performed when this is clearly defined and documented within a unit or facility protocol and the instruction and frequency is clearly documented.
- Oscillation does not occur when suction is applied (UNLESS patient has had major thoracic surgery with large intrathoracic volumes).
- Where a patient is on suction, staff generally do not disconnect from suction to check for oscillation but document 'on suction' on the UWSD observation chart. Measurement of fluid level in UWSD must be performed on suction and documented as such.
- Removal of suction breaks the seal and delays patient progress.

Absence of Oscillation

If Oscillation is absent, it may mean one of four things:

- The patient is lying on the tube, leading to occlusion of the drain
- The tube is blocked. If examination reveals no kinking and changing the patient's position does not rectify the problem, the absence of a swing should be reported to the medical officer
- The chest tube has been dislodged and is no longer within the pleural space
- The lung has fully expanded.

Drainage

The amount and appearance of fluid is recorded on UWSD chart.

Table 2: How to measure and record drainage

Amount of drainage	Drainage type
<ul style="list-style-type: none">Drainage is measured as level above the 0 ml marking on the bottleThe amount is accumulativeTotal drainage returns to 0mls when the bottle is changedAmount drainage should decrease over a 48 hour periodIf >100 mls of blood drained post procedure/surgery in 1-2 hours this is very significant and must be reported to an MO as the loss may need to be replaced.	Record appearance HS = Haemoserous HP = Haemopurulent P = Purulent S = Serous

Draining of a large metastatic or pneumonic pleural effusion

- A large effusion should be drained in maximum volumes of 1000 -1500 mls at one time, with lesser volume limits applicable dependent on patient weight and physical condition. Greater drainage than the defined maximum amount may lead to re-expansion pulmonary oedema
- Typical clinical signs of re expansion pulmonary oedema include shoulder tip pain, coughing, a sudden drop of blood pressure and/or oxygen saturations and increased respiratory rate and distress
- Normal practice is to drain a pre- determined amount, then clamp or turn off drain for 15 minutes and reassess the patient. If patient observations show no deterioration, unclamp and continue to drain
- If signs of patient deterioration, call for urgent MO review or escalate for clinical review or call for a rapid response as applicable
- The drain should not be left clamped over prolonged periods of time with haemorrhagic or pus effusion as it may lead to a blocked drain.

Tube patency

Ensure adequate tube length to allow safe movement but avoid looping of tubing which could lead to a “fluid lock” in the tube.

Ensure patient does not lie on the tube.

Check tubing for presence of clots or fibrinous material each time observations are performed. If present follow specialized unit or facility protocol in relation to orders for:

- flushing (pleural effusion or empyema only)
- changing the drain
- milking - gently and intermittently compressing and releasing the ICC between fingers whilst moving toward drainage bottle.

Check Connections

All pleural drains and UWSD connections should all be checked each time the observations are performed to ensure the tube has not dislodged and that all connections remain secure and taped.

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 but rarely in large amounts in normal circumstances.

It is characterised by the feeling of “crackling” or “rice bubbles” on palpation and /or a change in voice.

Surgical emphysema starts at the site of insertion of the drain and can spread.

Tracing a line around the border of the subcutaneous emphysema can be used, in combination with other observations, to indicate 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 (in severe cases) can cause changes to a patient’s voice and facial appearance. It is vital that staff reassure the patient and carers that their upper airway will not obstruct.

Surgical emphysema may be treated conservatively, or by applying suction, or a new pleural drain may need to be inserted. In the surgical setting applying suction to the drainage system is almost always required.

Table 3: Pleural drain emergencies

If an intercostal catheter (ICC) falls out Do not attempt to re insert the existing pleural drain

1	Pinch the skin edges together with a gloved hand
2	Ring for assistance
3	Redress drain site with Vaseline infused gauze and an appropriate dressing <ul style="list-style-type: none">• occlusive pressure for pleural fluid• gauze dressing secured on three sides for pneumothorax
4	Notify MO
5	Document incident and vital signs especially respiratory rate
6	Observe and reassure the patient

If the bottle or ICC becomes disconnected

1	Cross clamp the tubing closer to the patient than the disconnection
2	Reconnect system to a new drainage bottle
3	Unclamp ICC
4	Notify MO
5	Observe and reassure the patient
6	Document vital signs especially respiratory rate

Table 4: Trouble shooting UWSD and tubing problems

Air bubbles	
Possible Cause	Action
Normal at end expiration in spontaneously breathing patient with pneumothorax	Normal – no action required
Normal at peak inspiration in ventilated patient with pneumothorax	Normal – no action required
Continuous bubbling on suction may indicate: Disconnected or loose system Displacement of pleural catheter Bronchopleural fistula if on positive end expiratory pressure (PEEP)	If continuous bubbling, briefly clamp ICC close to the patient's skin. If bubbling is still obvious, clamp at intervals down the ICC to identify the site of the leak. If disconnection identified re-secure catheter and drainage bottle connection to overcome mechanical leak and then reconnect. If bubbling ceases during initial clamp, check insertion site as drainage eyelets may be outside of body or stab wound is too large. Apply Jelonet to ensure site is occluded and notify MO. If the cause cannot be identified – notify MO
Frothing of fluid	
Possible Cause	Action
Large pleural leak	If on suction. Add an overflow bottle between UWS and suction outlet to prevent fluid entering the suction unit Instil simethicom 1ml into drainage bottle
Cessation of bubbling	
Possible Cause	Action
Re-expansion of lung	Notify MO: CXR to confirm lung re expansion
Blocked ICC/disconnection	Check for clots: follow unit protocol Check for kinking – straighten Check for disconnections – reconnect Perform and record patient assessment Perform and record patient observations If not resolved notify senior MO Escalate as per Between the Flags
Oscillation (swing of fluid in rod)	
Possible Cause	Action
Fluid level rises on inspiration & falls on expiration [reverse if ventilated]	Normal – no action required
Cessation of swing	
Possible Cause	Action
Application of suction	Follow unit policy - only if stated disconnect tubing from suction once a shift to ensure swing is still present. Then reconnect as per unit policy.
Re-expanded lung	Nil
Blocked or dislodged pleural drain	Check tube location/depth to ensure not out of pleural space See actions for 'Cessation of bubbling' Perform and record patient assessment. Perform and record patient observations Notify Senior MO Escalate as per Between the Flags

Drainage (fluid loss)	
Possible Cause	Action
Normal or excessive loss	Check amount hourly or more frequently if required Consider need to change bottle, or for suction application
Rapid or excessive blood stained drainage (>100mls/2 hours)	
Possible Cause	Action
Haemorrhage	Measure drainage, record vital signs and immediately report to MO Check for need to change bottle Check need for urgent blood tests including cross match
Cessation of drainage	
Possible Cause	Action
Restoration of normal lung physiology	Notify Resident medical officer (RMO): CXR to confirm lung re-expanded: MO orders to remove drain
Blocked tube	See blocked tube under 'Cessation of bubbling'
Increased fluid level in rod	
Possible Cause	Action
Excessive drainage	see 'Rapid &/or Excessive Drainage'
Suction turned off/disconnected	Check suction orders and resume suction as ordered Check all connections
Bleeding around the insertion site	
Possible Cause	Action
Haemorrhage from small vessels at insertion site	Redress with gentle compression: notify MO: observe for further bleeding
Trauma at insertion site	As above
Drainage tube dislodged from insertion site	Check position of tube eyelets. If external to the skin redress as above and notify MO
Drainage tube inadvertently removed	With gloved hand pinch the sides of the insertion site together and access assistance both medical and nursing to assist and re assess the need for re insertion of new ICC. Do not re-insert the existing pleural drain or new pleural drain via the same insertion site. Aseptically dress the old infection site with an occlusive dressing (effusion) or gauze taped on three sides (pneumothorax). Order CXR

Flushing

Flushing should only to be performed by clinicians that are experienced and accredited by the facility to undertake the procedure.

Indications

- To maintain tube patency in patient with pleural effusion or empyema ONLY
- Flushing of pleural catheters for any other conditions is CONTRAINDICATED
- Flush frequency and volume must be ordered on the medication chart by an MO and administered by an RN competent in the procedure normally 6/24.

Contraindications for flushing fine bore catheters

- An inexperienced operator should not flush a pleural catheter
- Pneumothorax - pleural catheters and drainage bottles for pneumothorax should have a label affixed which is clearly marked 'Not to be flushed'.

Equipment for flushing

- Personal protective equipment (PPE) – non sterile gloves and facial protection
- Flat bladed clamps for ICC, three way tap for pleural pigtail catheter (PPC)
- 1 x sterile 50ml luer lock syringe loaded with 10mls sodium chloride for irrigation
- Chlorhexidine 2% & alcohol 70% swabs x 3
- Large dressing pack.

Flushing procedure

- Turn three way tap off to the patient and TOWARDS the pleural drain
- Perform hand hygiene
- Ensure there is a needleless access device (smart site bung) attached to the three way tap port
- Connect a 50ml luer lock syringe using either of the following two methods:
 - a) disinfect the bung with the alcohol swabs and connect a 50ml luer lock syringe loaded with 10mls of sodium chloride

OR

- b) disconnect the bung, clean with alcohol swabs and connect a 50ml luer lock syringe loaded with 10mls sodium chloride
- Turn the three way tap off to the UWSD (i.e. turned on to the patient)
- Gently aspirate and then instil the sodium chloride into the PPC i.e. towards the patient
- Turn the three way tap off to the patient and disconnect syringe
- Replace bung if required
- Return tap to normal drainage position
- Perform hand hygiene
- Document the procedure and outcome in the clinical notes and document the additional 10mls of sodium chloride on the UWSD chart – ensure the entry is made across the line so that the flush is clearly documented
- The UWSD should oscillate post flushing – if not inform the MO.

Clamping

Clamping a pleural drain is contraindicated in any patient receiving positive pressure ventilation or NIV.

Pleural drains should only be clamped on medical orders in specific circumstances which include:

- post pneumonectomy
- during drainage of large volumes of fluid
- in preparation for removal of large bore intercostal catheters
- for short periods to drain collected fluid from drain system tubing
- for change of bottle and /or tubing
- to assess for air leaks
- if is not possible to maintain the drainage system below the patient's chest e.g. moving a patient from bed to bed.

Unblocking a Pleural Catheter

Indications

- A blocked pleural catheter in patient with pleural effusion or empyema **ONLY**
- Flushing of pleural catheter for any other conditions is **CONTRAINDICATED**
- Medical request for unblocking of pleural catheter must be documented in the clinical notes and medication chart prior to attempting the unblocking procedure.

Procedure

Two RNs must be in attendance, with at least one trained and competent in the procedure. See Appendix 6, Guidance for assessing competency in pleural procedures for advanced trainees and specialist nurses.

Don PPE - non sterile gloves, gown, apron and facial protection.

Table 5: Unblocking large and small bore intercostal catheter

Large bore pleural catheters

Equipment	Procedure
Howard Kelly clamps 3x sterile catheter tip syringes each with 30mls sodium chloride for irrigation Large dressing pack	Clamp ICC near patient and above connections Disconnect UWSD tubing Unclamp and slowly aspirate tube, then instil sodium chloride Gently aspirate sodium chloride from ICC Clamp the tube and remove syringe Reconnect to UWSD Remove clamps and check patency Repeat process with another catheter tip syringe + 30mls sodium chloride if indicated Document the procedure and outcome in clinical notes The UWSD should oscillate post procedure – if not notify MO.

Small bore pleural catheters

Equipment	Procedure
Three way tap port 3x sterile 50ml luer lock syringes each with 10mls sodium chloride for irrigation Large dressing pack	Turn three way tap off to the patient Ensure smart site bung is attached to three way tap port Connect a 50ml luer lock syringe either: <ul style="list-style-type: none"> • directly into disinfected bung • disconnect bung and connect Turn three way tap to neutral position Gently aspirate PPC and then instil sodium chloride Gently aspirate sodium chloride from PPC Turn three way tap off to patient and on to the drain, push fluid into drain Turn three way tap off to patient and disconnect syringe Reconnect bung if required and turn tap to neutral position Repeat the process with another syringe and sodium chloride if required Document procedure and outcome in clinical notes and document additional (up to 30mls) on UWSD chart The UWSD should oscillate post procedure – if not notify MO.

Insertion site dressings

- Observe five moments of hand hygiene within the dressing procedure
- Ensure that when applying a pleural catheter insertion site dressing that the tube does not become kinked
- Ensure the tubing is anchored to the chest wall or abdomen using an appropriate method (statlock or omentum flap)
- Change the dressing at least 48 hourly and prn to keep the drain insertion site clean and dry.

Ensure each dressing applied to a pleural drain insertion site is:

- a key hole dressing /or other dressing that allows easy inspection of the tube exit site from the skin
- applied with the tube exiting from the centre of the dressing with only a small combine (if necessary) below the tube exit site to cushion the tube away from the patient if required
- not excessively bulky as this will prevent close observation and access to the drain site.

Bottle changes

- Performed by two RNs who have been instructed in the procedure (See Appendix 6, Guidance for assessing competency in pleural procedures for advanced trainees and specialist nurses)
- The frequency of drainage system changes is guided by manufacturer's instructions and their specified volumes
- Prepare the new system and ensure water seal is set as per manufacturer's instructions
- Perform hand hygiene
- Full PPE - Don gloves, apron, facial protection and non-sterile gloves
- Clean connections with antiseptic solution
- If no air leak - clamp ICC above the connection for the duration of approximately one breath as UWSD bottle / chamber is changed
- If there is an air leak (indicated by bubbling in the UWSD) do not clamp the catheter but ask the patient to hold their breath while changing the drainage system
- Ensure all connections are secure before unclamping the ICC
- Change bottle/chamber
- Perform hand hygiene
- Document UWSD system change in patient's medical record.

Disposal of drainage

All UWSD bottles /chambers are disposable.

Do not empty the UWSD contents - seal the UWSD unit prior to disposal in a yellow contaminated waste bin.



Figure 9: Insertion site prepared for application of dressing

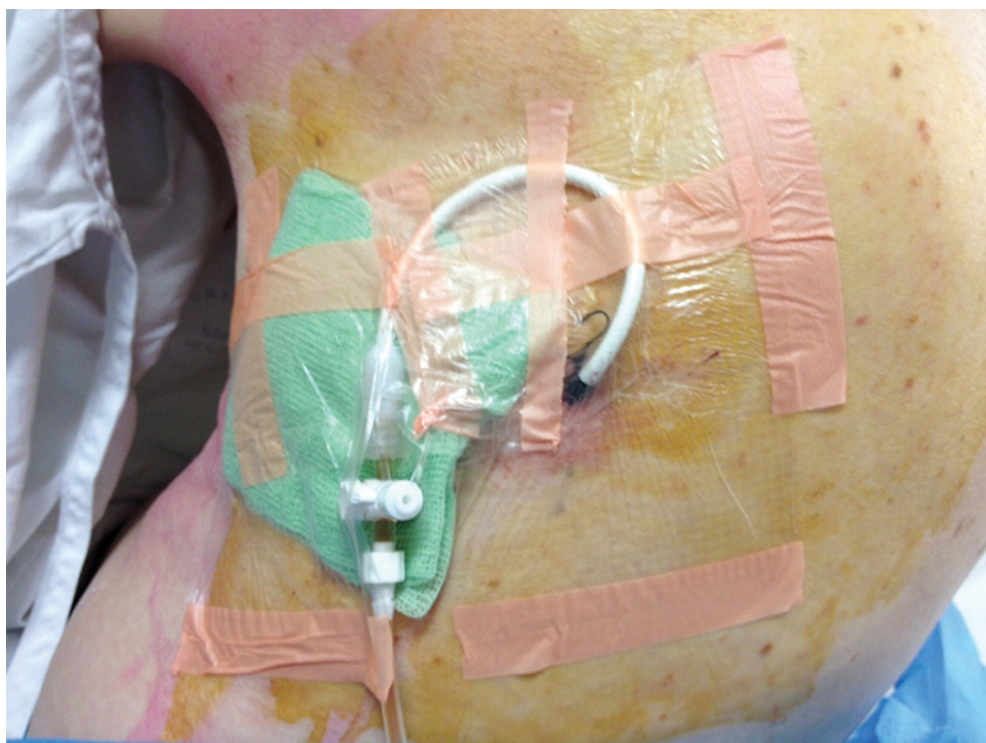


Figure 10: Insertion site dressing completed

Patient activity, hygiene and pain relief

- Select positions for the patient that avoid kinking and occlusion of tubing
- Offer rolled towels or pillows to splint the chest on the affected side as required
- Provide adequate analgesia to patients to enable deep breathing (hourly) and regular range of motion arm exercises on the affected side
- Encourage patients to mobilize several times a day and to sit out of bed for meals
- Avoid pressure areas by regular repositioning the patient and where required the use of bariatric devices
- Apply anti embolic stockings if mobility is reduced
- Advise patient of their responsibilities regarding care of the pleural drain and the need to maintain the drainage system below the chest especially when mobilizing
- Constipation and subsequent straining to empty bowel should be avoided in this patient group
- Patients may shower with assistance – if on suction check with MO if extended tubing is required or if brief discontinuation of suction is preferred for showering
- Refer to physiotherapy if additional mobility assistance is required.

The decision for removal must be documented by the MO in the progress notes.

Pigtail drains must be uncoiled prior to removal. Follow manufacturer's instructions regarding removal of drainage device, distance from the chest to cut the catheter and release the string. Failure to uncoil a pigtail drain prior to removal can cause severe pain and internal tissue damage to the patient.⁸

Prior to drain removal, check INR is ≤ 1.5 and or platelets $>50 \times 10^9/L$.

Check when anticoagulants were last given in all patients with anticoagulation therapy. The risk of haemorrhage will be reduced if removal of the drain occurs more than six hours since last dose of anticoagulants.

Recognise that the perception of the procedure will be unique for each patient.

Section 4

Removal of pleural drain

The decision for removal must be documented by the MO in the progress notes.

Pigtail drains must be uncoiled prior to removal. Follow manufacturer's instructions regarding removal of drainage device, distance from the chest to cut the catheter and release the string. Failure to uncoil a pigtail drain prior to removal can cause severe pain and internal tissue damage to the patient.¹⁴

Prior to drain removal, check INR is ≤ 1.5 and or platelets $>50 \times 10^9/L$.

Check when anticoagulants were last given in all patients with anticoagulation therapy. The risk of haemorrhage will be reduced if removal of the drain occurs more than six hours since last dose of anticoagulants.

Recognise that the perception of the procedure will be unique for each patient.

Indications for removal

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

Skilled operators

Removal of pleural drain may be undertaken by RN and MO who have achieved competence in chest drain management or under the direct supervision of a competent staff member. See Appendix 6, Guidance for assessing competency in pleural procedures for advanced trainees and specialist nurses.

Prior to removal

- Check for written orders for drain removal
- Check INR is 1.5 or less and when anticoagulants were last given prior to drain removal in patients with anticoagulant therapy
- Consider giving analgesia to the patient as soon as the decision for removal is confirmed and documented
- Perform a pain assessment prior to removal and offer analgesia as required
- Check that a recent CXR has been viewed to ensure the lung is re inflated
- Identify if the small bore intercostal catheter has any self-retaining mechanism which will need unlocking /disabling and confirm the appropriate procedure for removing the intercostal catheter and suture
- In the event that releasing the self-retaining locking mechanism does not work, arrange for either patient transfer to radiology for removal or follow the facility endorsed protocol
- Check the facility or unit preference for the specific phase of breathing required when the tube is being removed.

Equipment for removal of pleural drain

- Dressing pack
- Gauze squares x 6
- 0.9% saline for skin cleansing
- Skin closure strips (if no mattress/anchoring suture)
- Scissors to release locking mechanism of a small bore catheter (as applicable)
- Suture cutter
- Occlusive dressing
- Plastic backed protective sheet
- PPE (clinically clean gloves for removal of dressing, impervious gown/plastic apron, eye protection, mask)
- Sterile gloves are required for MO or RN removing the pleural drain and for the RN tying the suture or applying steri-strips and dressing.

Patient preparation

Administer analgesia and wait for it to be effective.

Explain procedure to patient and advise that they may experience a brief sensation of burning or pain as the drain is removed.

Explain how you want the patient to breath during the procedure and get the patient to demonstrate. Note that formal techniques may be difficult to teach and beyond the capability of many patients including those with cognitive or language barriers.

Place plastic backed sheet under the patient.

Position the patient in a semi fowlers to upright position to allow for ease of access to the pleural drain insertion site while maintaining patient privacy and comfort.

Support tubing throughout to prevent tension on the insertion site.

Preparation for removal of pleural drain

Both staff should sight the medical order for removal.

Large bore pleural drains require a closing mattress suture for effective wound closure following removal.

Small bore catheters generally only require suture closure strips or an occlusive dressing.

- Remove the dressing and anchor tape using clinically clean gloves
- Prepare sterile field
- Prepare occlusive dressing
- Discuss the procedure with assistant to ensure a coordinated approach
- Perform hand hygiene
- Don full PPE (gown, mask, gloves, goggles).

Role of the pleural drain remover

Thoroughly cleanse the drain insertion site and the first 10cm of the drain with skin cleansing solution 2% chlorhexidine & 70% alcohol or equivalent.

Dry the area with gauze (to ensure occlusive dressing adheres to skin) identify anchor suture, cut and remove the suture whilst supporting pleural drain.

Hold drain in dominant hand whilst gently pinching the skin at the insertion site with non dominant hand.

Remove the drain swiftly but gently while simultaneously pinching the skin around the insertion site.

There should be no excessive force required to remove the drain. If any resistance is met, STOP the procedure and review the device/procedure for additional sutures or locking device. If resistance continues STOP the procedure and call for senior medical assistance.

Check that the tip of the drain is intact.

Cut excessive suture material, dry skin and apply occlusive dressing, then label with date and time of removal.

Perform hand hygiene.

Document removal in the patient's medical record.

Role of assistant

Encourage the patient to take deep breaths and release muscle tension during exhalation. Continuously reassure the patient during the procedure.

Get the patient to practice the required breathing prior to removal of the drain.

Identify purse string sutures – if present prepare purse suture for tying and ensure there is enough length of suture material to tie with ease.

Pull sutures until insertion wound is sealed – do not pucker the skin.

Tie purse string three times (if present) – double loop tie first knot of purse suture and then tie second and third knot.

Post removal of a chest drain the drain site needs to be closed. This is achieved by either tightening the mattress suture and/or applying steri strips.

If a mattress suture is used to close the drain site, check for gaping and apply steri strip/s if required. Then apply adaptic or gelonet, a sterile gauze and occlusive dressing. The dressing is changed every 48 hours until the suture is removed (generally 7 days).

If steri- strips are used to close the drain site, apply an occlusive dressing. Change dressing every 48 hours and remove when the drain site has healed.

Instruct the patient to breathe normally once the drain is removed.

- Inspect insertion site for signs of local cutaneous sepsis or continued drainage once per shift. Take down an occlusive dressing after 48 hours to inspect site. Reapply occlusive dressing as required.
- Remove sutures at 72 hours post removal or as ordered.

Patient education post removal

Advise the patient and their carer regarding follow up arrangements for the removal of sutures/and dressings as required.

Advise patient and their carer regarding activities that should be avoided following pleural drain drainage - strenuous exercise, carrying heavy objects (>5kg for adults) and lifting objects above head height.

Advise patient and carer that air travel is not permitted until they have medical clearance from a designated specialist.

Advise the patient/and their carer to report any new or increasing symptoms to a health professional:

- **breathlessness**
- **pain on inspiration**
- **pain at insertion site**
- **discharge from drain insertion site**
- **fevers.**

Care after removal of a pleural drain

- Assist patient into a comfortable position.
- Assess patient's condition, including chest auscultation.
- Advise patient to rest quietly for 1 hour or until reviewed
- Arrange a post removal chest x-ray to be performed within 2- 4 hours and prompt review by MO
- Review the dressing for signs of air or fluid leakage daily – reinforce dressing with combines as required
- MO to review post removal chest X-ray and document findings

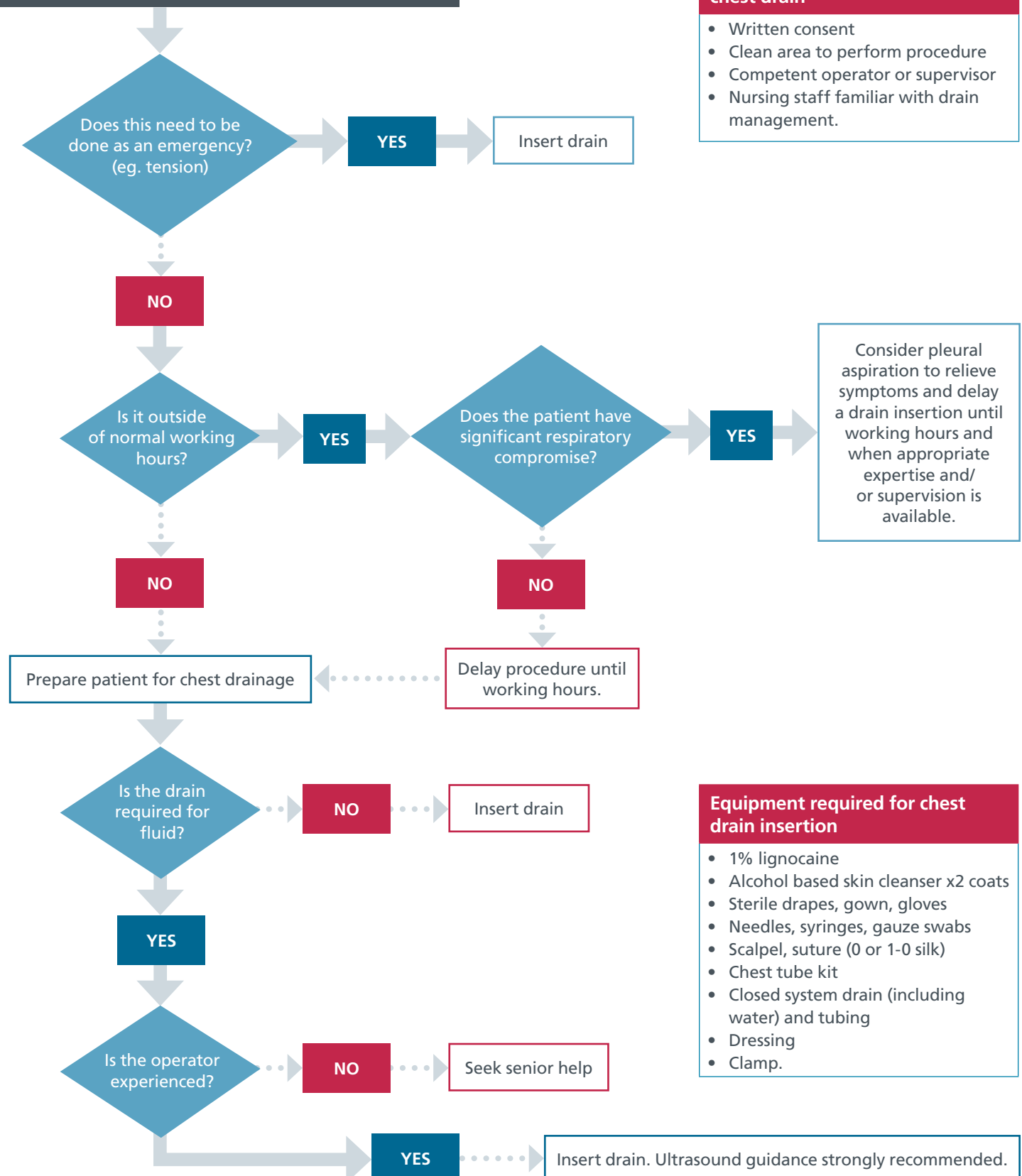
Glossary

BP	Blood pressure
CT scan	Cat scan
CXR	Chest x-ray
EN	Enrolled nurse
FNAB	Fine needle airway biopsy
HR	Heart rate
ICC	Intercostal catheter
INR	International normalised ratio
IV	Intravenous
MC&S	Microbial culture and sensitivity
MO	Medical officer
NIV	Non invasive ventilation
PEEP	Positive end expiratory pressure
PPC	Pigtail pleural catheter
PPE	Personal protective equipment
prn	when necessary [lit. pro re nata]
RMO	Resident medical officer
RN	Registered nurse
RR	Respiratory rate
Sac	Severity assessment code
SpO2	Blood oxygen saturation
TPR	Temperature, pulse, respiration
U/S	Ultrasound
UWSD	Under water seal drainage system

Appendices

Appendix 1 - Insertion of chest drain

Pneumothorax or pleural fluid requiring drainage



Requirements for insertion of chest drain

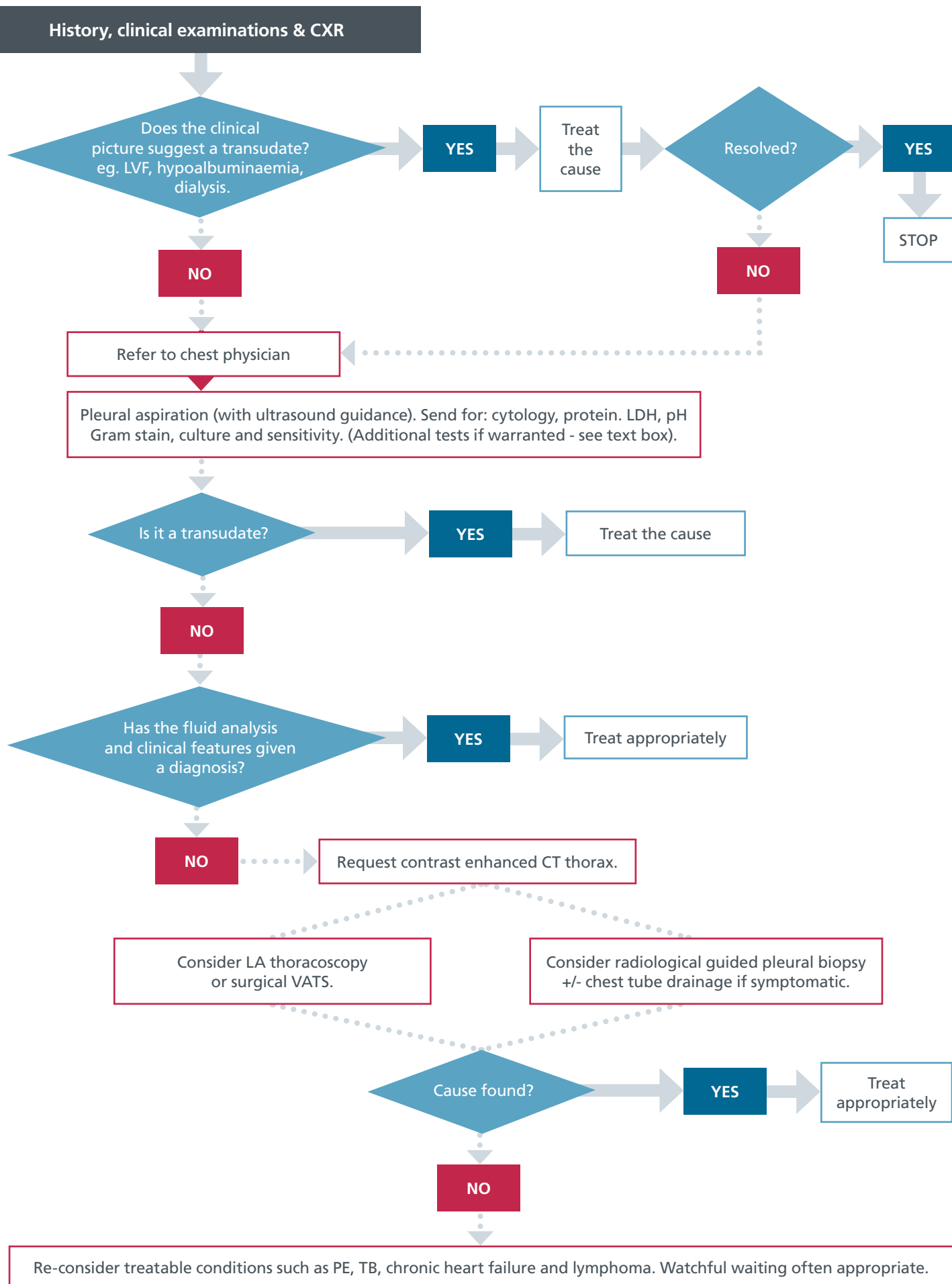
- Written consent
- Clean area to perform procedure
- Competent operator or supervisor
- Nursing staff familiar with drain management.

Consider pleural aspiration to relieve symptoms and delay a drain insertion until working hours and when appropriate expertise and/or supervision is available.

Equipment required for chest drain insertion

- 1% lignocaine
- Alcohol based skin cleanser x2 coats
- Sterile drapes, gown, gloves
- Needles, syringes, gauze swabs
- Scalpel, suture (0 or 1-0 silk)
- Chest tube kit
- Closed system drain (including water) and tubing
- Dressing
- Clamp.

Appendix 2. Diagnostic algorithm for the investigation of a unilateral pleural effusion

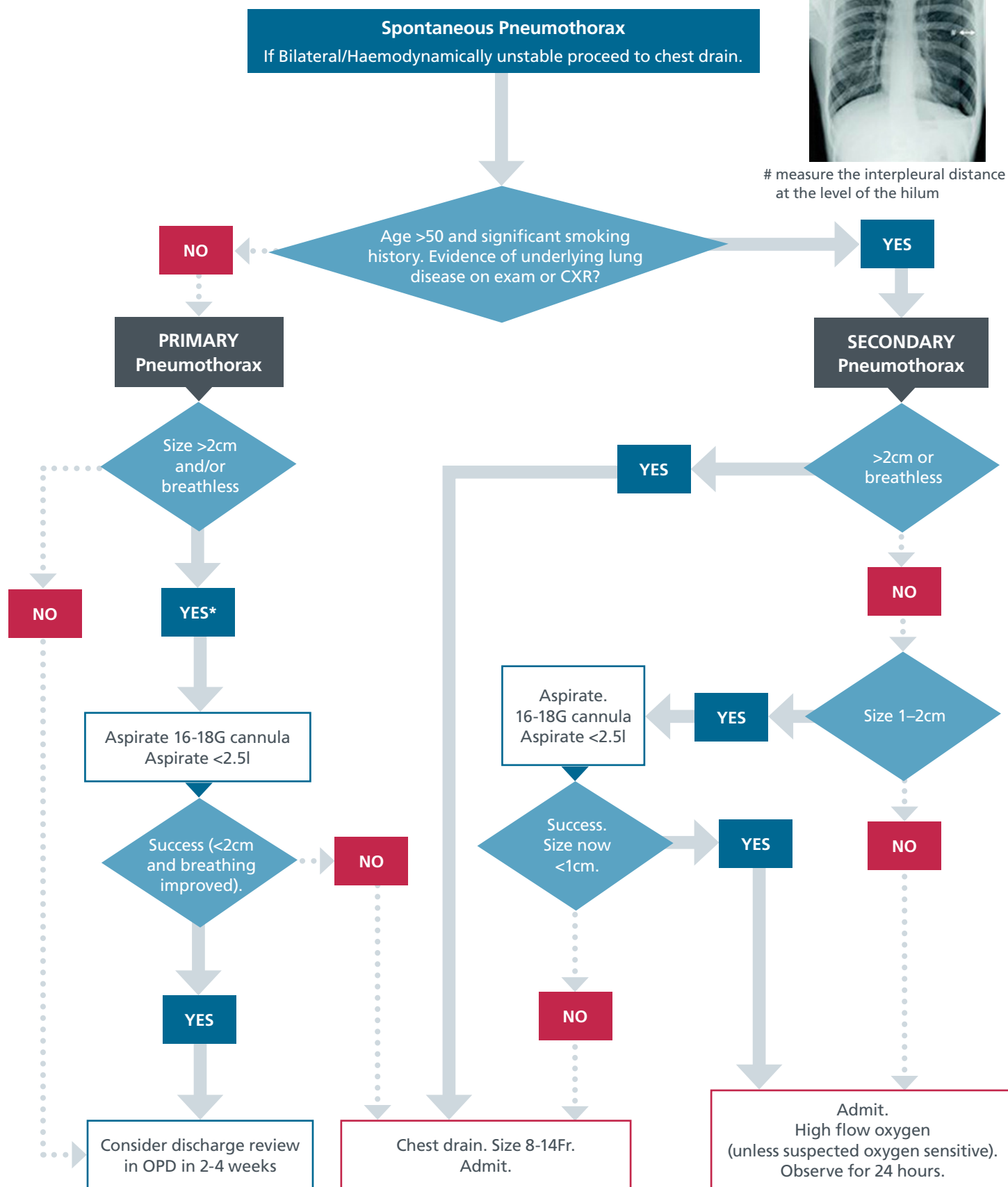


Hooper C et al. Thorax 2010;65:ii4-ii17. Copyright © BMJ Publishing Group Ltd and British Thoracic Society. All rights reserved.

Appendix 3 - Management of Spontaneous Pneumothorax



measure the interpleural distance at the level of the hilum



* In some patients with a large pneumothorax but minimal symptoms conservative management may be appropriate.

Appendix 4 – Local Health District Policies and Procedures

The following Local Health District (formerly Area Health Service) clinical resources were reviewed and content adapted for inclusion in the *Pleural Drain in Adults – Consensus Guideline*.

- Sydney South Western Area Health Service, *Intercostal Catheters (ICC) and Underwater Seal Drains (UWSD) Clinical Manual*, MC_PD2011_422
- St George and Sutherland Hospitals and Health Services (2011), *Respiratory – Underwater Seal Drain (UWSD), Clinical Business Rule* SGSHHS Clin145.
- Sydney Local Health District, *Chest Tubes and Intercostal Catheters Policy*, RPAH_PD2011_034
- Northern Sydney Central Coast, *Underwater Sealed Drains (UWSD) and Intercostal Catheters Guideline – North Shore Ryde HS*, GE2009_063, Nov 2010.

Appendix 5 – Pleural Procedures Training Form

INSERT STICKER HERE

Type of Procedure/Date of Procedure: _____

Indication: _____

Supervisor: _____

Site: _____

Type of Tube: _____

Size of Tube: _____

Technique: ☐ Seldinger ☐ Blunt dissection

Use of Pleural Ultrasound: ☐ Yes ☐ No

Complications: _____

Outcome: _____

Reflections: _____

*Accredited to Perform Procedure Independently?**

☐ Yes ☐ No

Supervisor Signature

* Please review log book to ensure adequate numbers of supervised procedure and technical competency has been achieved.

Department Respiratory Medicine, Western Sydney Local
Health District, 2013

A6: Pleural procedures

Guidance for assessing competency
in pleural procedures for advanced
trainees and specialist nurses

ACI Respiratory Network

A6: Acknowledgements

The Agency for Clinical Innovation (ACI) recognises the unique position of Aboriginal people in the history and culture of NSW. The ACI would like to acknowledge the traditional owners of the lands referred to in this report. We would also like to acknowledge and pay respect to elders of the communities covered in this report.

Special thanks to the ACI Pleural Procedures Education Group for their continual support of the project. The commitment and enthusiasm of current and past working and reference group members was integral to each phase of the Pleural Procedures project. Members showed a willingness to share their knowledge and skills that was very valuable and appreciated by their peers.

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- Erica Meggitt
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A6: Foreword

Pleural procedures that involve the insertion of intercostal catheters into the pleural cavity incur a high risk of adverse outcomes, including death. A review of 185 adverse incidents related to pleural drains in NSW in 2010–11) found that the majority (69%) were attributable to suboptimal clinical management. Incidents related to pleural drains occurred in both metropolitan and regional facilities, and within diverse settings including operating theatres, critical care units, emergency departments, specialised surgical and medical wards, general wards and medical imaging departments.

The *Guidance for assessing competency in pleural procedures for advanced trainees and specialist nurses* resource has been developed by members of the ACI Pleural Procedures Education Group, made up of respiratory physicians, respiratory nurses and managers from metropolitan and regional facilities across NSW.

The aim of the resource is to reduce the risks associated with pleural procedures in adults within all NSW hospitals. The resource defines a consistent standard for education, training and assessment of procedural and clinical skills. It applies to designated medical and nursing staff across clinical streams who are responsible for the insertion of pleural drains and care of adult patients with a pleural drain.

This resource is intended to be used in conjunction with *ACI Pleural drains in adults: a consensus guideline*, which is available from ACI website (<http://www.aci.health.nsw.gov.au/networks/respiratory/pleural-drains>)

The resource is available online for local health districts, special health Networks and clinical streams to review, adopt and endorse as per local requirements. Implementation of the recommendations will need to be tailored to align with the specific casemix and workforce as determined by local clinical streams and managers.

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Section 1

A6: About ACI

The Agency for Clinical Innovation (ACI) works with clinicians, consumers and managers to design and promote better healthcare for NSW.

ACI Clinical Networks, Taskforces and Institutes provide a unique forum for people to collaborate across clinical specialties and regional and service boundaries to develop successful healthcare innovations.

A priority for the ACI is identifying unwarranted variation in clinical practice and working in partnership with healthcare providers to develop mechanisms to improve clinical practice, patient care and outcomes (www.aci.health.nsw.gov.au).

Section 2

A6: Background

Accumulation of fluid or air within the pleural space is common and frequently requires drainage and/or other interventions. Significant and avoidable adverse events related to pleural drainage procedures have been identified via NSW Health clinical incident monitoring systems, of which the majority relate to suboptimal clinical management.

The ACI convened a Pleural Procedures Working Group (comprising clinical expert respiratory physicians and nurses) to lead the development of *Pleural drains in adults: a consensus guideline*. The guideline underwent extensive consultation prior to endorsement and release to the NSW Health system in May 2014.

To support statewide implementation of the guideline within NSW hospitals, the working group members identified the need to develop formal and consistent processes to determine competency for relevant advanced trainees and specialist nurses who are required to insert pleural drains and care for adult patients with a pleural drain.

Section 3

A6: Purpose

The recommendations define a standard for training and assessment of the knowledge and skills clinicians require in order to perform pleural procedures and provide ongoing pleural drain management. The primary targets are advanced trainees and respiratory nurses.

The recommendations relate to a range of pleural procedures including: needle thoracocentesis; closed pleural biopsy; insertion of small and large pleural catheters via Seldinger or blunt dissection technique; medical thoracoscopy; and indwelling (tunnelled) pleural catheters.

While it is recognised that other clinical specialties (including emergency care, critical care, interventional radiology, surgical specialties and paediatrics) may use specialty-specific credentialing processes, this set of recommendations is available for other clinical specialties to freely adopt or adapt for their own use.

The recommendations are intended for use in conjunction with the *Pleural drains in adults: a consensus guideline*, available at <http://www.aci.health.nsw.gov.au/networks/respiratory/pleural-drains>.

Section 4

A6: Aims

The recommendations aim to:

- ensure pleural procedures are performed safely, effectively and without adverse events
- define a standard process for demonstrating that clinicians have undertaken the pleural procedural training and attained the clinical skills required across the range of pleural procedures
- help Local Health Districts and Special Health Networks adopt formal processes to ensure that relevant clinicians have undertaken appropriate pleural procedural training and demonstrated the clinical skills required to perform pleural procedures and care for patients following a pleural procedure
- enhance the pleural procedural experience for both patients and operators.

Some facilities, especially regional hospitals, may lack the full range of sub-specialty clinical services, including respiratory. In this instance, a facility may decide that

the best means of achieving the recommendations is by creating a 'pleural team' or a 'chest drain team' whose members across a range of specialties have the appropriate experience and expertise in pleural procedures. A 'pleural team' may take on the role of auditing pleural procedures and monitoring patient outcomes within the facility.

In circumstances where appropriate expertise is not available within a hospital, formal telemedicine arrangements may be developed between a hub centre and its feeder peripheral hospital which would enable the hub centre to provide an on-call pleural procedure support service.

Section 5

A6: Recommendations for assessing competency in advanced trainees

Each facility is responsible for accrediting advanced trainees for pleural/chest drain management in line with their scope of practice.

Each facility is responsible for ensuring patients undergoing any pleural procedure are managed in a safe clinical environment where medical officers and specialist nurses deemed competent to insert and manage pleural drains are available at all times.

The competency recommendations aim to ensure that all NSW facilities follow a consistent process for educating and training advanced trainees and demonstrating that they have attained competency.

5.1 Advanced trainee pleural drain competency

The essential elements in the process of demonstrating pleural procedural competency are:

- the trainee gaining theoretical knowledge and becoming familiar with the equipment in use
- the trainee learning the physical skills and techniques required to complete the specific procedure
- the supervisor assessing the trainee's competency in pleural procedures
- the trainee participating in quality assurance processes.

5.1.1 Gaining theoretical knowledge and familiarisation with equipment

The advanced trainee should demonstrate satisfactory theoretical knowledge of, and be familiar with, the specific equipment in use before progressing to the practical aspects of procedural training.

This may be achieved by a combination of:

- the supervisor quizzing the advanced trainee to assess their knowledge of anatomy, physiology and pleural disease
- the advanced trainee completing one or more pleural procedure training courses, which include an assessment component (such as those provided by the Thoracic Society of Australia and New Zealand (TSANZ) and the Clinical Training and Evaluation Centre, University of Western Australia)
- the supervisor directing the advanced trainee to access recommended online resources (see section 6.4 E-learning resources).

5.1.2 Learning the procedural technique

Procedural training should occur via incremental experience, beginning with simulation, progressing to practise using models and eventually to performing procedures on patients under supervision.

Competency in less invasive procedures (such as thoracocentesis) should be gained before more complex procedures (such as pleural catheter insertion) are attempted. At each stage, the advanced trainee should demonstrate proficiency before progressing to a subsequent stage.

The emphasis should be on safe and effective technique, rather than on the absolute number of procedures performed. For all procedures, more than one supervised attempt is recommended.

It is expected that, with the variety and increasing complexity of procedures practised and the variable rate of skill acquisition by individual advanced trainees, multiple supervised attempts will be required before proficiency is achieved.

5.1.3 Assessing procedural competency in an advanced trainee

Proficiency and/or competency are not rigidly defined but depend on the supervisor's judgement as to whether the advanced trainee is capable of performing the specific pleural procedure independently.

This judgement will entail specific consideration of all aspects of the pleural procedure, including:

- the decision to perform the procedure
- choice of an appropriate location and timing for the procedure
- obtaining consent for the procedure
- appropriate administration of sedation, topical anaesthesia and analgesia
- completion of Clinical Procedure Level 2 Safety Checklist
- interpretation of contemporaneous imaging
- use of bedside ultrasound to assist a pleural procedure
- maintenance of aseptic technique throughout the procedure
- the procedural technique, including hand-eye coordination
- adherence to local policies and guidelines
- leadership skills and respectful interaction with the assisting staff
- accurate and appropriate documentation
- management of pleural drain complications and emergencies.
- use of an appropriate procedure for removal of the pleural drain.

5.1.4 Quality assurance

The advanced trainee requires insight into their own skill mix and limitations to ensure they know when to seek help and/or abandon a procedure to ensure a safe outcome for the patient. Recording evidence of participation in quality assurance processes, including self-reflection, completion a Pleural Procedure Training log (see ACI Pleural Drain in Adults Appendix 5), quality audit and critical incident monitoring is recommended throughout the training process.

Once deemed competent to perform a specific procedure, the advanced trainee will be formally credentialed for the specific pleural procedure in line with local facility processes.

5.2 Maintenance of procedural skills

Given insufficient evidence on which to base recommendations as to the number and frequency of procedures required each year to maintain clinical competency, this document relies on consensus expert opinion (ACI Pleural Procedures Working Group).

The working group recommends that each year the advanced trainee performs at least one supervised procedure and one procedure performed independently without adverse events.

Involvement in quality assurance processes is also recommended.

5.3 Supervisor roles and responsibilities

The supervisor is a medical officer deemed competent by the healthcare organisation governance bodies to perform pleural procedures.

The role of the supervisor is to:

- ensure that the advanced trainee has acquired appropriate theoretical knowledge
- ensure physical procedural skills are adequate and the advanced trainee is able to demonstrate procedural technique as required
- supervise and observe each procedural attempt until procedural competence is attained, which includes provision of timely and constructive feedback as required
- oversee quality assurance processes and monitor logbook entries
- maintain their own pleural procedural performance skills by periodically updating via peer review, pleural courses or similar means, sufficient to intervene (when necessary) while undertaking a supervisory role.

5.4 Advanced trainee roles and responsibilities

The advanced trainee is responsible for:

- attaining background theoretical knowledge prior to attempting any procedural techniques
- acquiring incremental procedural experience, starting with simulation, models and simple procedures before progressing to complex procedural techniques or applying procedures to patients
- practising pleural procedural techniques with the goal of achieving procedural competence and developing appropriate quality assurance processes
- completing procedures under direct supervision/ observation following the Royal Australasian College of Physicians' training requirements
- documenting procedures and keeping a procedural log book
- accepting and using supervisor feedback to achieve continuous improvement in performance
- maintaining procedural performance skills once credentialed via supervised procedures, independent procedures and assuming the supervisor role for other advanced trainees.

5.5 Inability to achieve competency

Some advanced trainees may not achieve procedural competency by the completion of their training period. Should such a trainee wish to undertake pleural procedures, further supervised training is required. This scenario may increase in frequency as pleural procedures become more specialised and complex.

At present, all NSW respiratory advanced trainees are required to achieve competency in specific procedural techniques and will fail to satisfy training requirements if they do not.

The Guide for assessing competency in pleural procedures for advanced trainees and specialist nurses aligns with:

- Clinical Procedure Safety Standards, NSW Health (PD 2014_36) <http://www.cec.health.nsw.gov.au/programs/clinical-procedure-safety>
- Royal Australian College of Physicians Adult Respiratory Medicine Advanced Training Curriculum. Physician Readiness for Expert Practice (PREP) Training Program. [http://cms.racp.edu.au/docs/default-source/default-document-library/respiratory-medicine-\(adult\)-advanced-training-curriculum-\(pdf\).pdf?sfvrsn=0](http://cms.racp.edu.au/docs/default-source/default-document-library/respiratory-medicine-(adult)-advanced-training-curriculum-(pdf).pdf?sfvrsn=0)

Section 6

A6: Pleural drain education for respiratory advanced trainees

6.1 Pleural Drain Lung School

A dedicated annual NSW Pleural Drain Lung School supported by the Thoracic Society of Australia and New Zealand NSW Branch commenced in 2015. It is recommended that all first-year respiratory advanced trainees attend this training. Training includes background knowledge, quality assurance and practical sessions covering blunt dissection, Seldinger technique, aspirating a pneumothorax and talc pleurodesis.

6.2 Thoracic ultrasound

It is recommended advanced trainees participate in formal thoracic ultrasound training in their first year to attain the skills required to perform real time ultrasound guidance during pleural drain insertion in line with ACI *Pleural drains in adults: a consensus guideline* (<http://www.aci.health.nsw.gov.au/networks/respiratory/pleural-drains>).

6.3 Practical aspects of pleural disease for doctors

The Clinical Training and Evaluation Centre, University Western Australia, provides simulated hospital training experience (<http://www.ctec.uwa.edu.au/>).

6.4 E-learning resources

Recommended online resources include:

- Queensland Chest Drain online resource package (available from TSANZ web public domain): <http://www.thoracic.org.au/professional-information/elearning-course-chest-drain-program/>
- British Thoracic Society *Pleural disease guidelines 2010*: <http://scholar.google.com.au/scholar?q=british+thoracic+society+pleural+disease+guideline+2010>
- ACI *Pleural drain in adults: a consensus guideline*: <http://www.aci.health.nsw.gov.au/networks/respiratory/pleural-drains>
- ACI Video insertion of pleural drain by Seldinger technique: <http://www.aci.health.nsw.gov.au/networks/respiratory/pleural-drains>

6.5 Workplace clinical skills training

Clinical supervisors provide trainees with incremental and individually tailored knowledge and procedural skills training, plus support opportunities for reflective practice and participation in quality assurance processes.

Section 7

A6: Recommendations for assessing competency in nurses

Patients with a pleural drain should be managed in a clinical environment where nurses deemed competent to manage chest/pleural drains are available at all times.

Each facility is responsible for accrediting designated nurses for pleural/chest drain management in line with their scope of practice. The competency recommendations aim to ensure that a consistent process is undertaken for nursing education, training and attaining competency in management of pleural drains within NSW.

7.1 Registered nurse/endorsed enrolled nurse pleural drain competency

Assessment of competency will entail specific consideration of all aspects required for the management of patients with a pleural drain and drainage devices.

7.1.1 Demonstrates an understanding of the fundamental principles of normal breathing and pleural drainage including:

- intrathoracic pressures
- regulatory mechanisms
- indications for insertion and removal of a pleural drain
- principles of chest/pleural drainage systems.

7.1.2 Competently assesses patient and drainage system, including:

- drainage type and amount
- oscillation
- air leak
- patent tube and secure connections
- dressing correct and intact
- appropriate use of suction
- need for bottle change.

7.1.3 Identifies cardinal signs of pleural drain complications and emergencies, including:

- tension pneumothorax
- surgical emphysema
- blocked chest drain
- dislodgement of chest drain
- haemorrhage.

7.1.4 Demonstrates ability to set up equipment, prepare and appropriately manage a patient undergoing a pleural procedure, including:

- understanding the role of an RN assisting the procedure
- obtaining valid consent
- maintaining Clinical Procedure Level 2 Safety Checklist Aseptic techniques and hand hygiene
- pain assessment and ensuring adequate analgesia is ordered
- educating patient and family
- selecting appropriate equipment and assembling it correctly
- recognising and managing complications
- taking pre-, peri- and post-procedural observations
- requirements for transfer and handover.

7.1.5 Displays knowledge of equipment required, current guidelines and procedure for:

- clamping
- flushing
- correct dressing
- changing bottles
- performing observations according to risk and/or the patient's condition
- managing a dislodged pleural drain
- unblocking a blocked drain
- removing a pleural drain.

7.1.6 Maintains effective communication with patient, staff and others, including:

- explaining procedures and interventions to patient and family
- discussing and reporting adverse findings to the medical officer or senior nurses
- appropriately documenting assessment findings on a chest drain chart and within progress notes
- Sharing information related to interventions and management of drainage system with colleagues at handover and when clinically relevant.

Section 8

A6: Pleural drain education for nurses

8.1 E-learning and face-to-face

Recommended resources include:

- ACI Pleural Drain in Adults Consensus Guideline and ACI Video Insertion of Pleural Drain by Seldinger technique: <http://www.aci.health.nsw.gov.au/networks/respiratory/pleural-drains>
- Queensland Chest Drain online resource package (Thoracic Society of Australia and New Zealand website; members only)
- local health district or facility policy or guidelines
- local health district or facility workshops
- ward in-services.

8.2 Practical skills

Practical skills can be gained by:

- observing pleural drain insertion/observations/removal procedures
- simulating pleural drain techniques (if available)
- performing actions under supervision until deemed competent.

8.3 Quality assurance

Opportunities are available for participation in audits, incidence information management system (IIMS) review and feedback.

Appendix 7 – Chest drain observation chart

Purpose

Patients with a pleural drain need regular and accurate observations of the drainage system, tubing and insertion site to ensure the system is working appropriately and to rapidly identify complications.

A review of chest drain charts in use across NSW showed significant variation in measures used and guiding information.

ACI formed an expert nursing advisory group across both medical and surgical care settings to develop a chest drain observation chart and instructions.

The ACI Chest Drain Chart is available for sites as a reference resource or for local endorsement.

Acknowledgements

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Mayrose Chan

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Addressograph

Site: ☐ Basal ☐ Apical Other: _____

☐ Intercostal catheter ☐ Pleural pigtail catheter ☐ Tunnelled catheter ☐ Other: _____

☐ Single or three-bottle system (underwater seal drain) ☐ Dry seal system (atrium)

☐ Clamps ☐ Three-way tap

☐ Number exposed markers on chest drain OR _____ cm from insertion site to hub

ALL parameters should be checked and recorded every time observations are performed

- Chart applies to all drains above the diaphragm
- One chart for each drain
- Total cumulative drainage MUST also be recorded on the Fluid balance chart
- Use in conjunction with regular observations on the SAGO chart
- Any variance requires mandatory medical officer (MO) review AND documentation in progress notes
- All bottle changes or flushing should be recorded by a line and descriptor across the observation chart row (see example).

Immediately post insertion: Half-hourly for two hours, then hourly for minimum four hours and then four-hourly when haemodynamically stable

Routine: Minimum four-hourly or more frequently as per clinical need or MO orders

[illegible]

OPTIONAL: Cumulative total drainage (this chart) _____ Previous cumulative total drainage (last 24 hours) _____

Observations:

Suction:

Must be ordered by MO

Record: _____kpa or _____cm H₂O or Nil

Check suction complies with medical order.

Thoraseal drain **LOW WALL SUCTION UNIT ONLY (range 3–5 kpa)**

Atrium drain Check suction dial e.g.: - 20cmH₂O (independent of level of suction from wall). Must ensure orange suction bellows are inflated to Δ mark. When off suction, suction tubing must be disconnected from the drain.

Air leak:

Indicated by bubbling in underwater seal drain (UWSD) or drain chamber.

Record: Nil no bubbling
+ bubbling only on forced expiration/coughing
++ talking or forced expiration/occasionally on a spontaneous or ventilated breath
+++ moderate amount of bubbling on every spontaneous expiration or positive ventilated breath
++++ large amounts, bubbling all the time.

Oscillation:

Indicates change in intra-pleural pressure.

Record: Y or N

Oscillation does not normally occur when suction is applied.

If oscillation is present, the drain is patent.

If oscillation is absent, it may indicate:

- tubing may be twisted, kinked, blocked, dislodged or disconnected
- lung may be re-expanded (CXR required to assess).

Thoraseal drain: a rise and fall of fluid in the tubing or UWSD.

Atrium drain: a rise and fall of the float ball in the water seal chamber.

Cumulative drainage: Total amount drained since bottle was last changed (mL)

OPTIONAL: **Drainage amount:** Amount drained since last measure (mL)

Drainage type:

Record: HS haemo serous
HP haemo purulent
P purulent
S serous
C chyle

Surgical emphysema: Indicates air in the subcutaneous tissue. Must notify the MO immediately if newly present or increased.

Record: Y or N

Air entry:

Assess by auscultation

Record: R=L or R>L or L>R

Connections/tubing:

Check

Record: Y or N for:

- insertion site/depth of insertion
- connections are taped and secure
- tubing is not kinked
- drain is secured to patient.

OPTIONAL:

Air vent open

Record: Open or On Suction

NB: Airvent must be uncapped in **Thoraseal 1 system** if not on suction.

Nursing care:

For example, Dressing, flushing

Record: action completed

Pain score:

Record VAS score (1-10) for pain related to the drain at rest (R) and with deep breathing and coughing (M).

Bottle changes:

Should be performed when the bottle is: ¾ full (adults); ½ full (paediatrics); or as clinically indicated.

Record all bottle changes or flushing when completed on the chart and then draw a line across the observations row to indicate the action. NB: Bottles are disposable and must not be emptied.

Date/ time	Suction (Kpa/ cm H ₂ O/ Nil)	Air leak (bubbling score)	Oscillation /swing (Y/N)	Cumulative drainage (mL)	OPTIONAL Drainage amount (mL)	Drainage type (HS/ HP/P/S/C)	Surgical emphysema (Y/N)	Air entry (R=L/ R>L/ L>R)	Connections taped/ secure/ tube not kinked (Y/N)	OPTIONAL Airvent (Open/ On suction/ N/A)	Nursing care (e.g. Dressing, flush)	Pain score (VAS) At rest/ with movement	RN / EEN (Initial)
15/5/15 0600	-20cm	+	Nil	1250	100	HS	N	R=L	Y	n/a	Dressing & wound swab [√]	5	JS
1000	-20cm	++	Nil	1400	150	HS	N	R=L	Y	n/a		6	JS
1005	BOTTLE CHANGED												JS
1400	-10cm	Nil	Nil	1580	180	HS	N	R=L	Y	n/a	Connections retaped		JS
1800	FLUSH												JS
2215	-20cm	+	Nil	1700	120	HS	N	R=L	Y	n/a	3-way tap off for 15 minutes. BP = 73/123	5	JS
2230	-20cm	++	Nil	1795	95	HS	N	R=L	Y	n/a		6	JS

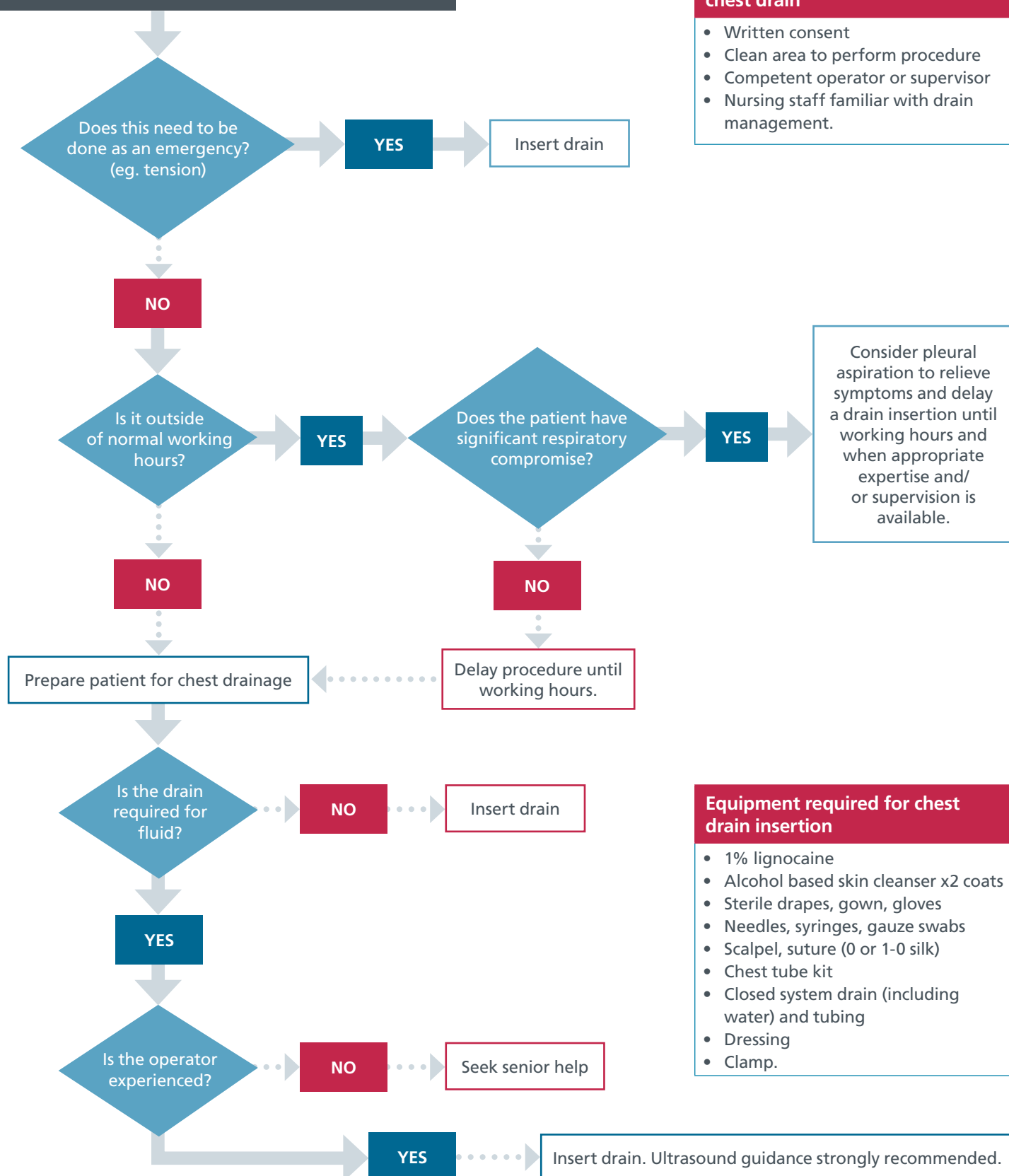
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Pleural Drains in Adults – A consensus guideline: Appendix 1

Insertion of chest drain

Pneumothorax or pleural fluid requiring drainage



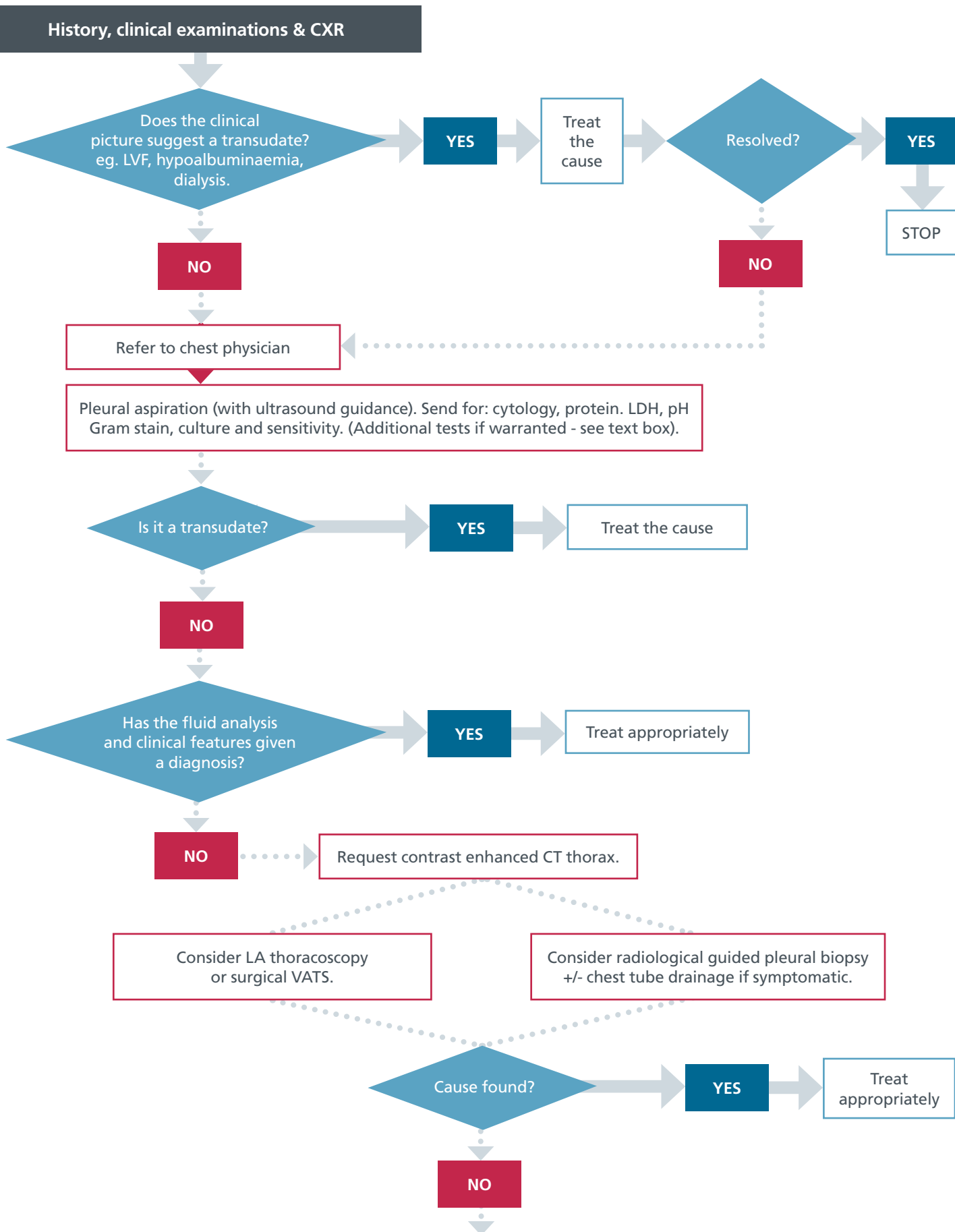
Requirements for insertion of chest drain

- Written consent
- Clean area to perform procedure
- Competent operator or supervisor
- Nursing staff familiar with drain management.

Consider pleural aspiration to relieve symptoms and delay a drain insertion until working hours and when appropriate expertise and/or supervision is available.

Equipment required for chest drain insertion

- 1% lignocaine
- Alcohol based skin cleanser x2 coats
- Sterile drapes, gown, gloves
- Needles, syringes, gauze swabs
- Scalpel, suture (0 or 1-0 silk)
- Chest tube kit
- Closed system drain (including water) and tubing
- Dressing
- Clamp.



Re-consider treatable conditions such as PE, TB, chronic heart failure and lymphoma. Watchful waiting often appropriate.

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