Thoracocentesis (Pleural Fluid Aspiration) Procedure

1. Guiding Principles

1.1 Purpose

The purpose of this document is to establish minimum practice standards for the care and management of patients requiring pleural fluid aspiration throughout the WA Country Health Service (WACHS) site hospitals.

1.2 Scope

All medical, nursing staff employed within the WACHS site hospitals acute care setting/emergency department. All health care professionals are to work within their scope of practice appropriate to their level of training and responsibility.

1.3 Considerations

Elective and urgent pleural fluid aspiration is only performed by or under the direction of an experienced senior medical officer.

1.4 General information

A thoracentesis/ thoracocentesis or pleural fluid aspiration is performed to either remove pleural fluid for investigation and/ or as a therapeutic procedure. It should be routinely sent for biochemistry, microscopy and cytology.

1.5 Indications for Procedure

Pleural fluid aspiration is indicated for any undiagnosed pleural effusion or for relief of symptoms due to large pleural effusions.

2. Procedure

2.1 Equipment

- Recent chest x-ray (CXR)
- Basic dressing pack x1
- Sterile gloves
- Sterile gauze
- Skin disinfectant > 0.5% chlorhexidine with 70% alcohol (if history of chlorhexidine sensitivity, use povidone iodine in alcohol).
- Local anaesthetic- Lignocaine 1% (50 mg/ 5 ml) or 2% (100 mg/ 5 ml)
- 5mL, 20mL and 50mL syringes.
- 21G x2, 25G x1 and drawing up needle x1.
- Catheterisation kit, thoracentesis: 8FG Catheter 18G RW Needle with 3-way stopcock; self sealing valve; 5 ml syringe; #11 scalpel; drainage tubing with roller clamp and 18G needle (Pleura-Seal)
- Blue underlay sheet
- Biochemistry tubes for protein, lactate dehydrogenase (LDH), albumin, glucose

- Haematology tube for cell count
- Arterial Blood Gas (ABG) syringe for pH
- Microbiology jar for microscopy, culture and sensitivities (MC&S)
- Cytology jar (x2 including 500 ml)
- Airtight dressing
- Hair clippers if required to clip hair.

2.2 Laboratory requirements

- Send pleural fluid for biochemistry (> 1 mL minimum), microbiology (> 5 mL minimum), and cytology (> 50mL minimum). For cytology, preferably send more than 500 mls.
- Prior to doing the procedure, take blood sample for protein and LDH to calculate Light's Criteria.
- Specimen for pH should only be collected in an ABG syringe and performed on the gas analyser through Path West hospital collecting centre. The specimen has to be received in Path West within 25 minutes. If the pleural effusion is frank pus, do not run it through the gas analyser machine.

2.3 Pre Procedure

- Pleural procedures should not take place out of hours, except in an emergency e.g. suspicion of a traumatic bleed, symptomatic patients with respiratory compromise.
- Elective pleural aspiration should be done between 0800 to 1400 hours so that any post procedure complications can be detected in working hours.
- For high risk patients and difficult procedures, consider transfer to High Dependency Unit (HDU) if continuous SPO2 or continuous cardiac monitoring is required for patient safety.
- Check coagulation and platelet count prior to procedure. INR should be < 1.5 and platelets > 50.
- Explain and obtain consent. For Indigenous patients, involve the Aboriginal Liaison Officer (Use the MR30A WACHS Patient Consent to Treatment or Investigation)
- Ensure recent CXR available and has been viewed by the practitioner performing the procedure.
- Ensure the patient has an IV access, minimum of 20G IV cannula or 18G IV cannula which is ideal. If history of chlorhexidine sensitivity, use povidone iodine in alcohol.
- Pleural aspirations should be carried out in a clean area using full aseptic technique.

2.4 Procedure

- Give analgesia.
- Position patient.

- Ultrasound is used to mark the area of intervention.
- Marking of the site for subsequent remote aspiration is not recommended. If the patient had ultrasound-marking at the Radiology Department and was transferred back to the ward for procedure, there should be confirmation of the marking with an ultrasound, in real-time by a person who has training in the use of bedside ultrasound.
- Clean the site, using > 0.5% chlorhexidine with 70% alcohol and drape.
- Infiltrate local anaesthetic - using Lignocaine 1% or 2% (maximum 3mg/kg). In a 1% lignocaine solution, the concentration is 10mg/mL. Therefore, in a 70kg patient, do not use more than 20mL 1% lignocaine.
- Once locally anaesthetised (remember, the skin and pleura are the most sensitive) can start aspiration. Use either a:
    - fresh 21G needle attached to a 50mL syringe at a level just above the rib (neurovascular bundle runs below the rib) at a 90 degree angle to the chest wall and aspirate as you go until you withdraw pleural fluid. The ultrasound that was performed would give a good guidance of the depth of fluid from the skin.
    - Or the arrow kit has got a specific one way valve mechanism which prevents air leak into the pleura.
    - If another kit is being used, make sure a three way locking system is employed to prevent air entering into the pleura and causing a pneumothorax.
- Maximum amount of fluid that can be drained is 1000 ml per day. This is because of the risk of re-expansion pulmonary oedema.

- The pleural aspiration catheter may be left in situ post procedure if another tap is required the following day. However please ensure adequate seal to avoid pneumothorax.

2.5 Post Procedure Management

- Document procedure in healthcare record and file consent form.
- In the event of a complication or symptomatic patient an immediate CXR should be ordered.
- In the event of a failed procedure, also a CXR should be ordered.
- Clinician should be aware of the signs associated with pneumothorax or an increase in pleural effusion which may indicate an iatrogenic pleural bleed.
- The proceduralist documents in the healthcare record that the CXR has been reviewed and the findings.
- A CXR should be done 4 hours post procedure. This CXR should be reviewed and findings documented on the healthcare record by the treating Clinician.
- Half hourly observations of heart rate (HR), respiratory rate (RR), oxygen saturation, blood pressure (BP) and pain score - for two hours. Document on the MR140a Observation and Response Chart (A-ORC).
- Observe site of entry for leakage.
- Ensure specimens are appropriately labelled and sent to laboratory (refer to WACHS Specimen Collection (including Phlebotomy) and Pathology Results - WACHS Clinical Practice Standard).
- Ensure there is a nominated person to follow up the results of the investigations ordered.

2.6 Complications

2.6.1 Early Complications

- Pain
- Procedure failure
- Pneumothorax
- Haemorrhage
- Visceral injury, lung, diaphragm, liver, spleen, heart
- Persistent air leak
- Subcutaneous emphysema

2.6.2 Late complications

- Re-expansion Acute Pulmonary Oedema
- Infection/Empyema

2.7 Management of Complications

2.7.1 Pneumothorax

- Up to 18% in non-transthoracic ultrasound (TUS) guided procedures

- Management will depend on the size of the pneumothorax, patient's symptoms and their co-morbidities.
- There should be a high index of suspicion when a patient develops increasing dyspnoea, chest pain, tachypnoea and desaturation. There may be a shift of the trachea to the opposite side in the case of tension pneumothorax.
- Patient needs to have an urgent CXR to confirm pneumothorax.
- Once confirmed, the patient can be shifted to the HDU if the clinician requires closer monitoring.
- Contact the Surgical Registrar for assistance in placing a chest drain.
- Following chest drain, repeat CXR to look for re-expansion of the lung.
- Management as per WACHS Chest Drain Management Clinical Practice Standard, including daily monitoring of bubbling of chest drain as a sign of continued air leak. Document using the MR129 WACHS Chest Drain Assessment and Observation Chart.

2.7.2 Intrapleural haemorrhage – from generalised coagulopathy or vessel disruption

Recognition:

- haemodynamic decompensation
- drainage of newly blood-stained pleural fluid
- an increasing pleural collection post-intervention
- a sudden drop in the haemoglobin

How to manage these patients:

- Urgent CXR
- Point-of-care TUS
- Urgent escalation to Consultant Physician-on-call and on-call Surgical Team including Surgical Consultant for immediate on-site review.
- Transfer the patient to HDU/ continuously monitored bed with 1:1 Nursing
- Resuscitate by restoring circulating volume using most appropriate colloid until blood transfusion is available. Check Full Blood Count (FBC) and Group and Hold.
- If there is a massive haemothorax, please activate Major Haemorrhage Procedure for WACHS Sites with Blood Products
- Pulmonary angiogram to look for evidence of leaking artery.
- Contact Cardio-thoracic Surgical Team of the tertiary hospital (Royal Perth Hospital, Sir Charles Hospital or Fiona Stanley Hospital) Fiona Stanley Hospital (FSH) and seek advice.
- Serial CXR to assess ongoing bleeding and increasing haemothorax
- Surgical Team to assist in drainage of persistent and increasing haemothorax

- Temporising measures: external pressure, local instillation of adrenaline
- Transfer to a tertiary hospital for definitive treatment: angiography + embolisation; video-assisted thoracoscopic surgery/ open thoracotomy and ligation under direct visualisation.
- If the patient has to be transferred to Perth, transfers with a chest drain in-situ.

2.7.3 Visceral injury (lung, diaphragm, liver, spleen, heart)

- Urgent surgical team referral

2.7.4 Persistent air leak

- Look for persistently bubbling chest drain as a sign of continued air leak. Never clamp as it can cause tension pneumothorax and/or severe subcutaneous emphysema
- Can use thoracic suction
- Surgical referral
- If there is cessation of drain bubbling within 48 hours → do a CXR to check if there is re-expansion of the underlying lung → follow one of the methods below unless the patient is symptomatic earlier. There are two widely used methods for removal of the chest drain:
  - observe to ensure stability → remove chest drain --> do a repeat CXR after 4-6 hours to ensure there is no recollection
  - clamp the chest drain for 4-6 hours → do a CXR to exclude continued slow air leak → remove drain
- Clear explanation to the patient upon discharge that if there is recurrence of symptoms, i.e, chest pain, shortness of breath, they need to represent for evaluation.

2.7.5 Subcutaneous emphysema

- Associated with persistent air leak
- Review chest drain for positioning and function
- If the subcutaneous emphysema is localised around the area of the procedure, generally does not require specific treatment --> a wait and watch approach is followed
- Consider whether a further drain is needed for adequate treatment
- Mark area of chest wall affected
- If subcutaneous emphysema is spreading to involve the upper chest and neck → may result in airway compromise hence urgent intervention → subcutaneous incision to allow milking and release of air from the soft tissue. The patient may even need advanced airway management.

2.7.6 Re-expansion pulmonary oedema

- Rare but life threatening

- Usually develops within 1-2 hours but may be delayed as long as 2 days
- Limit the first pleural aspiration to a maximum of 1L in the first 24 hours.
- Manage with diuresis, supplementary O2, HDU for positive pressure ventilation and haemodynamic support

2.7.7 Infection

- Manage with appropriate antibiotics /chest tube for empyema

2.8 Review of Complications

The number of thoracocentesis procedures to have adverse events is to be monitored by the Department of Medicine of the WACHS site hospital. This can be discussed monthly during the Clinical Review Meeting spearheaded by Head of the Department Medicine (HOD).

3. Definitions

Thoracentesis	A bedside procedure involving the withdrawal of fluid from the pleural cavity.
Pleural effusion	A build-up of excess fluid between the visceral and the parietal pleurae.
Light's Criteria	Pleural fluid is an exudate if one or more of the following criteria are met: • Pleural fluid protein divided by serum protein >0.5 • Pleural fluid LDH divided by serum LDH >0.6 • Pleural fluid LDH >two thirds the upper limits of normal serum LDH
Pneumothorax	Condition in which air accumulates in the pleural cavity
Subcutaneous emphysema	Leakage of air under the skin
Re-expansion pulmonary oedema	A rare complication of the treatment of lung collapse believed to occur when a chronically collapsed lung is rapidly re-expanded by evacuation of large amounts of air or fluid.
Intrapleural haemorrhage	Bleeding into the pleural cavity.

4. Roles and Responsibilities

Health Service Practitioners are responsible for ensuring their compliance with the Thoracocentesis (Pleural Fluid Aspiration) Procedure. They must complete appropriate training programs needed to perform thoracocentesis safely.

Health Service Providers must ensure they use the iSoBAR process when giving a clinical handover.

Managers must monitor compliance with this document policy and address incidents of non-compliance and adverse events with support from other Departments, if required.

Clinical incidents involving complications of the procedure are to be reported via Datix CIMS. Refer to the WA Health Clinical Incident Management Policy.

5. Compliance

Failure to comply with this procedure may constitute a breach of the WA Health Code of Conduct (Code). The Code is part of the Integrity Policy Framework issued pursuant to section 26 of the *Health Services Act 2016* (WA) and is binding on all WACHS staff which for this purpose includes trainees, students, volunteers, researchers, contractors for service (including all visiting health professionals and agency staff) and persons delivering training or education within WACHS.

WACHS staff are reminded that compliance with all policies is mandatory.

6. Records Management

To ensure good governance of local review processes, Health Service Providers are required to record and keep the following minimum information for all procedures that fall within the scope of this document procedure.

- Patient identifier (Name, Date of Birth, UMRN)
- Date of the procedure
- Details of the procedure and complications, if any
- Details of plan and recommendations made, if any

All WACHS clinical records must be managed in accordance with Health Record Management Policy.

7. Evaluation

Evaluation of this document procedure is to be carried out every 2 years.

8. Standards

National Safety and Quality Health Service Standards:1.23, 1.27, 2.6, 2.10, 3.3, 3.9, 5.3, 5.4, 5.5, 5.6, 8.3, 8.4, 8.6-8.11

9. Legislation

Access via: Western Australian Legislation

Health Services Act 2016 (WA)
Carers Recognition Act 2004 (WA)
Health Practitioner Regulation National Law (WA) Act 2010
Poisons Act 1964 (WA)

Poisons Regulations 1965 (WA)
State Records Act 2000 (WA)

10. References

1. Pleural procedures and thoracic ultrasound: British Thoracic Society pleural disease guideline 2010. Thorax 2010; 65 (Suppl 2): ii61-ii76
2. Common iatrogenic pleural complications. Curr Respir Care Rep (2012) 1:82-90
3. Pleural procedural complications: prevention and management. Journal of Thoracic Disease 2015; 7 (6): 1058-1067
4. J Hosp Med 2006. January; 1 (1): 54-55
5. Annals of Thoracic Surgery Vol 45, No 3 March 1988
6. MedicineNet

11. Related Forms

MR129 WACHS Chest Drain Assessment and Observation Chart
MR 140A Adult Observation and Response Chart (A-ORC)
MR175A WACHS Intravenous Blood Transfusion and Blood Product Treatment Order Chart
MR30A WACHS Patient Consent to Treatment or Investigation
MR30G WACHS Consent to Blood Products

12. Related Policy Documents

Clinical Escalation of Acute Physiological Deterioration including Medical Emergency Response Policy
Clinical Observations and Assessments Clinical Practice Standard (physiological, neurovascular, neurological and fluid balance)
Specimen Collection (including Phlebotomy) and Pathology Results - WACHS Clinical Practice Standard
Major Haemorrhage Procedure for WACHS Sites with Blood Products

13. Related WA Health System Policies

MP0095 Clinical Handover Policy
MP0122/19 Clinical Incident Management Policy 2019
MP0086/18 Recognising and Responding to Acute Deterioration Policy
OD0657/16 WA Health Consent to Treatment Policy

14. Policy Framework

Clinical Governance, Safety and Quality Policy Framework

This document can be made available in alternative formats on request for a person with a disability

Contact:	Dr Sean George/ Dr Rosanna Ramos		
Directorate:	Medical Services	**EDRMS Record #**	ED-CO-20-22893
Version:	1.01	**Date Published:**	07 September 2020