SMTU: Occult Pneumothorax (OPTX) Patients Presenting for Surgery Management Clinical Guideline (RPH)

Scope

Site	Department, Division or Operational Area	Applicable to
Royal Perth Hospital (RPH) only	State Major Trauma Unit (SMTU) Emergency Department (ED Operating Theatres (OT)	Medical, Nursing and Allied Health

Definition

Occult Pneumothorax (OPTX)	An OPTX is defined as one not detectable on antero-posterior/supine chest x-ray (CXR) or thoracic ultrasound (US), and only detectable on computerised tomography (CT) (abdominal or thoracic)[1].

General information/preamble

Chest injuries are common in patients admitted with major trauma and are present in around 50% of patients with traumatic deaths[2]. After rib fractures, pneumothoraces are the most common type of injury. Given the rapidly life-threatening situation that evolves in the case of a tension pneumothorax, knowledge of this diagnosis, and treatment is critical, in order to preserve life and minimise morbidity.

Pneumothoraces are not universally diagnosed, either clinically, or with the assistance of the supine CXR that is performed routinely during the primary and secondary surveys during trauma patient assessment. Small pneumothoraces are clinically silent and may not be visible on the CXR. However, more sensitive bedside ultrasounds and more sensitive CT scans often reveal these pneumothoraces during the patient's subsequent clinical evaluation and treatment. Left untreated, these occult pneumothoraces may become clinically significant. In an observational clinical series of Level 1 and 2 US trauma centres, among 588 OPTX, 21% underwent immediate intercostal catheter (ICC) insertion (at the clinical team's discretion)[3]. Among the 79% managed expectantly, 6% became clinically symptomatic during their hospitalisation and had an ICC placed. Among patients ventilated, 14% became symptomatic during the positive pressure ventilation. No case of tension pneumothorax was reported in this series.[3] An OPTX is reported among blunt torso trauma patients, with a frequency between 2 and 15%.[3]

General information/preamble cont'd

Unnecessary chest drains in patients should be avoided, as this intervention is associated with a 20% to 30% rate of major complications.[4, 5, 6] Possible complications include insertional (intercostal artery or intraparenchymal lung injuries); positional (requiring reinsertion); infective (empyema or wound infection) issues; pain; inadvertent tube removal; Horner's Syndrome and prolonged hospital stay.[5,7,8]

Diagnosis

Suspicion and concerns about pneumothoraces should be highlighted in the Emergency Department (ED) Resuscitation Bay based on:

- Mechanism of injury
- Respiratory distress
- Concomitant chest trauma: subcutaneous emphysema; rib fractures
- Associated CXR findings: e.g. subcutaneous gas, rib fractures, haemothoraces, contusion, etc.

Diagnosis is made on further imaging (either investigating the associated chest injuries, or incidentally, on other associated imaging):

- CXR (due to subsequent evolution of the pneumothorax)
- Supplementary CXR views
- US (E-FAST or thoracic US)
- CT scanning (cervical, thoracic or lumbar spine; chest; or abdomen)

Initial management

All patients presenting with a stable OPTX should be managed in accordance with the Eastern Association for Surgery of Trauma (EAST) guidelines and most recent literature evidence. An initial expectant management (i.e. without a chest drain) is generally suggested.[8,9,10]

The following must apply for a patient to be managed expectantly:

- Informed consent obtained from patient for possible ICC insertion
- Surgeons and theatre staff informed about the possibility of ICC insertion
- The necessary equipment for an ICC must be freely available in the patient's location
- A senior surgical staff member with ICC insertion experience is freely available at urgent notice (Trauma Fellow 0700-1700 hours, the Trauma Registrar (24 hrs), or Consultant Trauma Surgeon on duty)
- The chest must be easily accessible for clinical assessment and/or ICC insertion. If a prone or lateral position is required, then a prior discussion is necessary regarding appropriate feasibility of this

Note*:* Patients with **bilateral** occult pneumothoraces have generally been excluded from current guidelines, given limited data in this situation (these patients have classically been excluded from research in this field, and managed with best clinical judgement). The concern in this situation surrounds the development of a bilateral tension pneumothorax that may be clinically challenging to diagnose.

Intraoperative management

- Avoidance of nitrous oxide as anaesthetic agent
- Employ strategies to minimise ventilator induced barotrauma: minimise positive end-expiratory pressure (PEEP), tidal volume <6mL/kg (may go up to 10mL/kg once the abdomen is open) and inspiratory airway pressures <30cm H20
- Maintain a high index of suspicion, monitor clinical signs (frequent breath sound auscultation/ decrease in electrocardiogram (ECG) amplitude/deteriorating haemodynamics/increasing peak inspiratory pressures/decreasing oxygen saturation)
- If patient's condition deteriorates, immediate pleural decompression should be performed. An ICC will subsequently be necessary

Postoperative management

If an ICC was inserted in theatre, then the following is required:

- Post-operative CXR to confirm position of ICC
- Supplemental O2 (>28%) via nasal prongs at 2L for the first 24 hours
- If no ICC was inserted, and if clinically appropriate, consider post-operative imaging if prolonged surgery to assess for any increase in size of OPTX.

Assess and document vital signs on *Adult Observation and Response Chart (AORC)* and drain output chart; ½ hourly for 2 hours, hourly for a further 2 hours, then 2 hourly for 4 hours, then 4 hourly or as clinically indicated.

Indications for non-expectant management
(i.e. ICC may need to be inserted prior to surgery)

- High airway pressures expected due to decreased lung compliance (e.g. obesity /interstitial lung disease/concurrent pneumonia)
- Patients at increased risk for primary pneumothoraces: Bullous lung disease/chronic obstructive pulmonary disease (COPD)
- Prolonged ventilation is expected, or patient is going to the Intensive Care Unit (ICU) post-operatively (involve ICU in decision making process – a recent prospective observational series from US Level 1 and 2 trauma centres suggests approximately 15% of these patients will need a non-emergent chest drain insertion during ventilation3)
- If patient is hemodynamically unstable.

Discharge criteria

- An erect CXR must be performed and reviewed by the Trauma Fellow/Consultant prior to discharge in these high-risk patients
- On discharge, the patient should be provided with the Pneumothorax Patient Information Brochure (direct link) and advised of the risk for delayed pneumothorax/haemothorax and to seek medical help.

Facilitator

Sarah Orme A/Safety and Quality Coordinator, Surgical Division, RPBG

Review authors

Approved by RPH Trauma Committee 05/09/2024.

References

1. Matsumoto S, Sekine, K et al (2016) Diagnostic accuracy of oblique chest radiograph for occult pneumothorax: comparison with ultrasonography. *World Journal of Emergency Surgery* Vol 11:5 Accessed February 2025
2. Ekpe, E. E., & Eyo, C. (2014). Determinants of mortality in chest trauma patients. Nigerian journal of surgery : official publication of the Nigerian Surgical Research Society, 20(1), 30–34. Accessed February 2025
3. Moore FO et al (2011). Blunt traumatic occult pneumothorax: is observation safe? – Results of a prospective, AAST multicentre study. *J Trauma*. 2011 May;70(5):1019-23; discussion 1023-5. Accessed February 2025
4. Paschos KA, Boulas K and Vrakas X. (2012). Occult post-traumatic pneumothorax: too early to recognise, simply missed or truly occult? *Hellenic Journal of Surgery*. April 2012, Volume 84, Issue 2, pp 134-141 Accessed February 2025
5. Bayo, HL, Vioque et al (2016) Results of conservative treatment in patients with occult pneumothorax *Ciurgia Espanola* 94 : (4) 232-236 Accessed February 2025
6. Nassimizadeh, A, Taki, H et al (2015) Occult pneumothoraces – red flag or red herring? *Trauma* 17: (3) 201-207 Accessed February 2025
7. Omar et al. (2010). Occult pneumothorax, Revisited. *Journal of Trauma Management & Outcomes* 2010, 4:12. (Review) Accessed February 2025
8. Zhang, M, Teo, LT et al (2016) Occult pneumothoraces in blunt trauma: is there a need for tube thorocostomy? *Eur J Trauma Emergency Surg* 42; 785-790 Accessed February 2025
9. Mowery, NT, Gunter, OL et al (2011) Practice Management Guidelines for Management of Haemothorax and Occult Pneumothorax. *Journal of Trauma Injury, Infection and Critical Care*. Feb 2011Vol. 70. No.2 Accessed February 2025
10. Kirkpatrick, AW , Rizoli, S et al (2013) Occult Pneumothoraces in critical care : A prospective multicentre randomized controlled trial of pleura drainage for mechanically ventilated trauma patients with occult pneumothoraces. *J of Trauma and Acute Care Surgery* Vol 74 . No. 3 Accessed February 2025

Related policy, RPBG practice standard, clinical guidelines

RPBG Policy Hub

- Management of Tunnelled Pleural and Abdominal Catheters Nursing Practice Standard (NPS)
- Chest Drainage Systems Management NPS

Related National Standards

ACSQHC NSQHS Standards 2nd Edition (2021)
Standard 1: Clinical Governance
Standard 5: Comprehensive Care
Standard 6: Communicating for Safety
Standard 8: Recognising and Responding to Acute Deterioration