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

Definition

An OPTX is defined as one not detectable on antero-posterior/supine CXR or thoracic ultrasound, and only detectable on CT (abdominal or thoracic).

General Information/Preamble

Approximately one quarter of traumatic fatalities relate to injuries in the chest. In addition, chest injuries are associated with another 50% of traumatic deaths. 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 computerised tomography (CT) scans often reveal these injuries 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). 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.
case of tension pneumothorax was reported in this series\textsuperscript{4}. An OPTX is reported among blunt torso trauma patients with a frequency between 2\% and 15\%\textsuperscript{4}.

Unnecessary chest drains in patients should be avoided, as this intervention is associated with a 20\% to 30\% rate of major complications\textsuperscript{5, 6, 7}. 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\textsuperscript{6, 8, 9}.

**Diagnosis**

Suspicion and concerns about pneumothoraces should be highlighted in the 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
- Ultrasound (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\textsuperscript{1}. An initial expectant management (i.e. without a chest drain) is generally suggested\textsuperscript{9, 10, 11}.

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 0700-1800, 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.
- NB. 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 by best clinical judgement). The concern in this situation surrounds the development of a bilateral tension pneumothorax that may be clinically challenging to diagnose.
- Seek senor trauma medical review if concerned
Intraoperative Management

- Avoidance of nitrous as anaesthetic agent
- Employ strategies to minimise ventilator induced barotrauma: minimise PEEP, tidal volume <6mL/kg (may go up to 10mL/kg once the abdomen is open) and inspiratory airway pressures <30cm H₂O.
- Maintain a high index of suspicion, monitor clinical signs (frequent breath sound auscultation/ decrease in ECG amplitude / deteriorating haemodynamics / Increasing peak insp. pressures / decreasing 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
- Post-operative supplemental O₂ therapy

If no ICC was inserted, consider post-operative imaging if prolonged surgery or change in patient’s haemodynamics.

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 pneumo-thoraces: Bullous lung disease, COPD
- Prolonged ventilation is expected or patient is going to 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 ventilation⁴
- If patient is haemodynamically unstable

Discharge Criteria

An erect chest x-ray 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.

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References


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