

Chapter 88

Approach to Management of Pneumothorax in the ICU



88.1 Introduction

Pneumothorax is a critical condition characterized by the presence of air in the pleural cavity, leading to partial or complete lung collapse. In the intensive care unit (ICU), timely recognition and effective management are vital, especially in patients with respiratory distress or hemodynamic instability. This chapter provides a comprehensive approach to managing pneumothorax in the ICU, incorporating detailed indications and contraindications, procedural techniques, post-procedural care, and considerations for training and nursing perspectives [1, 2] [Ref: Algorithm 88.1].

88.2 Initial Assessment of Clinical Signs

- Key Considerations: Conduct a thorough clinical assessment to determine the patient's stability.
- Unstable Features:
- Respiratory Distress: Severe dyspnea, increased respiratory rate, hypoxia.
- Hemodynamic Instability: Tachycardia, hypotension, signs of shock.
- Rationale: This step establishes the urgency of intervention and guides immediate management decisions.

88.3 Indications and Contraindications

- Indications for Chest Drain Insertion:
- Ventilated Patients with Pneumothorax: Positive pressure ventilation can exacerbate pneumothorax, necessitating prompt chest drain placement.

- Large Secondary Spontaneous Pneumothorax (SSP): Patients with underlying lung disease and significant air accumulation require immediate intervention.
- Contraindications:
- Dense Pleural Adhesions: Can make drain insertion difficult and increase the risk of complications.
- Uncorrected Coagulopathy: Increases the risk of bleeding; coagulopathy should be corrected prior to the procedure if possible.

88.4 Use of Ultrasound Guidance

- Role of Real-Time Ultrasound:
- Site Selection and Needle Placement: Ultrasound aids in identifying the optimal insertion site, especially in patients with complex effusions or uncertain anatomy.
- Benefits:
- Reduces the risk of organ injury.
- Improves the success rate of drain placement.
- Application: Particularly useful in patients with adhesions, obesity, or distorted chest wall anatomy [3].

88.5 Pre-Procedural Considerations

- Consent and Patient Preparation:
- Informed Consent: Discuss the procedure, benefits, and potential complications such as infection, bleeding, and organ injury with the patient or their surrogate decision-maker.
- Aseptic Technique: Strict adherence to aseptic protocols minimizes the risk of infection.
- Premedication:
- Analgesia: Administer appropriate pain control measures.
- Anxiolytics: Consider sedation to reduce patient anxiety and movement during the procedure.

88.6 Drain Insertion Techniques

- Techniques Overview:
- Seldinger Technique (Guidewire Method):
- Indication: Preferred for small-bore (≤ 14 Fr) chest drains.
- Procedure: Involves needle insertion, guidewire placement, dilation, and drain insertion.

- Advantages: Less traumatic, smaller incision, suitable for pneumothorax and simple effusions.
- Blunt Dissection Technique:
- Indication: Used for large-bore drains (>14 Fr), often necessary for draining thick pleural fluids or empyemas.
- Procedure: A small incision and blunt dissection through the intercostal muscles into the pleural space.
- Advantages: Allows placement of larger drains, better for viscous fluids.
- Safe Triangle for Drain Placement:
- Boundaries:
- Anterior Border: Lateral edge of pectoralis major muscle.
- Posterior Border: Anterior edge of latissimus dorsi muscle.
- Inferior Border: Line horizontal to the nipple (fifth intercostal space).
- Importance: Minimizes the risk of injury to underlying structures such as nerves, vessels, and organs.

88.7 Management of Unstable Patients

- Immediate Intervention:
- Lung Ultrasound:
- Findings: The “barcode sign” (absence of pleural sliding) and “lung point” confirm pneumothorax (M mode).
- Chest Drain Insertion:
- Action: Do not delay insertion for further imaging in life-threatening cases.
- Guidance: Use ultrasound guidance if time permits.

88.8 Management of Stable Patients

- Diagnostic Imaging:
- Chest X-Ray (CXR):
- Purpose: Confirm diagnosis, assess pneumothorax size, detect mediastinal shift or other complications.
- Computed Tomography (CT) Scan:
- Indication: Consider if CXR is inconclusive or for detailed assessment in complex cases.
- Immediate Action for Tension Pneumothorax:
- Signs: Mediastinal shift, severe respiratory compromise, cardiovascular collapse.
- Intervention: Perform needle decompression (mainly in primary spontaneous pneumothorax) followed by chest tube insertion.

88.9 Size-Based Evaluation

- Classification:
- Small Pneumothorax:
- Definition: Rim <2 cm between lung margin and chest wall or $<20\%$ lung collapse.
- Management: May consider conservative treatment or needle aspiration in primary spontaneous cases.
- Large Pneumothorax:
- Definition: Rim ≥ 2 cm or $\geq 20\%$ lung collapse.
- Management: Chest drain insertion is typically required [4].

88.10 Primary Spontaneous Pneumothorax (PSP)

- Characteristics:
- Occurs in patients without underlying lung disease, often young and otherwise healthy.
- Management:
- Small PSP:
- Needle Aspiration: First-line treatment to evacuate air.
- Observation: If asymptomatic and small, some cases may be managed conservatively.
- Failed Aspiration or Symptomatic Patients:
- Chest Drain Insertion: If aspiration is unsuccessful or symptoms persist.
- Prognosis: Generally favorable with appropriate management.

88.11 Secondary Spontaneous Pneumothorax (SSP)

- Characteristics:
- Occurs in patients with underlying lung conditions such as COPD, cystic fibrosis, or pulmonary fibrosis.
- Higher risk due to limited pulmonary reserve.
- Management:
- Chest Drain Insertion:
- Recommended regardless of pneumothorax size due to the risk of deterioration.
- Needle aspiration is often insufficient as the leak persists due to fragile lung tissue and is usually not recommended.

88.12 Post-Procedural Care

- Monitoring Protocols:
- Assess for Complications:
- Air Leaks: Check for continuous bubbling in the water seal chamber.
- Infection: Monitor insertion site for signs of infection.
- Blocked Drains: Ensure adequate drainage and patency of the tube.
- Suction Application:
- Indication: May be applied to facilitate lung re-expansion, especially in cases of persistent air leaks (Maximum—20 cms of H₂O).
- Drainage Monitoring:
- Fluid Characteristics: Note volume, color, and consistency.
- Removal Criteria:
- Resolved Pneumothorax: No air leak and full lung expansion on imaging.
- Minimal Drainage: Less than 200 mL in 24 h for pleural effusions.

88.13 Management of Complications

- Persistent Air Leak or Failure of Lung Expansion:
- Low-Pressure Suction: Apply to aid lung re-expansion.
- Advanced Interventions:
- Video-Assisted Thoracic Surgery (VATS): For repair of air leaks, resection of blebs or bullae.
- Chemical Pleurodesis: Instillation of agents (e.g., talc) to adhere the lung to the chest wall.
- Chest Drain Dislodgement:
- Immediate Action: Cover the site with an occlusive dressing and prepare for reinsertion if necessary.
- Drainage Cessation:
- Assessment: Check for kinks or obstructions.
- Intervention: Flush the drain or replace if needed.

88.14 Nursing Perspectives

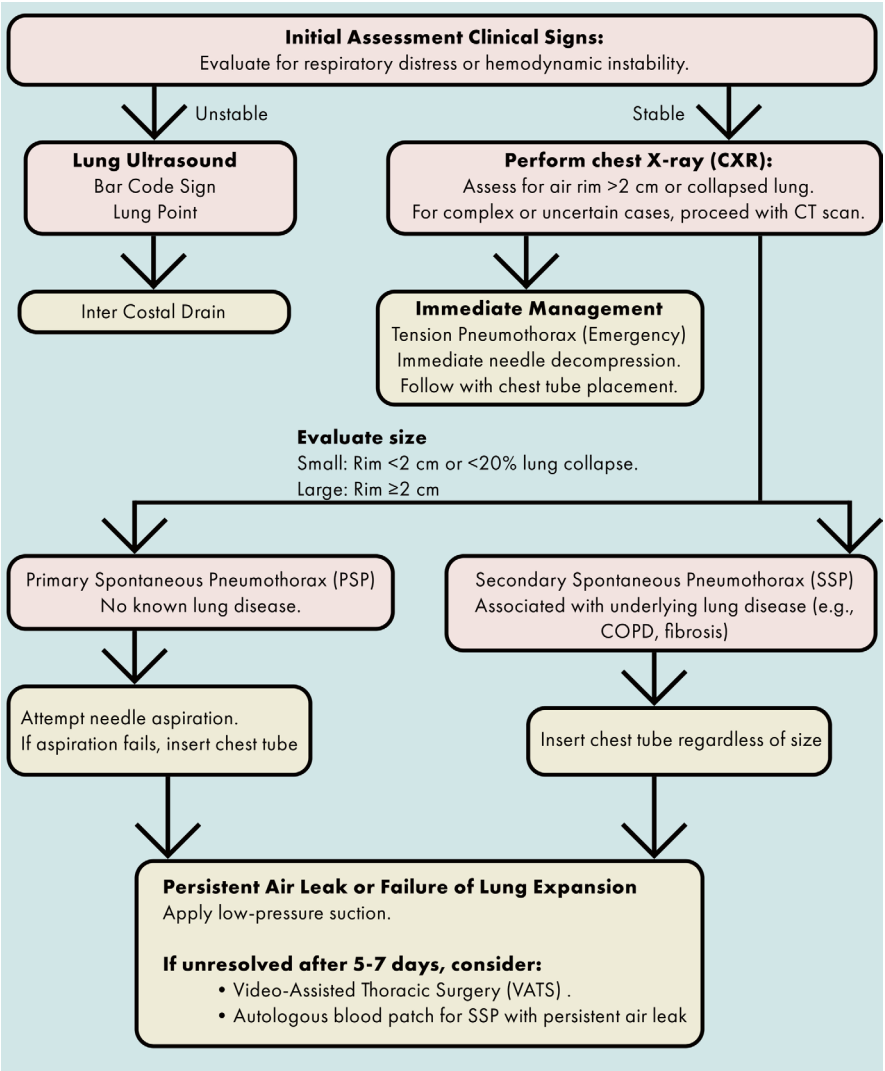
- Routine Assessments:
- Vital Signs: Monitor respiratory rate, oxygen saturation, heart rate, and blood pressure.
- Drain Site Care: Inspect for signs of infection or dislodgement.
- Securing Drains:

- **Fixation:** Ensure the drain is securely taped and anchored to prevent accidental removal.
- **Dressing Changes:** Maintain sterile technique during dressing changes.
- **Patient Positioning:**
- **Optimal Positioning:** Encourage semi-Fowler's position to promote drainage and prevent tube kinking.
- **Mobility:** Assist with ambulation as appropriate, ensuring the drain remains secure.

88.15 Conclusion

Effective management of pneumothorax in the ICU requires a systematic approach that prioritizes rapid assessment, precise diagnosis, and tailored intervention. Detailed understanding of indications and contraindications, proficiency in various drain insertion techniques, and adherence to pre- and post-procedural protocols are essential. Incorporating ultrasound guidance enhances safety and success rates. Addressing complications promptly and involving multidisciplinary teams, including nursing staff, optimizes patient outcomes. Continuous training and adherence to best practices ensure high standards of care and minimize the risk of adverse events.

Algorithm 88.1: Approach to management of pneumothorax in the ICU



Bibliography

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