Guideline Title: Pneumonectomy Management

Summary: Pneumonectomy is the surgical removal of an entire lung. The chest drain balance system is utilised post-operatively to balance the pressure within the hemithorax and reduce the risk of pressure changes that could shift the mediastinum.

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Replaces Existing Guideline: Pneumonectomy Post-op Care and Management of Balanced Chest Drainage System_2011

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1. Background Information

Pneumonectomy is most commonly performed for carcinoma of the lung. Pneumonectomy is associated with a variety of reasonably predictable anatomic changes, significant decrements in pulmonary function, and a number of potential complications that involve the respiratory system, the cardiovascular system, and the pleural space. Immediately following pneumonectomy, air fills the space previously occupied by the lung (i.e., the postpneumonectomy space). Over time, a number of changes result in a decrease in the size of the postpneumonectomy space including elevation of the hemi diaphragm, hyperinflation of the remaining lung, and shifting of the mediastinum towards the postpneumonectomy space. At the same time, there is progressive reabsorption of air in the postpneumonectomy space and replacement with fluid. As pleural pressure increases, the rate of fluid accumulation decreases, and after two weeks, 80 to 90 percent of the postpneumonectomy space is filled with fluid. The location of vital organs (including the heart and great vessels, liver, and spleen) changes significantly following pneumonectomy as a consequence of mediastinal shift and elevation of the hemi diaphragm. After left pneumonectomy, the heart rotates counter clockwise into the vacant left pleural space. Following right pneumonectomy, the heart shifts into the vacant right pleural space.
2. Introduction:
The risk addressed by this policy:
Patient Safety

The Aims / Expected Outcome of this policy:
Staff caring for Pneumonectomy patients will have the knowledge and skills to provide safe and effective management

Related Standards or Legislation
NSQHS Standard 1 Governance

Related Policies
Number / Title
LH_PD_ICU_2014 Pain assessment and analgesia
LH_PD_ICU_2015 Non Invasive ventilation
LH_PD_ICU_2014 Intercostal insertion and management
LH_PD2014_P12.03 Removal of the intercostal catheter (ICC)
LH_PD2014_P12.02 Assessment and management of Intercostal Catheter (ICC) a
LH_PD2014_C03.29 Patient Controlled Analgesia - PCA
LH_PD2012_P12.25 Post Operative Extrapleural Analgesia for Thoracotomy pat
LH_PD2014_P12.01 Insertion of an Intercostal Catheter (ICC)

3. Policy Statement:
- All care provided within Liverpool Hospital will be in accordance with infection prevention/control, manual handling and minimisation and management of aggression guidelines.
- The balanced chest drainage system for the Pneumonectomy patient must not be connected to suction
- The water levels in the balanced chest drain should not be adjusted without consultation with Cardiothoracic surgeon
- Do not clamp the drains. The balanced pressure drainage system maintains the mediastinum in normal position, while still allowing the drainage of excess post–operative blood or fluid.
- If the drainage is > 150mL/ hour, the ICU team and cardiothoracic team must be notified immediately
- Do not cover air vents on Bottle C & Bottle D. Ensure that they remain open to air at all times.
- All connections must be checked to make sure that they are properly connected and airtight
- UWSDs must be kept below the level of the patient’s chest to avoid the risk of fluid re-entering the pleural space. Drainage occurs during expiration when pleural pressure is positive
- ICC and/or UWSD MUST only be clamped
  - Immediately prior to changing the tubing and/or UWSD bottle
  - If sudden disconnection of the underwater sealed system occurs.
  - Just prior to removal of an ICC
  - If documented by medical staff for a specific reason
4. Principles / Guidelines

a) Indications

- Bronchogenic carcinoma
- Inflammatory diseases
- Infections and fungal diseases
- Trauma
- Tuberculosis

b) Equipment

- Pneumonectomy patients will return from OT with the balanced chest drain system which prevents mediastinal shift
- The balanced chest drain system **MUST NOT BE CONNECTED TO SUCTION**
- The water levels in positive and negative chambers should not be adjusted without consultation with the cardiothoracic surgeon. These levels are set by the surgeon to determine the level of pressure the individual patient requires.

![Image of chest drain system]

- A = connecting tube from patient;
- B = collecting bottle from patient; monitor hourly output
- C = positive pressure regulator; If the pressure in the chest becomes too positive, air will come out of the chamber
- D = negative pressure regulator; If the pressure in the chest becomes negative, air will move into the pleural cavity.
- E = air entering the system from atmosphere; attach a bacterial filter

![Diagram showing A: From Patient, B: Drainage chamber, C: Positive pressure chamber, D: Negative pressure chamber, and E: Air enters (D) & Leaves (C) Bacterial filter attached]

c) Procedure

-Performed via a thoracotomy, which is an incision that extends from below the shoulder blade along the curvature of the ribs at the front of the chest. Part of or a rib may be removed for a clearer view of the lung and to assist in removing the diseased organ

- Surgeon then
  - deflates the lung
  - ties off the major blood vessels
  - Clamps and cuts main bronchus to prevent fluid from entering the air passage
  - removes the lung
  - staples or sutures the end of the bronchus
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Systems_ Cardiothoracic

- makes sure that air is not escaping from the bronchus
- inserts a chest tube between the layers of the pleura and the surgical cavity
- closes the chest

d) **Post-op care**

- **Airway**
  - Do full respiratory assessment- rate, depth, frequency, rise and fall of chest
  - Oxygen mask according to assessment and ABG
  - If the patient requires non-invasive ventilation (NIV) consult with ICU Staff Specialist and Cardiothoracic teams

- **Circulation**
  - Continuous haemodynamic monitoring
  - 2nd hourly recording of Heart rate, BP, Temperature and Oxygen saturation
  - Full physical assessment
  - Post op 12 lead ECG, then daily or as indicated

- **Analgesia**
  - All patients should have PCA
  - Some may have extra-pleural catheters. This continues for 24-48hrs until documented to cease by cardiothoracic team

- **CXR/Pathology**
  - CXR post op then daily to assess line and chest tube placements and structural changes
  - Post op ABG, UEC, Coags, FBC, CMP, LFTs, CKMB
  - These tests are repeated daily and/or PRN as indicated

**Forty-eight hours after surgery, fluid has quickly accumulated in the postpneumonectomy space after removal of the chest tube. Note the shift in the trachea towards the operative side (arrow).**

- **ICC management**
  - Check for oscillations. Perform hourly chest drain observations. Check Drainage, and bubbling.
  - Ensure chest tube clamps are at the patient’s bedside. These are to remain within close proximity of the patient **at all times** in case of an emergency clamping of the system is required
  - Observe around the insertion site for signs of infection (redness, swelling, ooze). Look for welts/excoriation/allergic reaction to dressing. If this occurs change type of dressing, document and inform medical staff
  - Ensure the sutures are intact and no drainage holes are visible on the intercostal catheter.
  - Check the occlusive dressing to ensure it is clean, dry and intact.
  - Ensure all connections between the intercostal catheter and the UWSD are tight and securely taped
• Make sure there are no clots occluding or building up on the inside of the tubing. If clots/drainage is present, the tubing should be raised and lowered to encourage drainage to flow into the UWSD collection chamber

**Fluids/Nutrition**

**Day 0**
- NBM, IV fluids as ordered being careful not to over hydrate as excess fluids can cause pulmonary oedema which can be life threatening for pneumonectomy patients.

**Day 1**
- Left pneumonectomy – ice to suck
- Right pneumonectomy – NBM
- NGT on free drainage, until day 2
- Right pneumonectomy is likely to have respiratory compromise if they develop gastric distension.

**Day 2**
- Clear fluids for left and ice to suck for right pneumonectomy

**Day 3**
- Light diet for left and clear fluids for right pneumonectomy
- 1500ml fluid restriction
- Daily weight

**Physiotherapy**
- Position patient sitting upright to re expand lungs and for adequate gas exchange
- Deep breathing and coughing second hourly
- Shoulder and leg exercises
- Sit out of bed Day 1 and ambulate as soon as possible

**Wound Care**
- Dressing intact till day 2 unless oozing
- Observe wound for ooze, redness, discharge

**e) Complications**

- **Pulmonary**
  - Postpneumonectomy pulmonary oedema
  - Postpneumonectomy syndrome
  - Atelectasis

- **Pleural space**
  - Postpneumonectomy space empyema
  - Bronchopleural fistula
  - Oesophagopleural fistula
  - Chylothorax
  - Acute haemothorax
  - Pneumothorax

- **Cardiovascular**
  - Arrhythmias
  - Myocardial infarction
  - Intracardiac right-to-left shunt
  - Cardiac herniation
  - Thromboembolism

- **Miscellaneous**
  - Oesophageal motility disorders
  - Gastric volvulus
  - Pneumopericardium
  - Postpneumonectomy paralysis
  - Postpneumonectomy scoliosis
  - Haemorrhage
5. **Performance Measures**

All incidents are documented using the hospital electronic reporting system: IIMS and managed appropriately by the NUM and staff as directed.

6. **References / Links**


3. Thoracic Anaesthesia. Dr Paul Forrest. [www.anaesthesia.med.usyd.edu.au](http://www.anaesthesia.med.usyd.edu.au)


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