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- Complete course evaluation

Objectives
- Describe pathophysiologic changes following thoracic surgeries
- Review trauma-related injuries to the thoracic areas & nursing management
- Identify important nursing management in caring for patients post-thoracic surgical procedures

Thoracic Surgeries
- Tracheal resection
- Lung Transplant
- Pulmonary resection
  - Lobectomy
  - Pneumonectomy
  - Wedge resection
- VATs with decortication
- LVRS (Lung Volume Reduction Surgery)
- Surgeries post traumatic injuries

Thoracic Surgery & Procedures
- Pneumonectomy = removal of entire lung
- Lobectomy = resection of one or more lobes of the lung
- Wedge Resection = removal of small wedge shaped section of lung tissue
- Segmental Resection = removal of bronchovascular segment of the lung lobe
Thoracic Surgery & Procedures

- Bullectomy = resection of emphysematous bullae
- LVRS = Resection of diseased and functionless lung tissue
- Open Lung Biopsy = resection of portion of lung for biopsy through a thoracotomy incision
- Decortication VATS procedure = Endoscopic procedure through small incision
- Pulmonary Stent = device(s) placed by flexible or rigid bronchoscopes to keep airways open in the central tracheobronchial tree

Primary Lung Cancer

- Small Cell Carcinoma (20%)
  - Occurs centrally
  - Widely disseminated
- Non-small Cell Carcinoma
  - Squamous cell carcinoma (30%), central, slow
  - Adenocarcinoma (35%)-peripheral, quick
  - Large cell carcinoma - peripheral, quick

Surgical Approach

- Centrally located tumor
  - Pneumonectomy
- Tumor that involves bronchus
  - "Sleeve lobectomy"
- Benign tumor, metastases, cancer in those who would not tolerate full lobectomy
  - Limited wedge resection

Physiologic Effects of Thoracic Surgery

- Proximity of the planned procedures to the diaphragm
- Anesthetic agents → diaphragmatic chest wall functions → V/Q mismatch
- Pain → decreases ventilation (lack of deep breaths)
- Decreased FRC by 35% → atelectasis → infection

Thoracic Surgery

- Wedge resection
- Lobectomy
- Pneumonectomy

Remove all vasculature & Lymph nodes

Cardiothoracic Critical Care, 2007—Thoracic Surgery, pp 188

Cardiothoracic Critical Care, 2007—Thoracic Surgery, pp 191-192

1) Atelectasis/Pneumonia (2-22%)
  - Postural drainage
  - Incentive Spirometry (IS)
  - NT suction
  - Early ambulation
  - Nebulizer treatment
  - Antibiotic (if indicated)
Thoracic Surgery
Early Post-op Complications
Pulmonary

2) ARDS
- Mechanical Ventilation with high PEEP & FiO2
- Steroids
- Prostaglandins
- Prone position

3) Pulmonary Edema
- Diuresis
- Strict monitoring of fluid status
- For Pneumonectomy, mortality rate > 50%

Thoracic Surgery
Early Post-op Complications
Cardiac

- Myocardial Ischemia
  - O2
  - ECG
  - Morphine Sulfate, ASA, NTG, Inotropes
  - Balloon Pump
  - Cardiac Catheterization
  - Anticoagulant (Heparin, GIIb/IIIa platelet inhibitors)

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Thoracic Surgery
LATE Post-op Complications

1) Prolonged air leak (longer than 7 days)
- CT
- Talc Sclerosis
- Heimlich Valve

2) Bronchial Fistula
- Bronchopleural Fistula—Interventions
- Operative closure
- Fibrin glue if small
- Absolute alcohol injection
- Bronchovascular Fistula (rare)—massive hemoptysis
- Post Pneumonectomy Syndrome
  - Torsion or compression of the trachea, bronchus or pulmonary vasculature due to mediastinal shift
- Wound Infection/ Empyema—CT drainage
- Post thoracotomy Pain—narcotics & anti-inflammatory are not effective. TENs, nerve blocks, gabapentin
**Thoracic Surgery Post-op Management**

- **Hemodynamic Management**
  - Maximum 20 ml/kg IV within the first 24 hours post-op
  - Acceptable UO 0.5 ml/kg/hr
  - Use vasopressor to ensure adequate perfusion
  - Hgb 7-9

- **Medications**
  - Anti-HTN may be held before surgery
  - Re-start B blocker as soon as tolerated
  - Antibiotics
  - Anti-emetics
  - Stress ulcer prophylaxis
  - Reglan & bowel regimen
  - DVT Prophylaxis

- **Respiratory**
  - IS
  - Chest physiotherapy (clapping, postural drainage, vibratory therapy)
  - C & DB
  - Early ambulation & pulmonary Rehab
  - Nebulized Albuterol

- **Pain Management**
  - Epidural (thoracic region preferred)
  - Coagulopathy
  - Cardiopulmonary bypass
  - Low dose Lovenox or Heparin
  - PCA
  - Intrathecal (slow onset, hard to titrate)
  - Intrapleural catheter (sympathectomy & HPN)
  - Intercostal nerve blocks (short duration)
  - NSAIDs

- **Nutrition**
  - Treat nausea & vomiting
  - Starts early
  - Avoid gas producing food
  - Small frequent feeding

- **Drains & Tubes**
  - Early transition to water seal suction may promote quicker resolution of parenchymal air leak
  - Pneumonectomy—may be no drain, slow mediastinal shift toward operative side
  - 300-400 ml/24 hr is acceptable
  - Pleurodesis for malignant pleural effusion (may have stricter requirement of fluid output)
  - Chyllothorax (lymphatic fluid) & Empyema (individualized)
  - Foley remained in place until Epidural is d/c’ed
Thoracic Traumas

- 10%-15% of all trauma admissions
- Associated with 25% of all deaths in trauma
  - Pulmonary contusion, Hemothorax
  - Rib fractures (12% mortality)
  - Flail chest
  - Traumatic airway injuries
  - Traumatic diaphragmatic injuries
  - Tension Pneumothorax

Thoracic Traumas

Lung Contusion

- The force of impacts (steering wheel) on chest wall is transmitted to the lung, rupturing tissue, small airways, and alveoli→Hemorrhage into adjacent alveolar spaces
- More commonly seen in thin and young persons
- Usually associated with flail chest

Lung Contusion

- Hemorrhagic response that can lead to interstitial and alveolar edema→atelectasis & edema→V/Q mismatch
- S/S: dyspnea, tachyphnea, slight moist rales and bloody sputum, cyanosis, hypotension, decreased BS
- DX: CXR is not indicative the first 24 hrs. (Opacity with “blossom” appearance) Chest CT
- Man: aggressive pulmonary toilet, IS, euvolemia (CVP, UO), CT for pneumothorax, hemothorax, pleural effusion

Lung Contusion--Continued
Fracture Ribs

- Most common blunt thoracic injury (300,000 people in US in 2000)
- Occur in 39% of patients admitted to trauma centers
- If 2 or more ribs are fractured, correlates with hemothorax or pneumothorax (81% of cases)
- More common in older persons
- Higher mortality if patient’s age is > 65

Fracture Ribs

- S/S: Pain, ineffective ventilation, secretion retention, CXR
- Ribs 1-2: high impact trauma (lungs, aortic arch, vertebral column)
- Ribs 3-9 injury to lungs, bronchus, pleura, heart
- Ribs 10-11 associated with liver and spleen fractures

Fracture Ribs

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Fracture Ribs Treatments

- Ensure oxygenation & ventilation to prevent atelectasis
- Pain control
  - Epidural
  - Rib blocks
  - Intrapleural instillation of anesthetics
  - IV pain medications
  - NSAIDS

Flail Chest

- Generally occurs when 2 or more ribs are fractured
- S/S:
  - Paradoxical ventilation (if not on a ventilator)
  - Assessed by palpation
  - Mediastinal flutter
  - Decrease venous return to the heart (drop in CO and BP)
- TX:
  - Pain control (depends on the extend of injuries)
  - Keep airway cleared from blood (contusion)
  - Intubation (14-21 days) → tracheostomy
  - 65%-75% do not require intubation → TS, C & DB
  - Surgical intervention (FTW, uncontrolled pain)
Flail Chest

- Inspiration
- Expiration

Paradoxical Ventilation

Hemothorax/Pulmonary Hemorrhage

- Blood collection in pleural space → Obstructs the airway → poor ventilation. Tracheal deviation towards ______???
- 80% of penetrating & 90% of blunt traumas are self-limiting
- Massive hemothorax = 1.5 to 4 liters intrathoracic blood loss or 200/hr for 2-4 hours
- S/S: Loss of BS on affected side, dullness on percussion, CXR >300 ml of blood, 5 cm elevation of diaphragm

Tx:
- Support ventilation and oxygenation
- Large CT (32-40 Fr) insertion at 4th & 5th intercostal space

Pneumothorax

- Air in pleural space interfering with the normal ventilation
- Causes: positive pressure ventilation, biopsy, central lines, thoracentesis, spontaneous, traumatic injuries
- S/S:
  - Early: Dyspnea (air hunger), tachypnea, tachycardia, bradycardia, decreased respiratory excursion, wider intercostal spaces, absent or reduced BS, hyperresonant to percussion, asymmetrical chest expansion, distended neck vein
  - Late: Acute onset CP (pleuritic), severe dyspnea, respiratory distress, contralateral tracheal shift, Crepitis, hypoxemia, hypercapnia, hypotension, change in LOC, cyanosis, acidosis

Tension Pneumothorax

- Continued accumulation of air in pleural space
- S/S:
  - Shift in the mediastinum toward the uninvolved hemithorax
  - Hemodynamic instability

Pneumothorax--Treatments

- Observation & Monitoring if not severe (ventilation and oxygenation)
- Emergency needle decompression & Aspiration
- Tube thoracostomy drainage → CT at 2nd intercostal space
- Pigtail catheter

Crepitis---Clinical Presentation
Lung Volume Reduction Surgery

Lung Reduction
Destruction of pulmonary parenchyma
Decrease mass of functioning lung tissues
Loss of Elastic recoil
Decreased amount of gas exchange
Interferes with Ventilation and Gas Exchange of normal lung tissues

Emphysema---Surgical Interventions
- Bullectomy (S/S: dyspnea, pain, spontaneous pneumothorax, bleeding, infection)
- Lung Transplant - 1963 Hardy et al.
- LVRS -
  - Late 1950’s Brantigan & Mueller in Baltimore → 75% patients improved but mortality was 16%
  - 1993 Cooper & Patterson → mortality 0-7%

LVRS--Indications
- Patients with crippling dyspnea
- 20% of patients w/ COPD qualifies for LVRS
- Hyperinflation
- Diaphragmatic dysfunction
- Heterogenous disease distribution

LVRS--Exclusions
- Poor pulmonary function
- Homogenous pulmonary disease
- Insufficient target area

LVRS--Surgical Approach
- Median Sternotomy (bilateral)
- VATS (less air leak, less vent days)

LVRS--Day of Surgery
- Short pulse steroid (40 mg/day for 3 days)
- Epidural insertion
- Cephalosporin 30 min. before initial incision
- Hydrocortisone IV bolus 100 mg and q 8 hr X 3 doses
- IV access & A line insertion
- Single lumen ETT → Bronch → sputum culture
- Double lumen ETT
- Resection (healthy lung tissues collapse)
- Saline solution → assess for air leak
- Single lumen ETT
- Wake patient up and extubate
LVRS--Post-Op Care
- 10 cm water suction
- Neb q 30 min. for 4 doses
- Aminophylline for severe bronchospasm
- PCA, Epidural, or Ketorolac
- ICU stay → PCU stay
- Physical Therapy, GI care, RT, CXR, IS
- Remove CT within 24 hours
- PFT q 3 mon. for the first year, then Q 6 mon

LVRS--Complications
- Significant air leaks
  - > 1/3 requires CT after 1 week
  - If > 1 week → use Heimlich valve
- Infections:
  - Pneumonia
  - Empyema
  - Mediastinitis
  - Sternal dehiscence
- GI bleed & bowel perforation
- PE
- Cardiac Arrythmias
  - AF
  - SVT

LVRS--Long Term Outcome
- Clinical Improvement after 3 months
  - 2/3 of patients improve significantly at 1 year mark
  - If unilateral lung, FEV1 gain 20-30%
  - If bilateral lungs, FEV1 gain 40-80%
  - Mortality rate 0-7%

Pneumonectomy
- Post-Pneumonectomy Syndrome = herniation of the mediastinum, heart, and contralateral lung into the post- Pneumonectomy space.
  - Usually associated with Right pneumonectomy.
  - Usually occurs months to a year after surgery
  - S/S: audible stridor, dyspnea, recurring pulmonary infections
  - CXR, CT → marked deviation of mediastinal contents rotate posteriorly. Bronchoscopy → tracheal deviation.
  - Avoid this post-op by not using CT with suction
  - Post-Pneumonectomy Pulmonary Edema = 2-5% incidence, 60-90% mortality

Indications for Tracheal Surgery
- Post-intubation (1-6 weeks post extubation)
- Direct trauma (GSW, stab wound)
- Primary tumor (rare)
- Secondary tumor

Tracheal Lesions
- S/S:
  - Wheezing/ strider
  - Dyspnea
  - Barking cough with exp. Wheeze (malacia)
  - Cough & hemoptysis (malignancy)
  - Hoarseness
- DX: may be delayed
  - Tracheal air column view
  - Flexible bronchoscopy
  - CXR
  - Chest CT (evaluating tumor)
Tracheal Surgery after GSW

Post-op Management (Goals: Promote anastomotic healing & maintaining good pulmonary toilet)
- Maintain cervical flexion for 5-7 days (limit neck extension)
- Prevent blood running to lungs
- Minimize volume overload
- Increase HOB
- Racemic epinephrine to prevent laryngeal edema
- No talking
- Humidified FM
- Therapeutic flexible bronchoscopy

Thoracic Surgery Post-Op Nursing Management
- Monitor for possible complications:
  - Bronchopleural Fistula (SOB, cough, serosanguineous sputum)—CT, good side up
  - Hemorrhage (CT drainage)
  - CV disturbance (increase RV workload)
  - Atelectasis (IS, deep breathing & early ambulation)
- Positioning:
  - Lobectomy—remaining lungs down
  - Pneumonectomy—operative side down or supine

A 25 year old male patient is admitted with massive hemothorax in his left chest. Following your initial assessment, what will you find?

1. Hyperresonance to percussion and decreased excursion on left side; tracheal deviation toward left side.
2. Dullness to percussion and decreased excursion on left side; tracheal deviation toward left side.
3. Hyperresonance to percussion and absent breath sounds on left side; tracheal deviation toward right side.
4. Dullness to percussion and absent breath sounds on left side; tracheal deviation toward right side.

Mr. J. has been on prolonged bed rest following a pelvic fracture. Suddenly he becomes dyspneic and confused. His HR = 140, BP 90/50, RR 36. His SaO2 is dropping rapidly. Which of the following conditions has he most likely developed?

1. Flail chest
2. Pulmonary embolus
3. Tension pneumothorax
4. Pneumonia

Your patient has a diagnosis of emphysema. He develops sudden signs of increasing respiratory distress. Breath sounds and chest movement are decreased on the right side. You suspect he has developed:

1. A flail chest
2. A pneumothorax
3. An empyema
4. Bronchiectasis
A flail chest can cause:

1. Displacement of the mediastinum toward the unaffected side during inspiration
2. Outward bulging of the affected segment during expiration
3. Increased intrapleural pressure on the affected side during inspiration
4. All of the above

Purulent sputum is most often seen with:

1. Pulmonary embolus
2. Atelectasis
3. Pneumonia
4. Pleural effusion

Which of the following disorders is associated with chronic hypoxemia and chronic hypercapnia?

1. Emphysema
2. Asthma
3. Chronic bronchitis
4. All of the above

Which of the following conditions is associated with pleuritic chest pain?

1. Bronchiectasis
2. Bronchospasm
3. Pulmonary infarct
4. Asthma

Medical management of a flail chest may include:

1. Mechanical ventilation
2. Stabilizing the ribs with a binder
3. Bronchodilators
4. All of the above

65 yo male S/P LVRS 3 days ago is recovering in PCU. BP 126/85, NSR = 87 w/o ectopy, RR = 16, SaO₂ = 98% on 2 L N/C. You note on the monitor that he is now in a new onset A-Fib/ A-Flutter. What is your initial nursing action?

1. Continue to monitor his hemodynamic status since this is a common occurrence post thoracic surgery
2. Check his BP, mentation, presence of chest pain, peripheral pulse, and call his surgeon
3. Obtain 12 lead EKG to confirm the rhythm and consult cardiologist
4. Assess the quality and quantity of CT output; this may be an early sign of hemothorax
Patients with S/P Lung volume resection surgery are prone to hypotension post-operative state due to:

1. The need to limit IV fluid infusion in an attempt to reduce pressure in the lungs
2. The use of epidural analgesic for pain control
3. Higher risk for post-op atrial fibrillation
4. All of the above

Sample Question #10

Mrs. James is a 34 yo executive who is recovering from Tracheal Surgery due to primary tumor 4 days ago. She finds it very difficult to sleep with her neck slightly in flexed position. Which of the following statements is the best explanation to the reason for this management?

1. “This position will reduce the likelihood of aspiration pneumonia”
2. “This position will help with good pulmonary toilet”
3. “This position will promote easier flow of air into your lungs”
4. “This position will help in the healing of the surgical incisions made during surgery”

Sample Question #11

36 yo male admitted through the trauma team after suffering acceleration deceleration injury to the chest while driving. He became very dyspneic, tachypneic, cyanotic, and coughing up blood. Upon auscultating his chest, you noted inspiratory rales with dimished BS through out. What is the most likely cause of this change in his condition?

1. Pulmonary contusion
2. Flail chest
3. Pulmonary embolus
4. Early ARDS

Sample Question #12

A 20 yo male who was in a fight at the local bar, suffered fracture ribs # 9, 10 and 11. What other assessment parameters are important given the level of injury?

1. Assess right upper abdominal and check for the presence of blood in the Foley catheter
2. Assess for the presence of blood in the chest tube and quality of breathing
3. Assess for signs of hypotension, dysrhythmias, and chest pain
4. Assess for rib pain, mental status changes, and EKG changes

Sample Question #13

Which of the following nursing interventions can enhance the positive outcome of patient post- thoracic surgery?

1. Aggressive pulmonary toilet, early ambulation, effective pain management, close hemodynamic monitoring
2. Early ambulation, Epidural use, Aggressive fluid resuscitation, and aggressive pulmonary toilet
3. Effective pain management, close hemodynamic monitoring, Narcan infusion, and CT use
4. Head of bed elevation, early ambulation, early feeding, DVT prophylaxis, and NSAIDS use for at least 2 weeks

Sample Question #14

Mr. Rossy just had right sided pneumonectomy. His CT is intact and draining moderate amount of blood. Upon receiving the patient from the PACU, you checked the MD order noted that the CT is not ordered for suction. What might be the rationale for this order?

1. Since there is no lung tissue on the right side of the chest, attempt for blood evacuation is not clinically indicated.
2. Not using suction on the same side of pneumonectomy had been shown to reduce the risk of post-pneumonectomy syndrome.
3. The MD may want to “test” the nurse’s competency & knowledge by posting opportunity for collaboration and learning.
4. Not using the suction may reduce the likelihood for air leak post-operatively.

Sample Question #15
Summary

- Describe pathophysiologic changes following thoracic surgeries
- Review trauma-related injuries to the thoracic areas & nursing management
- Identify important nursing management in caring for patients post-thoracic surgical procedures

References