Problems with Oxygenation
Lemone and Burke Chapter 36-39

Objectives
- Review anatomy and physiology of respiratory system.
- Describe changes associated with aging.
- Review O2 delivery systems
- Explain maintenance and types of suctioning
- Discuss exams used to measure adequacy of ventilation and oxygen exchange.
- Recognize diversity issues in clients
- Describe the etiology, pathophysiology, clinical manifestations, complications, and collaborative care of the following alterations in oxygenation:
  - Emphysema
  - Bronchitis
  - Asthma
  - Tuberculosis
  - Coccidiomycosis

Anatomy and Physiology
- Respiratory System
  - Nose
  - Sinuses
  - Pharynx
  - Larynx
  - Trachea
  - Lungs
    - Bronchi
    - Bronchioles
    - Alveoli
  - ...

Diagnostic Tests
- ABG
  - Assess alterations in acid base balance
  - Help determine if or metabolic issues
  - Normal values:
    - pH – 7.35-7.45
    - PaCO2 – 35-45 mm Hg
    - PaO2 – 80-100 mm Hg
    - HCO3 – 22-26 mEq/L
    - BE - +/- 2 mEq/L

- Pulse Oximetry
  - Monitor O2 sat
  - Normal 95-100%

- CBC
  - Infection present?
  - Oxygen carrying capacity?
- Sputum collection
  - C&S
  - Acid fast
  - Cytology
- MRSA swab
  - Use swab culture kit
  - Insert into both nostrils

7. Diagnostic Tests
- CXR
  - Used to identify abnormalities
  - Monitor treatment
- CT scan
  - Differentiate conditions
  - Monitor treatment

8. Diagnostic Tests
- Bronchoscopy
  - Visualization of larynx, trachea, and bronchi
  - Identify lesions
  - Remove drainage
  - Remove foreign objects
  - Obtain specimens

9. O2 Delivery Systems
- Nasal Cannula
  - 24-45% at 2-6L
- Masks
  - Simple – 40-60%
  - (no pic)
  - Venturi – 24-50%
  - Non-rebreather – up to 100%

10. O2 Delivery Systems
- ETT
  - OR
  - Ventilator support
  - Oral
  - nasal
- Trach
  - Long term vent support

11. Suctioning
- Oral
- Nasal
- Pharyngeal
- Tracheal

12. Asthma – Reactive Airway Disease
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- Lemone & Burke Chapter 39, pages 1320 - 1330
13 **Definition**
- Asthma is a chronic inflammatory disorder of the airways, which causes attacks of wheezing, shortness of breath, chest tightness, and coughing.
- Causes airflow into and out of the lungs to be restricted.
- Strong genetic components can also be environmental

14 **Pathophysiological Changes**
- The muscles of the bronchial tree become tight
- The lining of the air passages swells, reducing airflow and producing the characteristic wheezing sound
  - Histamine
  - Leukotriene

15 **Triggers - Intrinsic and Extrinsic Factors**
1. **Intrinsic**
   - Uncertain
   - Physical stress
   - Psychological stress
   - Exercise-induced
   - Respiratory infections
2. **Extrinsic**
   - Allergens
   - Air pollutants
   - Cold
   - GERD
   - Tobacco smoke

16 **Symptoms**
- Wheezing
- Tachypnea
- Dyspnea
- Cough
- Chest pain
- Tachycardia
- Anxiety
- Intercostal retraction
- Nasal flaring

17 **Emergency Symptoms**
- Extreme difficulty breathing
- Bluish color to the lips and face
- Severe anxiety due to shortness of breath
- Chest pain
- Sweating
- Decreased level of alertness, such as severe drowsiness or confusion, during an asthma attack

18 **Diagnosis**
- Determined by:
  - Frequency of attacks
  - Severity of attacks
- Mild intermittent = < 2 x week
- Mild persistent = > 2 x week, < 1 x day
- Moderate persistent = daily
- Severe persistent = continuous symptoms
Diagnostic Tools
- ABG’s
- Pulmonary Function Tests (PFT’s)
  - The most accurate test for asthma
- Chest X-ray
- Clinical presentation
- Blood drug levels

Goals of Medical Therapy
- Decrease the bronchospasms
  - Bronchodilators
    - Albuterol
- Decrease inflammation
  - Anti-inflammatory agents
    - Steroids
- Leukotriene blockers
- Increase oxygenation
  - Administer O2

Nursing Interventions
- Health history – current symptoms, triggers, what relieves symptoms
- Physical exam – vital signs, lung sounds, color, anxiety
- Diagnostic tests – ABG, PFT,
- Education – emergent symptoms, id and avoid triggers, proper use of inhalers, other meds, exercise, quit smoking

Status Asthmaticus
- Severe, life-threatening acute episode of airway obstruction
- Becomes more intense once it begins
- Often does not respond to routine treatment
- Medical emergency, if not treated promptly can lead to respiratory and cardiac arrest

Treatment of Status Asthmaticus
- Immediate IV fluids
- Potent IV bronchodilators
- Steroids
- Epinephrine
- Oxygen
- Prepare for emergency intubation if necessary

Asthma Video

Chronic Obstructive Pulmonary Disease
- Chronic Bronchitis
  - Inflammation and scarring of lining of bronchial tubes
- Emphysema
  - Involves alveoli
  - Irreversible lung damage secondary to loss of elasticity
  - These two conditions can co-exist

Chronic Bronchitis
• Chronic airway inflammation with:
  – Vasodilation
  – Congestion
  – Mucosal edema
  – Bronchospasm

27 Pathophysiology Chronic Bronchitis
• Cilia damaged
  – Cannot clear airway
• Increased airway resistance
• Pulmonary infections
  – From increased sputum production
• Polycythemia develops
  – Response to hypoxemia

28 Emphysema
• Anatomic and Functional Changes
  – Loss of lung elasticity
  – Hyperinflation of the lung

29 Emphysema - Etiology
• Cigarette smoking (90%)
• Air pollution
• Occupational substances (coal dust)
• Alpha1-antitrypsin (AAT) deficiency
  – Normally prevents breakdown of lung tissue

30 Emphysema - Assessment
• Clinical Manifestations
  – Accessory muscles
  – Underweight
  – Exertional dyspnea
  – Diminished breath sounds
  – Wheezes or crackles
  – Activity intolerance
  – Frequent respiratory infections
  – Barrel Chest
  – Clubbing (sign of advanced COPD)

31 Emphysema - Assessment
1 Barrel chest

2 Clubbing

32 Emphysema - Assessment
33 Diagnostic Tools
• ABG’s
  – Decreased P02
  – Increased PC02
• Chest x-ray
  – Hyperinflated lungs
  – Flattened diaphragm
– Cardiomegaly
  ▪ Pulse Oximetry
  ▪ Pulmonary Function Tests
  –
  ▪ CBC
    – Polycythemia
    – Elevated H/H – late sign
  ▪ Serum alpha 1 antitrypsin
  ▪ Sputum cultures
    – if infection suspected

Interventions COPD

▪ Airway maintenance
▪ Monitoring
▪ Oxygen therapy
▪ Drug therapy
▪ Chest physiotherapy
▪ Suctioning
▪ Hydration
▪ Positioning
▪ Education

Expected Outcomes

▪ Activity tolerance is optimal or returns to baseline
▪ Pulmonary irritants are avoided
▪ Pulmonary infections are reduced (secretions reduced and patient is afebrile)
▪ Nutritional intake is adequate

COPD Review

Mycobacterium Tuberculosis

▪ Acid-Fast Bacilli Causes Tuberculosis of all types.

 ▪ During the 17\textsuperscript{th} & 18\textsuperscript{th} Century caused 25\% of all adult deaths in Europe.

 ▪ Obligate Aerobe which takes 4-6 weeks to fully incubate in the lab.

Pulmonary Tuberculosis

Pathophysiology

▪ Lung infection caused by:
  – Mycobacterium tuberculosis
    ▪ Acid-fast bacillus, Gram-positive, bacteria
  – Any tissue can be infected but most commonly found in the lungs
Transmission is via airborne droplets
Granulation leads to necrosis
Cavitation occurs

**Etiology/ Incidence/ Prevalence**
- Close contact with an infected person
- Steadily increasing in US and worldwide
  - Due to HIV infection and increased immigration to the US from other countries
Those at risk
- Immune dysfunction or HIV
- Live in crowded areas
- Older and homeless people
- Drug and alcohol abusers
- Lower socioeconomic groups
- Healthcare workers

**Droplet Nuclei Transmission**
- Three thousand droplet nuclei are expelled with:
  - 1 Cough
  - 1 Min. of Singing
  - 5 Min. of Talking

**Assessment**
- Clinical Manifestations
  - Frequent cough
    - Early sign-non productive cough
    - Late sign-pink frothy sputum
  - Night sweats
  - Anorexia
  - Weight loss
  - Shortness of breath
  - Fever and chills
  - Nausea
  - Fatigue and lethargy

**Diagnostics**
- Sputum culture of M. tuberculosis confirms the diagnosis
- Tuberculin skin test (Mantoux) PPD, most commonly used
- CXR- clinically active or old healed TB

**Interventions**
- Airborne precautions
  - Private room
  - Negative air pressure
- HEPA mask
- Gown and gloves if risk of hand and clothing contamination
- Monitor respiratory status
- Monitor 02 sats
  - Provide 02 if needed
- Provide diet rich in protein, iron, and Vit C
- Obtain sputum culture every 2-4 weeks
  - After 3 negative cultures patient no longer infectious
- Administer prescribed medications

### Medication Therapy for TB

- **Current Therapy**
  - Isoniazid (INH) and rifampin throughout therapy
  - Pyrazinamide is added for the first 2 months
  - Ethambutol or streptomycin may be added as the fourth drug
    - This protocol shortens therapy from 6-12 months to 6 months
- Compliance issues

### Extensively Drug-Resistant TB (XDR-TB)

- Resistant to both first and second line drugs.
- Resistant to any fluoroquinolone and at least one of the three injectable second-line drugs.
- Treatment options are seriously limited.

(World Health Organization)

### Patient Education

- Infection control
  - Handwashing
  - Cough, sneeze, or laugh into tissue and dispose in closed bag
- Adequate air ventilation
- Take medication as prescribed for the full duration to prevent resistant organisms
  - May need Direct Observation Therapy (DOT) if patient non-compliant
- Maintain good nutrition, rest for healing and to prevent fatigue

### Expected Outcomes

- Patient adherence to prescribed medication
- Productive cough resolved
- Afebrile
- Normal respiratory rate
- ABG’s/ 02 sats normal or baseline
- Maintains body weight
- Prevents spread

### Coccidiomycosis

- Valley Fever
- Fungal infection
  - Primary site is the lungs
  - Can but rarely moves outside of the lungs
- Disseminated form – skin most common
- Internal organs, bones, meninges, skin
- Fungus lives in soil and spreads through the air as spores, person becomes infected by inhaling these spores

**Endemic Areas**

**Symptoms**
- Fever
- Aching
- Chills
- Sweats
- Fatigue
- Cough
- Headache
- Lower extremity nodular erythema

- Severity depends on:
  - How many spores inhaled
  - How susceptible the host is

**Diagnosis**
- Skin Tests
  - 30-60 % of people in high endemic areas test positive for having had the disease
- Cocci titers
  - More sensitive
  - Most physicians are using this test now
  - Higher the titer - more severe is the disease
  - As immunity develops – titer falls

**Treatment**
- Non life-threatening disease
  - Nizoral (oral)
  - Diflucan (oral)
  - Sporanox (oral)
- Disseminated disease, more severe cases
  - Amphotericin B (IV or intra-spinal)
  - Intravenous Diflucan
  - Miconazole

**Common Nursing Diagnosis**
- Impaired gas exchange
- Ineffective breathing pattern
- Ineffective airway clearance
- Imbalanced nutrition
- Anxiety
- Activity intolerance
- Knowledge deficit
- Social isolation