Pulmonary Pathologies
Pneumonia, COPD & ARDS

What Causes Pneumonia?
• Bacteria
  http://www.nhlbi.nih.gov/health/health-topics/topics/pnu/causes.html

What Causes Pneumonia?
• Viruses
  http://phys.org/news124033451.html

What Causes Pneumonia?
• Fungi

What Causes Pneumonia?
• VAP
• MRSA
• Necrotizing Pneumonia

Pneumonia: Pathophysiology
• Invasion of a foreign substance
• Alveolar cells produce mucus
• WBC’s attempt to wall it off
• Inflammation increases blood flow to area & cause capillary permeability
• Mucous and fluid fill alveoli causing shunting
**Nursing Assessment**

- Lungs
  - Cough/Sputum
  - Lung sounds
  - SOB
  - ABG’s/SaO₂
- Cardiovascular
- Fever/Chills
- Skin

**ABG’s in Pneumonia**

- Hypoxemia
- Early: Respiratory Alkalosis
- Later: Respiratory Alkalosis, HCO₃ dropping
- Severe: Mixed Respiratory and Metabolic Acidosis

**Pneumonia: X-Ray**

**Bilateral Pneumonia**

**Nursing Care: Oxygenation and Airway Support**

- Nasal airway
- Oxygen administration
- CPAP/BiPAP

**SaO₂ > 90% is the goal**

**Nursing Care: Suctioning and Sputum Culture**

- nasopharyngeal suctioning
- cough and spit
- bronchoalveolar lavage

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**Disruptions of Organ Systems in Critical Care:**

*Pulmonary, GI, Renal, & Endocrine*

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Nursing Care: Mechanical Ventilation

Nursing Care: Drug Therapy

Antibiotics are the key!
- Culture and sensitivity
- Bug specific drugs
- Peak and trough labs

Routine ICU drugs

Nursing Care

- Nutrition
- Hydration
- Kidney care
- Activity
- Prevention & Education

Complications of Pneumonia

- Bacteremia
- Pleural Effusion
- Lung Abscess
- Other

Question

Pneumonia complications may include….
  a. Bacteremia
  b. Septic shock
  c. Pleural effusion
  d. Lung abscess
  e. Acute Respiratory Distress Syndrome (ARDS)
  f. All the Above

COPD
COPD: Pathophysiology

Nursing Assessment

- Lungs
- Cough/Sputum
- Lung sounds
- SOB
- ABG's/SaO2
- Chest excursion
- Crepitus
- Chest: AP Diameter
- Cardiovascular
- Skin
- LOC

ABG’s in COPD

- Early: hypoxemia and increased pCO2
- Later: more hypoxemia, increased pCO2 and respiratory acidosis
- HCO3 will fall with continued acidosis

COPD: Radiology

Nursing Care:
Oxygen and Ventilation

Oxygen CPAP and BiPap

Nursing Care:
Mechanical Ventilation

- Hypotension
- Pneumothorax
- Barotrauma
### Nursing Care: Pharmacologic Management
- Anticholinergics
- Bronchodilators
- Steroids
- Antibiotics

### Bronchodilators

#### Sympathetic and Parasympathetic Nervous Systems

### Bronchodilators: Beta-Agonists

- **Short Acting:**
  - Albuterol
  - Proventil
  - Ventolin (salbutamol)

- **Long Acting**
  - Serevent (salmeterol)
  - Albuterol HFA

### Anticholinergics

- Tiotropium (Spiriva) Atrovent
- These medications block stimulation of the parasympathetic nervous system, resulting in dilation of the airways

### Corticosteroids

- Antiinflammatory
- Used for chronic asthma
- Does not relieve symptoms of acute asthmatic attacks
- Oral or inhaled forms
- Inhaled forms reduce systemic effects
- May take several weeks before full effects are seen

### Inhaled Corticosteroids: Side Effects

- Pharyngeal irritation
- Coughing
- Dry mouth
- Oral fungal infections
- Systemic effects are rare because of the low doses used for inhalation therapy
COPD Exacerbation

- SOB, Cough
- Changes in Sputum
- Crackles may occur

Nursing Care

- Nutrition
- Activity
- Smoking
- Education

Question

When the nurse is weaning a patient who has COPD from mechanical ventilation, which patient assessment indicates that the weaning protocol should be discontinued?

a. Tachypnea
b. Mild anxiety
c. Oxygen saturation declining
d. a and c only
e. All of the above

ARDS

History of ARDS

Causes of ARDS

<table>
<thead>
<tr>
<th>Respiratory (direct)</th>
<th>Non-Respiratory (indirect)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aspiration</td>
<td>Blood transfusion reactions</td>
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<tr>
<td>Near-drowning</td>
<td>Burns (massive)</td>
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<td>O₂ toxicity</td>
<td>DIC</td>
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<tr>
<td>Pneumonia (all types)</td>
<td>Drug abuse</td>
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<tr>
<td>Post-pneumonectomy</td>
<td>Fat embolism</td>
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<td>Raised ICP (head injury)</td>
<td>Pancreatitis (acute)</td>
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<td>Smoke inhalation</td>
<td>Prolonged cardiopulmonary bypass</td>
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<tr>
<td>Thoracic irradiation</td>
<td>Septis</td>
</tr>
<tr>
<td>Traumas (lung contusion/injury)</td>
<td>Shock (severe and prolonged)</td>
</tr>
<tr>
<td>Vasculitis</td>
<td></td>
</tr>
</tbody>
</table>
ARDS Pathophysiology

- Immune system activated causing inflammation
- Increased vascular permeability
- Pulmonary edema
- Atelectasis
- Causes shunting, decrease compliance and increased work of breathing

Nursing Assessment

- Lungs
  - Lung sounds
  - SOB
- ABG’s/SaO₂
  - Cardiovascular
  - Fever/Chills
  - Skin
  - Level of consciousness

ABG’s in ARDS

- Early: mild hypoxemia with respiratory alkalosis
- Middle: moderate hypoxemia with respiratory alkalosis
- Late: severe hypoxemia with mixed respiratory alkalosis and metabolic acidosis

Criteria for ARDS

1. Timing
2. Chest x-ray
3. PCWP
4. Oxygenation

*American–European consensus definition

Disruptions of Organ Systems in Critical Care: Pulmonary, GI, Renal, & Endocrine
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3. PCWP

PCWP less than 18 mm hg and/or no clinical evidence of CHF

4. Oxygenation

PaO2/FiO2 ≤ 200 mm hg regardless of PEEP

Nursing Care

• Treat underlying cause
• Prevent further A-C membrane damage
• Maintain oxygenation and ventilation
• Maintain hemodynamic stability and tissue perfusion

Nursing Care: Mechanical Ventilation

• When to intubate
  • RR 30/min
  • PCO2 > 45
  • FiO2 > 0.60
• Mechanical Ventilation Mode
• Permissive Hypercapnia

Nursing Care: Mechanical Ventilation

Positive End Expiratory Pressure (PEEP)

PEEP
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Nursing Care: Mechanical Ventilation
- Oxygen
- Suctioning

Nursing Care: Pharmacology
- Neuromuscular blockade
- Sedation
- Pain control
- Diuretics
- Hemodynamic support

Supportive Care
- Nutrition
- VAP
- Cardiovascular
- DVT Prophylaxis

Prone Positioning in ARDS
Computed tomography scan of the lungs showing acute respiratory distress syndrome when the patient is lying supine (left) and prone (right).

Complications of ARDS
- Barotrauma
- VAP
- Pneumothorax
- GI
- Cardiac
- Other

http://www.kolumbus.fi/hans/gastrolab/sls035.htm

Nursing Care: Prone Positioning
Repositioning into the prone position (face down) may improve oxygenation by relieving atelectasis and improving perfusion
Question
Ms. Jones aspirated at the time of intubation and develops ARDS with worsening hypoxemia, with SpO2 of 85% on FiO2 0.8 and PEEP 5 cm H2O.
Which one of the following interventions is a priority?
   a. Increase his FiO2 to 1.0 and accept SpO2 of 90%
   b. Increase the level of PEEP as required and monitor ICP
   c. Initiate low tidal volume ventilation
   d. Prepare for urgent bronchoscopy

Question
Mr. Evans has ARDS and is on the following ventilator settings: FiO2 0.5 PEEP 12 AC 22 Volume Controlled ventilation with VT 450 cc. Blood gases are: PaO2 64 PCO2 58 pH 7.22 HCO3 26.
Which one of the following interventions would be the priority?
   a. Increase the PEEP
   b. Increase the tidal volume
   c. Change to Pressure Control Ventilation
   d. Increase the AC rate

References

Recommended Reading