• Pediatric Nursing
• Respiratory "part 3"
• Lecture "9"
In this lecture, we will discuss:

- Tuberculosis.
- Asthma.
- Cystic fibrosis.
- Bronchopulmonary dysplasia.
Tuberculosis (TB) is caused by organism *Mycobacterium tuberculosis*, which is transmitted through the air in infectious particles called droplet nuclei.

Children catch the infection from adults who cough, sneeze, speak, or sing. Because they sent tiny droplets containing the bacillus.

As the child inhale the droplets, it takes its way directly to the alveoli through the airway.
Once they reach the alveoli, an immune response is initiated, and the microphages surrounds the bacillus and wall off it in small hard capsules called tubercles.

The tubercles remain inactive and grow slowly until its number reaches 1000-10,000 after 2-12 weeks.

At that time the inflammatory process against TB can be identified through TB test.

A time between 2-12 months the tubercles become active and the symptoms of the disease occur.
Tuberculosis

- The tubercle bacilli spread to the blood stream and lymphatic system causing spreading of the disease to whole body (TB meningitis or miliary TB).

- TB is communicable disease when it in the active form of the diseases.

- TB patient is manifested by:
  - persistent cough, weight loss, or failure to gain weight,
  - low grade fever, wheezing, decreased breathing sounds, anorexia, enlarge lymph node.

  Hemoptesis in the sever cases.
A **screening questions** must be asked during the regular child visit, and if the child have two or more risk factors; the TB test must be done.

<table>
<thead>
<tr>
<th>Question</th>
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<tbody>
<tr>
<td>Is the child born or traveled outside the country?</td>
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<tr>
<td>Has the child exposed to anyone with TB disease?</td>
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<tr>
<td>Has the child exposed to anyone with positive TB test?</td>
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<tr>
<td>has any member of the family traveled or born outside the country?</td>
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<tr>
<td>Test</td>
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<tr>
<td>--------------------------------------------------</td>
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<tr>
<td><strong>Mantoux test</strong> <em>(intradermal injection of 5 tuberculin units of purified protein derivative)</em></td>
</tr>
<tr>
<td>Chest X-ray or CT scan</td>
</tr>
<tr>
<td>Blood culture</td>
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<tr>
<td>Sputum culture</td>
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<tr>
<td>Lumber puncture</td>
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</table>
• Mantoux test
Medication used are isoniazid (INH), rifampicin, pyrazinamide, ethambutol & streptomycin.

For active TB:
• Start with medication for 6 months; daily for two months twice weekly for four months

For latent TB:
• Start with medication for 9 months; once daily. 2-3 time weekly.
Nursing Managements

• TB is a major health disease and must be reported to the health department.

• Public health nurses need to evaluate contacts with the child to identify the primary cause of TB, and other potentially infected members.

• Providing supportive care when needed.

• Teaching the parents about the disease process, medication and the importance of long term therapy.

• Encourage proper nutrition and rest to ensure normal growth and development.
• Asthma

• Also called bronchial asthma, is a chronic inflammatory process of the airway with airway obstruction that can partially or completely reversed, and increase in airway responsiveness to stimuli.

• It's an immediate hypersensitivity (type 1) response, the most common chronic illness in children.

• Symptoms occur before 5 years of age and diagnosed as frequent occurrences of bronchiolitis.

• Its result from inflammation and bronchoconstriction that result from cold air or irritating odor (pollens, house dust, some food, smoking (passive)).
Mechanism of disease :-

@@ Inflammation causes the normal protective mechanism of lung to react excessively in response to a stimuli & cause obstruction of the airway. **These mechanisms are:**

1- Airway muscle contraction (bronchospasm).
2- Inflammation of bronchial mucosa (swelling of mucosa)
3- Increase bronchial secretion (mucus formation)
Pathophysiology

- **Triggers** such as allergens, bacterial or viral agents, dust, furry pets, birds, whether changes (humidity & temperature), exercise, stressful or emotional events.

- All can initiate a response, and an antigen binds to specific immunoglobulin E surface on the mucosal mast cells & histamine is released with intercellular chemical mediators (leukotrienes, prostaglandins, platelets activation factors) → resulting in bronchospasm, mucosal edema, & mucus secretion.
Bronchial tube in run-up to an asthma attack

Inflamed bronchial tube during an attack

Cytokines

Mucus
NORMAL AIRWAY:
- No Muscle Tightening
- Normal airway lining

ASTHMA AIRWAY:
- Airway lining swollen and red
- Muscle Tightening
- Mucus
A late allergic response can be started after 6-9 hours from first episode because another waves of mediator release occur. Which stimulate more airway inflammation & bronchospasm.

The three mechanisms caused narrowing of the airway, & mucus plug the small airways & traps air; leading to decrease perfusion of the alveolar capillaries results from hyperinflation of the alveoli.

Hypoxemia occur, increase respiratory rate.
Clinical Manifestations

- Sudden appearance of breathing difficulties (cough, wheeze, or shortness of breath).
- Rapid respiration, labored breathing.
- Nasal flaring, intercostal's retractions.
- In case of severe obstruction, wheezing is not heard due to lack of air.

- Hypoxemia, hypoxia.
- Agitation, lethargic irritability.
- Barrel chest (in children with repeated acute episodes).
Retractions

Barrel chest

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The diagnosis of asthma has four key elements:

- Symptoms of episodic airflow obstruction.
- Partial reversibility of bronchospasm with bronchodilator treatment.
- Exclusion of alternative diagnosis.
- Confirmation by spirometry of measurement of forced expiratory flow variability, for children older than 4 years old.
Diagnostic evaluation

- **Green zone** (80%-100%) no asthma attack present, and he can take routine medication

- **Yellow zone** (50%-80%) an episode of asthma may be beginning

- **Red zone** (below 50%) a severe episode start and immediately take an inhaler beta 2-agonist. then repeat test.
• Asthma
<table>
<thead>
<tr>
<th>Assessment criteria</th>
<th>Mild</th>
<th>Moderate</th>
<th>Sever</th>
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<tbody>
<tr>
<td>PEER</td>
<td>70-90 %</td>
<td>50-70 %</td>
<td>&lt; 50 %</td>
</tr>
<tr>
<td>Resp. rate</td>
<td>Normal to 30% increase</td>
<td>30-50% increase</td>
<td>Increase over 50%</td>
</tr>
<tr>
<td>Dyspnea</td>
<td>Absent or mild</td>
<td>Moderate</td>
<td>Sever</td>
</tr>
<tr>
<td>Color</td>
<td>Good</td>
<td>Pale</td>
<td>Cyanosed</td>
</tr>
<tr>
<td>$O_2$ saturation</td>
<td>&gt; 95 %</td>
<td>&lt; 40 %</td>
<td>&lt; 40 %</td>
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# Rescue medications

<table>
<thead>
<tr>
<th>Medication</th>
<th>Action</th>
<th>Implication</th>
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<tbody>
<tr>
<td>Beta₂-agonist</td>
<td>Relax smooth muscle in airway, increase water content in mucus; to help in clearance.</td>
<td>Teach about side effects (tachycardia, vomiting)</td>
</tr>
<tr>
<td>corticosteroid</td>
<td>Decrease airway inflammation. Enhance effects of Beta₂-agonist</td>
<td>Give with food. Long term side effect: immunosuppression</td>
</tr>
<tr>
<td>Anticholinergic</td>
<td>Inhibit bronchoconstriction, decrease mucus production</td>
<td>Side effect: cough, dry mouth, headache.</td>
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<tr>
<th>Type</th>
<th>Description</th>
<th>Medication</th>
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<tbody>
<tr>
<td>Mild intermittent</td>
<td>Night symptoms, 2 time/week</td>
<td>No daily medication needed</td>
</tr>
<tr>
<td>Mild persistence</td>
<td>&gt; Twice/week, but &lt; once daily</td>
<td>Low dose inhaled corticosteroid</td>
</tr>
<tr>
<td>Moderate persistent</td>
<td>Daily symptoms of coughing &amp; wheezing.</td>
<td>Low dose inhaled corticosteroid + long acting B₂ agonist.</td>
</tr>
<tr>
<td>Sever persistence</td>
<td>Contentious day time symptoms. Frequent night symptoms</td>
<td>High dose inhaled corticosteroid + long acting B₂ agonist (nebulizers).</td>
</tr>
</tbody>
</table>
Nursing Diagnosis

• Ineffective airway clearance related to
                          ..........................................................

• Impaired gas exchange related to
                          ..........................................................

• Risk for deficit fluid volume related to
                          ..........................................................

• Anxiety/ fear (parents or child) related to
                          .......................................................
Nursing interventions

- Maintain airway patency.
- Meet fluid needs.
- Promote rest & stress reduction.
- Support family participation.
Cystic Fibrosis

• Is a common inherited autosomal recessive disorder of the exocrine glands that results physiological alteration in the respiratory, gastrointestinal, integumentary, musculoskeletal, & reproductive system.

• It caused by mutation of the gene 23 on chromosome No. 7; which is Cystic Fibrosis Transmembrane conductance regulator (CFTR).

• With defective (CFTR); the epithelial cells & exocrine glands which are glands that secrete their products (enzymes) into ducts including sweat glands, salivary glands, mammary glands, stomach & liver
Pathophysiology

- Will have defective chloride ion transport & decrease water flow across cell membrane.

- This will leads to abnormal accumulation of viscous & dehydrated mucus that affects all body organ with mucous ducts. It becomes obstructed & damaged.
Inheritance of Cystic Fibrosis (CF)

Father (Carrier of CF Gene)

Mother (Carrier of CF Gene)

Child (Does Not Have CF)

Child (Carrier of CF Gene)

Child (Carrier of CF Gene)

Child (Has Cystic Fibrosis)

Normal Gene

Defective Gene
Effects on Lungs

- The lungs are always filled with mucus, which the respiratory cilia cannot clear.

- This causes the air to become trapped in the small airways, resulting in atelectasis.

- Secondary respiratory infections occur because secretion provides a good environment for bacteria to grow.

- Respiratory failure is the leading cause of mortality.
Effects on Lungs

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Effects on the pancreas

- Excess secretion of mucus will block the ducts resulting in pancreatic damage.

- Natural enzymes that are important in fat & protein digestion are not secreted, resulting in malabsorption.

- If damage reach the Beta cells responsible in secreting insulin, the child will develop Cystic fibrosis related Diabetes.
**Effects on reproductive system**

- Female’s reproductive tract become occluded that interfere with sperm passage leads to infertility.

- Male’s vas deference become obstructed from secretion → leading to sterility (infertility).
Clinical manifestation

- **Respiratory**: chronic moist, productive cough, & frequent respiratory infections.
- **GI**: frothy stool (large quantity), foul smell, contain fat (greasy), constipation and rectal prolepse.
- **Sinus**: frontal headache, facial tenderness, purulent nasal discharge.
- **Weight**: inability to gain weight, due to malabsorption.
Diagnostic test

• The child is diagnosed with CF, when he presents three things:

1- newborn meconuim ileus (small bowel obstruction in the newborn’s first 48 hours of life).
2- malabsorption (failure to thrive).
3- chronic recurrent respiratory infections.
Managements

1- respiratory therapy:
   • Increase exercise & physical fitness to promote lung function.
   • Chest physiotherapy twice daily to clear the lungs.
   • Give immunization, to prevent viral or bacterial infections.

2- GI:
Enema to relieve constipation and obstructed intestine.

3- nutritional needs:
Provide pancreatic enzymes, to assist in digestion.
Bronchopulmonary Dysplasia

• Bronchopulmonary dysplasia (BPD) is a chronic lung disease of infancy.

• It is most common among children who were born prematurely, with low birth weights and who received prolonged mechanical ventilation to treat respiratory distress syndrome.

• BPD is characterized by inflammation and scarring in the lungs.

• More specifically, the high pressures of oxygen delivery result in necrotizing bronchiolitis and alveolar septal injury, further compromising oxygenation of blood.
Management

• The diagnosis of lung injury is evident by chest radiograph that often shows hyperexpansion, atelectasis, & interstitial thickening.

• Barrel chest is evident due to trapped air in alveoli.

• As management: the goal is to provide O2 without use of high concentration.

• In addition to symptomatic treatment that support the respiratory function.

• Chest physiotherapy, medication (diuretics, bronchodilators, anti-inflammatory, inhaled cortisone).