PNEUMONIA

H. Helmi M. Lubis, Dr, Sp.A(K)
H. Ridwan M. Daulay, Dr, Sp.A(K)
Wisman Dalimunthe, Dr, Sp.A
Acute Respiratory Infections (ARI)

**Developed and developing countries**
- High morbidity
- 5 – 8 episodes/year/child
- 30 – 50% outpatient visit
- 10 – 30% hospitalization

**Developing countries**
- High mortality
- 30 – 70 times higher than in developed countries
- 1/4 - 1/3 death in children under five year of age
Distribution of 12.2 million deaths among children less than 5 years old in all developing countries, 1993

- ARI (26.9%)
- Malaria (6.2%)
- ARI/Malaria (1.6%)
- Measles (2.4%)
- Diarrhoea/measles (1.9%)
- Diarrhoea (22.8%)
- Other (33.1%)
- ARI/Measles (5.2%)
- Malnutrition (29%)

RISK FACTORS FOR PNEUMONIA OR DEATH FROM ARI

- Malnutrition, poor breast feeding practices
- Vitamin A deficiency
- Lack of immunization
- Low birth weight
- Young age
- Cold weather or chilling
- Increase risk of ARI
- High prevalence of nasopharyngeal carriage of pathogenic bacteria
- Exposure to air pollution
  - Tobacco smoke
  - Biomass smoke
  - Environmental air pollution

Increase risk of ARI

- Cold weather
- Crowding
- Young age
- Low birth weight
- Vitamin A deficiency
- Lack of immunization
- Malnutrition
- Poor breast feeding practices
Magnitude of the Problem in Indonesia

Pneumonia in children (< 5 years of age)
- Morbidity Rate 10-20%
- Mortality Rate 6/1000
- Pneumonias kill
  - 50,000/a year
  - 12,500/a month
  - 416/a day = passengers of 1 jumbo jet plane
  - 17/an hour
  - 1/four minutes

Pneumonia is a no 1 killer for infants (Balita)
**Definition**

An inflammation of the parenchima of the lungs

**Classifications**

- **Anatomical classification**
  - Lobar pneumonia
  - Lobular pneumonia
  - Interstitial pneumonia
  - Bronchopneumonia

- **Etiological classification**
  - Non infection: Aspiration of food, gastric acid, foreignbodies, hydrocarbons, Hypersensitivity reaction, Drug/radiation induced
  - Infection: Bacterial, Viral, Mycoplasma, Mycotic
Etiology

- Predominantly: viral and bacterial
- In developing countries:
  - bacterial > viral
  - (Shann, 1986): In 7 developing countries, bacterial → 60%
  - (Turner, 1987): In developed countries,
    - bacterial → 19%; viral → 39%

Viral etiology:
- Respiratory virus (most common)
- Non respiratory virus (less common)

Bacterial etiology:
- Streptococcus pneumoniae
- Hemophilus influenzae
- Staphylococcus aureus
- Streptococcus group A – B
- Klebsiella pneumoniae
- Pseudomonas aeruginosa
- Chlamydia spp
- Mycoplasma pneumoniae
Clinical manifestation

**Viral**
- Preceded by several days of upper respiratory tract symptom, typically rhinitis and cough
- Fever, lower than bacterial pneumonia
- Tachypnea accompanied by intercostal, subcostal, and suprasternal retractions, nasal flaring, and use of accessory muscle
- Severe infection: cyanosis, respiratory fatigue
- Chest auscultation: rales, and wheezing

**Bacterial**
- Sudden onset with a shaking chill followed by high fever, cough, and chest pain (older children)
- Preceded by mild upper respiratory infection tract infection (stuffy nose, fretfulness, and diminished appetite)
- Appear ill with moderate to severe air hunger
- Often cyanosis
- Respiratory distress (grunting, nasal flaring, retraction, tachipnea and tachicardia)
Characteristic features

- *S. pneumoniae*
  - mucosal inflammation lesion
  - alveolar exudates
  - frequently → lobar pneumonia)
- *H. influenzae, S. viridans, Virus*
  - invasion and destruction of mucous membrane
- *Staphylococcus, Klebsiella*
  - destruction of tissues → multiple abscesses

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**BACTERIA ISOLATED FROM LUNG ASPIRATES IN 370 UNTREATED CHILDREN WITH PNEUMONIA**

- S. Pneumoniae
- H. Influenzae
- S. Aureus
Simple Clinical Signs of Pneumonia (WHO)

Fast breathing (tachypnea)

Respiratory thresholds

<table>
<thead>
<tr>
<th>Age</th>
<th>Breaths/minute</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 2 months</td>
<td>60</td>
</tr>
<tr>
<td>2 - 12 months</td>
<td>50</td>
</tr>
<tr>
<td>1 - 5 years</td>
<td>40</td>
</tr>
</tbody>
</table>

Chest Indrawing
(subcostal retraction)
Pathology and Pathogenesis

Bacteria → peripheral lung tissues → tissues reaction → oedematous
- Red Hepatization Stadium
  alveoli consist of: leucocyte, fibrine, erythrocyte, bacteria
- Grey Hepatization Stadium
  fibrine deposition, phagocytosis
- Resolution Stadium
  neutrophil degeneration, loose of fibrine, bacterial phagocytosis

Bronchopneumonia
Early stages of acute bronchopneumonia. Abundant inflammatory cells fill the alveolar spaces. The alveolar capillaries are distended and engorged.
**Bronchopneumonia**
Acute bronchopneumonia. The alveolar spaces contain abundant PMNs and an inflammatory infiltrate rich in fibrin.

**Acute Bronchopneumonia**
Acute bronchopneumonia; the alveolar spaces are full and distended with PMNs and a proteinaceous exudate. Only the alveolar septa allow identification of the tissue as lung.
Radiographic patterns

1. Diffuse alveolar and interstitial pneumonia (perivascular and interalveolar changes)
2. Bronchopneumonia (inflammation of airways and parenchyma)
3. Lobar pneumonia (consolidation in a whole lobe)
4. Nodular, cavity or abscess lesions (esp.in immunocompromised patients)
Female girl, 6.5 y, cXr interstitial infiltrates, eC S pneumoniae: IgG pneumolysin increased, leucocytosis 29800, ESR 35 mm/h l, CRP 9 mg/l.

Male boy, 1.9 y, cXr alveolar infiltrates in right lobe, eC S pneumoniae: IgG pneumolysin increased, leucocytosis 13800, ESR 125/h l, CRP 332 mg/l.
Female girl, 2.8 y, cxr. alveolar infiltrates in lower left lobe ec. rhinovirus: leucocytosis 17700, ESR 64 mm/h l, CRP 128 mg/l.

Female infant, 0.3 y, cxr. alveolar infiltrates in upper right lobe ec parainfluenza and human herpes virus, leucocytosis 17000, ESR 8 mm/ h l, CRP 22 mg/l.
Blood Gas Analysis & Acid Base Balance

- Hypoxemia ($P_aO_2 < 80 \text{ mm Hg}$)
  - with $O_2$ 3 L/min
    - 52.4%
  - without $O_2$
    - 100%
- Ventilatory insufficiency
  - ($P_aCO_2 < 35 \text{ mmHg}$) 87.5%
- Ventilatory failure
  - ($P_aCO_2 > 45 \text{ mmHg}$) 4.8%
- Metabolic Acidosis
  - poor intake and/or hypoxemia 44.4%
    (Mardjanis Said, et al. 1980)

Management

Severe Pneumonia

- Hospitalization
- Antibiotic administration
  - Procain Penicilline, Chloramphenicol
  - Amoxycillin + Clavulanic Acid
- Intra Venous Fluid Drip
- Oxygen
- Detection and management of complications
### WHO recommendations for treatment of infants less 2 months who have cough or difficulty breathing

<table>
<thead>
<tr>
<th>Condition</th>
<th>Symptoms</th>
<th>Treatment</th>
</tr>
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<tr>
<td><strong>No pneumonia</strong></td>
<td>No tachypnea, no severe chest indrawing</td>
<td>Do not administer an antibiotic</td>
</tr>
<tr>
<td><strong>Severe pneumonia</strong></td>
<td>Tachypnea or severe chest indrawing</td>
<td>Admit, administer benzylpenicillin + gentamycin, and oxygen</td>
</tr>
</tbody>
</table>

### WHO recommendations for treatment of children aged 2 months to 4 years who have cough or difficulty breathing

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<tr>
<td><strong>Pneumonia</strong></td>
<td>Tachypnea, no chest indrawing</td>
<td>Home treatment with cotrimoxazole, amoxicillin or procaine penicillin</td>
</tr>
<tr>
<td><strong>Severe pneumonia</strong></td>
<td>Chest indrawing, no cyanosis, and able to feed</td>
<td>Admit; administer benzylpenicillin i.m. every 6 h</td>
</tr>
<tr>
<td><strong>Very severe pneumonia</strong></td>
<td>Chest indrawing with cyanosis and not able to feed</td>
<td>Admit; administer chloramphenicol i.m. every 6 h and oxygen</td>
</tr>
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### Initial empirical treatment based on age and severity of pneumonia

<table>
<thead>
<tr>
<th>Age</th>
<th>Outpatients (Mild to Moderate)</th>
<th>Inpatients (Moderate)</th>
<th>Inpatients (Severe)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 - 6 mos</td>
<td>Amoxicillin with or without clavulanate Erythromycin</td>
<td>Ceftriaxone or cefotaxim</td>
<td>Ceftriaxone or cefotaxime + vancomycin</td>
</tr>
<tr>
<td>6 mos to 5 yrs</td>
<td>Amoxicillin with or without clavulanate Erythromycin</td>
<td>Ceftriaxone, cefotaxime, or Cefuroxime + macrolide</td>
<td>Ceftriaxone or cefotaxime + macrolide + vancomycin</td>
</tr>
<tr>
<td>5 – 18 yrs</td>
<td>Macrolide</td>
<td>Ceftriaxone or cefotaxime + macrolide</td>
<td>Ceftriaxone or cefotaxime + macrolide + vancomycin</td>
</tr>
</tbody>
</table>

Hsiao G et al, 2001

### Complications

- Pleural effusion (empyema)
- Piopneumothorax
- Pneumothorax
- Pneumomediastinum
Thankyou