ECHO Summary,12/APR/2024

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Definition

- Pneumonia refers to acute inflammation and infection of the lungs and may be subdivided into:
    - Lobar pneumonia - involves lung parenchyma
    - Bronchopneumonia - involves lung parenchyma AND bronchi

Epidemiology

- Globally 1 child dies of pneumonia every 39 seconds
- 50% of the pneumonia cases and deaths are in sub-Saharan Africa
- 20%of all cases of pneumonia occur in children less than 8 years
- In Africa, pneumonia causes approximately as many childhood deaths as malaria

Risk Factors

- Malnutrition
- Immunosuppression
- Measles, pertussis
- Pre-existing lung or heart disease

Clinical features

- Respiratory distress
- Fever
- Cough
- Chest pain
- Decreased feeding
- Vomiting
- Abdominal pain
- Wheezing
- Lethargy
- Cyanosis
- Seizure

Classification

Moderate Pneumonia	Severe Pneumonia
● Rapid breathing (> 30 bpm) ● No chest indrawing	● O2 saturation <90%, or central cyanosis ● Rapid breathing (≥60 breaths/minute) ● Heart rate >120 bpm ● Hypotension for age ● Severe respiratory distress characterized by grunting or chest indrawing ● Signs of pneumonia with danger signs such as inability to breastfeed, lethargy, or altered mental status ● Age <2 months

Clinical features

- **AIRWAY**: Signs of airway compromise such as grunting, nasal congestion, secretions
- **BREATHING**: Signs of respiratory distress such as tachypnea, chest in-drawing nasal flaring, tripod positioning, grunting, or cyanosis. Crackles/crepitations on auscultation SpO2<90% on room air, central cyanosis
    - Tachypnea can be defined depending on the age as follows:

AGE	RATE
0-2 months	>60 breaths per minute
2-12 months	>50 breaths per minute
1-5 years	>40 breaths per minute
Adults- >5 years	>30 breaths per minute

- **DISABILITY**:
    - Always check glucose because patients likely have not been feeding. Younger children have less reserves than adults and are at higher risk for hypoglycemia
    - Look for signs of an altered or reduced level of consciousness
    - Check for fever or hypothermia
- **CIRCULATION:** Look for signs of hypovolemia such as cold extremities, diaphoresis, the character of the pulse, thin thready pulse, clammy skin, pallor, hypotension, signs of dehydration, presence of added heart sounds as seen in endocarditis
- **EXPOSURE**: Assess patients for the presence of a fever
    - Look out for signs of dehydration such as sunken eyes, lethargy, and any other missed features

Note - Children are more susceptible to respiratory distress compared to adults because of the following:

- Infants are obligate nasal breathers therefore congestion/secretions can cause significant respiratory distress.
- Their smaller airways make it easy for them to get obstructed due to inflammation and congestion
- Compliant chest walls combined with more horizontal rib orientation result in less functional residual capacity

Causative organisms vary by age as follows:

Age	**Common causative organisms**
Neonates	Group B Streptococcus Klebsiella pneumoniae Escherichia coli Chlamydia pneumoniae Staphylococcus aureus

<5 years	Streptococcus pneumoniae Haemophilus influenzae Staphylococcus aureus Moraxella catarrhalis Mycoplasma pneumoniae Viruses [including influenza, measles, Covid, respiratory syncytial virus (RSV), etc.]
Adults and children >5	Streptococcus pneumoniae Mycoplasma pneumoniae Viruses
Children with HIV	Same etiologies as immunocompetent patients If CD4 < 200 - consider Pneumocystic jirovecci, fungal pathogens, and atypical viral infections such as cytomegalovirus (CMV)

Diagnostics

Pneumonia in children is a clinical diagnosis therefore laboratory investigations are not routinely required for a diagnosis of pneumonia however the following can be helpful:

- Malaria rapid diagnostic test or blood smear for malaria parasites
- Complete blood count - leukocytosis may be seen; however, this lacks sensitivity and specificity in the diagnosis of pneumonia. Leukocytosis > 25,000 may be indicative of severe pneumonia
- Chest x-ray - consolidation may lag behind clinical features of pneumonia by several days and might be falsely reassuring
    - Bilateral pneumonitis may be suggestive of P. jirovecci
    - Pneumatocoeles (cavities filled with air) are suggestive of S. aureus
    - Upper lobar consolidation or pneumothorax can be associated with Mycobacterium tuberculosis (MTB)
    - Diffuse nodular densities can occur secondary to septic pulmonary emboli from endocarditis
- Sputum testing for the following
    - Culture and gram stain - can help guide antibiotic therapy
    - Ziehl-Neelsen (ZN) stain, culture, AFB, gene Xpert for MTB
- Blood cultures for severe cases/associated sepsis
- Urea and electrolytes

Treatment

DEFINITIVE TREATMENT

- Antibiotics
    - Duration: Continue treatment for at least 5 days, and for 3 days after the child is well
        - If concomitant meningitis: 21 days

        - If concomitant septicemia: 10 days
    - First-line treatment
        - Neonates
            - Ampicillin 50 mg/kg or benzylpenicillin 50,000 u/kg every 6 hours
            - Gentamicin 7.5 mg/kg once daily (5 mg/kg once daily if <7 days old)
        - Children
            - First-line
                - Oral amoxicillin 40 mg/kg/dose twice daily for 5 days
            - If penicillin allergy or poor response after 48 hours (possible atypical pneumonia), give:
                - >8 years old - doxycycline 100 mg every 12 hours for 7-10 days
                - Erythromycin 500 mg every 6 hours for 5 days
            - If atypical pneumonia, extend the course to 14 days
    - If there is no improvement within 48 hours and Staphylococcus is suspected, gentamicin 7.5 and cloxacillin 50 mg/kg are recommended
        - Clindamycin can also be considered in cases of MRSA
    - Ceftriaxone 100 mg/kg IV once daily in cases of respiratory therapy or failure of first-line therapies
        - Alternative therapy: chloramphenicol 25 mg/kg IV every 6 hours (contraindicated in premature babies and neonates <7 days old)
- Paracetamol 10-15 mg/kg every 4-6hrs for fever and/or pain
- Salbutamol 1-2 puffs every 4-6 hours if wheezing present

SUPPORTIVE CARE

- Suction any secretions at the entrance to the nasal passages
- If wheeze is present rapid-acting bronchodilators and steroids for patients with reactive airway disease/asthma, depending on history and clinical findings
- Encourage breastfeeding for infants
    - Nasogastric tube (NGT) if too lethargic or tachypneic to feed
- Ensure that the child receives daily dextrose-containing maintenance fluids if unable to feed
- Keep O2 saturation ≥ 94%
    - Oxygen therapy should be administered as follows:
        - Oxygen therapy via nasal prongs is the preferred method of oxygen delivery in children
            - Nasal cannula 0.5-1 L/min for neonates
            - 1-2 L/min for infants
            - 1-4 L/min for older children
        - Face mask for delivery for higher flow
        - Continuous positive airway pressure (CPAP) for those with moderate to severe increased work of breathing or those with hypoxia that is not adequately improved with treatment

        - CPAP provides continued pressure support to the lungs decreasing atelectasis, reducing work of breathing, and improving oxygen delivery especially in patients with severe respiratory distress not responding to oxygen therapy via nasal prongs

Complications

- Septicemia, leading to septic shock
- Metastatic bacterial infection (i.e. meningitis, peritonitis, endocarditis, septic arthritis)
- Pleural effusion or empyema - often caused by S. aureus; clindamycin is the antibiotic of choice
- Abscess - these may require surgical drainage

Disposition

- Admission until work of breathing has improved to the point that children can feed and they are no longer requiring oxygen

Prevention

- Breastfeeding as opposed to formula feeding for infants
- Reduction of indoor air pollution
- Good hand hygiene
- Prevention and treatment of malnutrition
- Encouraging vaccinations

Special Notes

- Patients with mild pneumonia who are feeding well and are not hypoxic should be managed at home with oral antibiotics
    - Supportive care may include soothing the throat with cold and hot foods and relieving the cough with safe remedies
        - Honey is recommended for children above 1 year for the management of cough
    - Mucolytics and cough suppressants have been shown to have no added benefit - therefore prescribers should be cautious of side effects
- Parents need to be educated and reassured that coughing is a protective mechanism. They should be counseled to return if there has been no improvement on 5 days of oral antibiotics
    - Other return precautions include worsening shortness of breath; signs include nasal flaring, retractions, tracheal tugging, inability to feed due to tachypnea, cyanosis, or pallor
- MTB should always be ruled out in patients with risk factors such as immunosuppression or known exposures

Collaborating Partners

1. Ministry of Health of the Republic of Uganda

2. Seed Global Health
3. Techies Without Borders

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