CHILDHOOD PNEUMONIA IN LOW INCOME COUNTRIES

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Burden of Childhood Pneumonia

- Causes 20% of deaths in children in LIC
- Only 4,3% of deaths in high income countries
- Globally 0,29 events per child year or 150 million new episodes anually.
- 75% of new cases in just 15 countries, more than 50% in just 6 countries (India, China, Pakistan, Bangladesh, Indonesia and Nigeria).
- Severe pneumonia requiring hospitalization accounts for 7-13% of cases.

Diagnosis

WHO diagnostic guidelines:

- Developed as case management guidelines to ensure recognizian and appropriate treatment of pneumonia in community settings
- Sensitive for identifying pneumonia but lacking specificity
- Problematic in astma, viral bronchiolitis, malaria with tachypnoea, acidosis a.o.

WHO Classification	IMCI Classification	Clinical Signs	Management
No pneumonia	Cough or cold	No signs of pneumonia or very severe disease	Symptomatic treatment, advise carer when to return immediately, follow up in 5 days if not improving
Non-severe pneumonia	Pneumonia	Fast breathing	Give oral antibiotics for 3 days, advise the carer when to return immediately, follow up in 2 days
Severe pneumonia	Severe pneumonia or very severe diasease	Chest indrawing	Give first dose of antibiotic Refer urgently to hospital
Very severe disease		Any general danger sign	Give first dose of antibiotic Refer urgently to hospital

Pneumonia etiology

Methodological difficulties

In 1983 multicenter needlepuncture studies and later smaller studies documents LIC countries pneumonia frequently caused by bacterial pathogens (50%) in contrast to HIC pneumonia (15%)

Etiology

- Most frequent bacterial pathogens:
- Streptococcus pneumonia
- Haemophilus influenzae
- (Staph. Aureus, Klebsiella pneumoniae, nontyphoidal Salmonellae in tropical Africa)
- Main viral causes (rural Kenyan study): RSV, influenza type A and parainfluenza type III, adenovirus, coronavirus, metapneumonia virus
- Often multiple pathogens

Epidemiology

- Burden of childhood pneumonia increased in high HIV prevalence areas
- Pneumonia related mortality is sixfold higher in HIV infected, higher risk of severe pneumonia, high prevalence of TB

Burden of disease

Research needed in:

- Better tools for pneumonia diagnosis
- Rapid and reliable methods for etiological diagnosis
- Existing estimates of disease burden affected by some uncertainty but still depicts childhood pneumonia as a major problem

Prioritizing and prevention

- WHO and UNICEF global action plan for prevention and control of pneumonia (GAPP)
- Highlights Pneumonia as a major cause of deaths in children
- Aims at scaling up interventions with proven benefit

Prevention strategies

Strategies to Reduce Childhood Pneumonia

General Strategies

Nutrition and micronutrient supplementation

- Exclusive breastfeeding for 6 months in HIV-uninfected mothers
- Adequate nutrition
- Vitamin A supplementation
- Zinc supplementation

Environmental factors

- Avoidance of indoor air pollution
- Hand washing

Prevention strategies

Specific Strategies

Immunisation

- Measles
- Haemophilus influenzae type b
- Pneumococcal
- Pertussis

Antibiotic prophylaxis

- Cotrimoxazole for HIV infected or exposed children
- Isoniazide for mycobacterial disease

Prevention of HIV infection in children

• Upscaling mother to child transmission programs

HAART in HIV-infected children early

Exclusive breastfeeding

- Decreases infant mortality, early neonatal sepsis, ARI and diarrhoea
- Bangladesh study:
- 2,4 times higher ARI risk
- 2,2 times higher risk of infant death
- Coverage of exclusive breastfeeding only 40% in the 90 countries with more than 90% of child deaths
- Potential reduction of pneumonia incidense 15-23%

Optimizing Nutrition

Stunting, Underweight and Micronutrient deficiency identified as risk factors for pneumonia, severe pneumonia and poor outcome

 Lack of interventional research but one study: 6% reduction in mortality with complimentary feeding 6-23 months

Micronutrients

- Zinc supplementation 70 mg one weekly in Banghladesh study: 17% reduction in pneumonia, 49% reduction in severe pneumonia. Its role in treatment is less clear
- Vitamin A reduces pneumonia morbidity and mortality associated with measles but has no effect on non-measles associated pneumonia

Indoor Air Pollution

Recent meta-analysis of exposure to indoor air pollution showed increased risk of pneumonia and severe pneumonia (OR 1,78) .Interventions by switching to cleaner fuels or improved combustion and increased ventilation reduces pneumonia incidence by 20-40%

Handwashing

- Reduces the risk of ARI and diarrhoea
- Randomized Pakistan trial: 50% reduction in pneumonia episodes with provision of training and soap, no difference between plain and antibacterial soap

Immunizations

 Measles vaccination eliminates measles associated pneumonia. Vaccination, however, often delayed significantly beyond 9 months.
Pertussis pneumonia and pertussis related mortality greatest in the first 6 months of live. Timely vaccination important.

Immunizations

- Hib conjugate vaccine reduces radiologically confirmed pneumonia and nasopharyngeal carriage
- PCV7 reduces the incidence of bacteremic pneumonia, radiologically confirmed pneumonia and clinical pneumonia. After introduction in the US hospitalized cases of pneumonia was reduced by 30%. In rural Gambia PCV9 reduced childhood mortality by 16% and radiologically confirmed pneumonia by more than 20%. PCV9 has proven effective in HIV infected children in South Africa though less than in immunocompetent children.

Antibiotic Prophylaxis

- TMP-SMX prophylaxis against PCP is effective. A randomized controlled trial in Zambia in HIV-infected childrenfound a 43% reduction in mortality and a 23% reduction in hospitalization in children on prophylaxis.
- Prophylaxis indicated in HIV exposed uninfected children until 6 months of age.

Prophylaxis may be discontinued in HIV infected children older than 18 months with sustained immune reconstitution on HAART.

Antibiotic Prophylaxis

INH prophylaxis in a South African trial of HIV infected children not on HAART living in an area of high TB prevalence showed reduction in TB by 72% and mortality by 54%



HAART in HIV infected children reduces the incidence of bacterial pneumonia and respiratory ooportunistic infections fivehold.

Case Management of Childhood Pneumonia

WHO case management guidelines assume:

- Most fatal pneumonia caused by bacterial infection
- These can be treated effectively with antibiotics
- Children can access health care facilities
- Clinical signs can be taught to health care workers.
- Incorporated into IMCI guidelines

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Impact of case management

A meta analysis has estimated the impact of case management to 24% reduction in total child mortality and 36% reduction in pneumonia related mortality in children under 5.

Challenges:

- Limited scale IMCI implementation
- Delayed care seeking
- Insufficient dosing with low quality drugs
- Poor quality care in district hospitals
- Lack of access to antibiotics and oxygen

WHO guidelines for antibiotic treatment of pneumonia

Drug	Route	Dose	Frequency	Duration
Amoxicillin or Trimethoprim- sulpha methoxazole	Oral Oral	15 mg/kg or 30 mg/kg 4 mg/kg trimethhoprim component	3 times daily 2 daily 2 daily	5 days 3 days 3 or 5 days
Beta lactam antibiotic: Benzyl penicillin Ampicillin	Intravenous	50 000 units/kg 25 mg/kg	4 times daily 3 times daily	Until child improves then change to oral amoxicillin, total 5 days
Beta lactam antibiotic: Benzyl penicillin or Ampicillin AND Gentamicin	Intravenous Intravenous	50 000 units/kg 50 mg/kg 7.5 mg/kg	4 times daily 3 times daily 1 daily	10 days 10 days 10 days
	Drug Amoxicillin or Trimethoprim- sulpha methoxazole Beta lactam antibiotic: Benzyl penicillin Ampicillin Beta lactam antibiotic: Benzyl penicillin Ampicillin or Ampicillin or Ampicillin	DrugRouteAmoxicillin orOralAmoxicillin orOralDrimethoprim- sulpha methoxazoleOralBeta lactam antibiotic: Benzyl penicillin AmpicillinIntravenousBeta lactam antibiotic: lenzyl penicillin AmpicillinIntravenousBeta lactam antibiotic: Benzyl penicillinIntravenousBeta lactam antibiotic: Benzyl penicillinIntravenousBeta lactam antibiotic: Benzyl penicillinIntravenousIntravenous IntravenousIntravenous	DrugRouteDoseAmoxicillin or Trimethoprim- sulpha methoxazoleOral15 mg/kg or 30 mg/kg 4 mg/kg trimethhoprim componentBeta lactam antibiotic: Benzyl penicillin AmpicillinIntravenous Intravenous50 000 units/kg 25 mg/kgBeta lactam antibiotic: Benzyl penicillin AmpicillinIntravenous Intravenous50 000 units/kg 25 mg/kgBeta lactam antibiotic: Benzyl penicillin AmpicillinIntravenous Intravenous50 000 units/kg 25 mg/kgBeta lactam antibiotic: Benzyl penicillin or Ampicillin AND GentamicinIntravenous Intravenous50 000 units/kg 50 mg/kg	DrugRouteDoseFrequencyAmoxicillin or Trimethoprim- sulpha methoxazoleOral15 mg/kg or 30 mg/kg 4 mg/kg trimethhoprim component3 times daily 2 daily 2 daily 2 dailyBeta lactam antibiotic: Benzyl penicillin AmpicillinIntravenous50 000 units/kg 25 mg/kg4 times daily 3 times daily 3 times daily 3 times daily 3 times daily 3 times daily 1 times daily 3 times dail

Hypoxia

- Hypoxia is best identified by pulse oximetry
- If not available respiratory rate above 60/minute and altered mental state may be used as clinical indicators.
- Routine screening for hypoxia with pulse oximetry and improved oxygen delivery systems have shown to significantly reduce pneumonia mortality.
- Challenges in pneumonia treatment:
- How to identify children that fail to response adequately to antibiotic treatment (9-20%)
- Proper management in HIV infected children.

Summary

- Childhood pneumonia continous to be a major cause of mortality in LIC and MIC
- Effective preventive strategies must be intensified
- Case management strategies should be more widely implemented at community level
- Better access to pulse oximetry and oxygen delivery systems needed
- Interventions specific for HIV infected children are needed
- Further research to develop better diagnostic tests and reliable methods for etiological diagnosis are needed.