Pediatric Viral Pneumonia

Amir Hossein Jafari-Rouhi MD, MSc
Associate Professor of Pediatrics
Pediatric Pulmonologist
TBZUMS

PNEUMONIA

"Inflammation of the lung"

-From Greek pneumōn meaning 'lung'

Community Acquired Pneumonia

- Defined as the presence of signs and symptoms of pneumonia in a previously healthy child due to an infection which has been acquired outside hospital
- 120 million annual worldwide incidence of pneumonia in children <5 years old
- mortality rate 8.7% severe pneumonia
- >80% of all childhood pneumonia deaths occur in children <2 years old
- mortality rate reduced from 4-6 million in early 1980s to ~0.9 million in 2015[1]
- still second most common cause of childhood mortality worldwide second only to neonatal/preterm birth complications[1]

[1]JAMA Pediatr. 2017;171(6):573

Community Acquired Pneumonia

- Incidence higher in boys[1]
- Incidence of severe pneumonia higher in children < 5 years of age[1]
- Marked seasonal pattern with winter preponderance for hospital admission due to pneumococcal infection (December and January 3-5x higher than August) [2]
- Winter preponderance also noted for many viral infections including respiratory syncytial virus, influenza and parainfluenza 1 & 2 [3]

[1]JAMA Pediatr. 2017;171:573 [2]Epidemiol Infect 2007;135:262 [3]Journal of Infection 2006;52:37

Etiology

- Viruses most prevalent cause of CAP in childhood particularly during infancy
- RSV, influenza and human metapneumovirus most common viruses[1]
- *Corona viruses, Covid 19*
- *AND then, Bacterial Causes . . .*

[1] Thorax 2019;74:261 [2]Clin Infect Dis 2014;58:918

Clinical Features

- No single symptom or sign is pathognomic for CAP in children
- May present with fever, cough, tachypnoea, breathlessness or difficulty in breathing, wheeze or chest pain
- May also present with abdo pain and/or vomiting +/- headache
- Large study of children hospitalised with CAP and CXR changes[1]:
  - 95% presented with cough, 90% fever, 75% anorexia, 70% short of breath

[1]NEJM 2015;372:835

Clinical Features

- Tachypnoea
  - relatively specific but not sensitive[1]
  - associated with hypoxaemia in infants (>70 bpm)[2]
- Increased work of breathing
  - signs include grunting, nasal flaring and chest retractions or indrawing
  - highly specific for pneumonia[1]
- Chest examination
  - Crackles on auscultation
  - Wheeze more common with CAP due to atypical bacteria and viruses (also consistent with asthma and bronchiolitis)
  - Signs of consolidated lung including vocal resonance,vocal fremitus, reduced breath sounds, dullness to percussion

[1]JAMA 2017;318:426 [2]Ann Trop Paediatr 1998;18:31

Radiological Investigations

- Chest radiographs in childhood CAP have a number of limitations:
  - findings do NOT correlate well with etiologic agent[1]
  - have limited impact on therapeutic decisions
  - lateral views do not add diagnostic value
- Chest radiography should not be considered a routine investigation in children thought to have CAP
- Consider performing a Chest X-Ray (Antero-Posterior) particularly in those:
  - with hypoxaemia
  - with significant respiratory distress

[1]Thorax 2002;57:438

General Investigations

- Pulse oximetry provides a non-invasive, easy to use estimate of arterial oxygenation
  - hypoxaemia (<92% in air) indicates severe disease

- Acute phase reactants (C reactive protein, procalcitonin, white blood cell count)
  - raised levels associated with bacterial pneumonia but significant overlap with pneumonia of viral etiology – therefore of little clinical utility[1]

[1]PIDJ 2008;27:95

Microbiological Investigations

- Microbiological diagnosis should be attempted in children with severe pneumonia sufficient to require pediatric intensive care admission or those with complications of CAP
- Microbiological investigations should not be considered routine in those with milder disease or those treated in the community
- Microbiological methods should include:
  - blood culture
  - nasopharyngeal and/or nasal swabs for PCR viral detection
  - acute and convalescent serology for viruses & atypical bacteria
  - pleural fluid for microscopy, culture and/or PCR

Severity Assessment

Features of Severe Pneumonia:

- Tachypnoea (>70 bpm under 12 months age, >50bpm over 12 months)
- Moderate/severe recession (<12 months)
- Severe difficulty breathing (>12 months)
- Grunting
- Nasal Flaring
- Apnoea (<12 months)
- Cyanosis
- Tachycardia (>170 bpm under 6 months, >160 bpm 6-12 months, >150 bpm 1-3 years, >140 3-5 years, >120 5-12 year, >100 over 12)
- Capillary Refill Time ≥ 2 secs
- Hypoxaemia (sustained oxygen saturation <92% in room air)
- Not feeding (< 12 months)
- Signs of dehydration (>12 months)

Adapted from BTS CAP in children guideline 2011

Severity Assessment

- Children with CAP in the community or hospital should be reassessed if symptoms persist and/or they are not responding to treatment
- Children with oxygen saturations <92% should be referred to hospital
- Auscultation revealing absent breath sounds with a dull percussion note should trigger a referral to hospital (?pneumonia with effusion)
- A child in hospital should be reassessed medically if there is persistence of fever 48 h after initiation of treatment, increased work of breathing or if the child is becoming distressed or agitated

General Management - Community

- Advise parents and carers about:
  - management of fever
  - preventing dehydration
  - identifying signs of deterioration
  - identifying signs of other serious illness
  - how to access further healthcare (providing a ‘safety net’).
  - the ‘safety net’ should be one or more of the following:
    - provide the parent or carer with verbal and/or written information on warning symptoms and how further healthcare can be accessed
    - arrange a follow-up appointment at a certain time and place
    - liaise with other healthcare professionals, including out-of-hours providers, to ensure the parent/carer has direct access to a further assessment for their child

General Management - Hospital

- Antipyretics and analgesia as necessary
- Ventilatory support as required
  - patients whose oxygen saturations are ≤92% in air should receive oxygen to maintain saturations >95%
  - oxygen may be administered by nasal cannulae, face mask or high flow delivery device as necessary
- Children unable to maintain fluid intake due to breathlessness/fatigue should receive fluid therapy
  - avoid NG tubes particularly in severely ill patients and infants with small nasal passages
  - Baseline and daily monitoring of urea & electrolytes when on IV fluids
- Chest physiotherapy is not beneficial and should not be performed in children with pneumonia

Antibiotic Management

- All children with a clear clinical diagnosis of pneumonia should receive antibiotics as viral and bacterial pneumonia cannot be reliably distinguished from each other
- Amoxicillin is recommended as first choice for oral antibiotic therapy (alternatives are co-amoxiclav, cefaclor and macrolide antibiotics)
- Macrolide antibiotics may be added at any age if there is no response to first-line empirical therapy
- Macrolide antibiotics should be used if either mycoplasma or chlamydia pneumonia is suspected or in very severe disease

Antibiotic Management

- Co-amoxiclav should be used for pneumonia associated with influenza
- Oseltamivir ?
- Favipiravir ?

Prognosis and Follow Up

- Overall prognosis excellent with no long-term consequences
- Pneumonia mortality rate in developed countries is <1 per 1000 per year[1]
- Follow up not necessary for children with uncomplicated CAP who are asymptomatic - residual radiographic findings are rare and, even when present, do not result in additional therapy[2]
- Children with severe pneumonia, empyema and lung abscess should be followed up after discharge until they have recovered completely and their chest x-ray has returned to near normal

[1]Clin Infect Dis 2017;65:1721 [2]Ped Pulmonol 2005;40:223

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Jafarirouhi@tbzmed.ac.ir