

CASE SIX

Short case number: 3_20_6

Category: Children & Young People / Respiratory & ENT Systems

Discipline: Paediatrics Medicine

Setting: Emergency Department

Topic: Lower respiratory tract infections_Pneumonia

Case

Michael Pancirov, is a 6 year old boy who presents with cough, fever and shortness of breath.

He has been unwell for a few days with coryzal symptoms and temperature.

On arrival: Looks unwell,

Temp. 39°C, RR 30bpm, with grunting, HR 120 bpm. SaO₂ – 90% [room air].

Questions

1. You are concerned that Michael has pneumonia, outline the key clinical features of your history and examination that would support a diagnosis of pneumonia.
2. Outline the clinical features that can assist in differentiating pneumonia due to strep pneumoniae, staphylococcus aureus, haemophilus influenzae B and mycoplasma pneumoniae.
3. Michael undergoes a CXR – Describe the radiological features of bacterial pneumonia, how does this differ from pneumonia due to mycoplasma pneumoniae and viral pneumonia.
4. What antimicrobial therapy would be commenced if Michael's diagnosis is pneumonia due to strep pneumoniae? How would this therapy differ if the organism was staphylococcus aureus, haemophilus influenzae or mycoplasma pneumoniae?
5. Viruses are more commonly the cause of pneumonia in children; outline the risk factors for viral pneumonia.
6. Summarise the main pathogens and clinical features of viral pneumonia in children.

Suggested reading:

- South M, Isaacs D editors. Practical Paediatrics. 7th edition. Edinburgh: Churchill Livingstone; 2012.
- Thomson K, Tey D, Marks M, editors. Paediatric Handbook. Staff of the Royal Children's Hospital Melbourne, Australia. 8th edition. Chichester: Wiley-Blackwell; 2009.
- Therapeutic Guidelines - Antibiotic Guidelines 2014
<https://tgldcdp.tg.org.au/etgAccess>

ANSWERS

1. You are concerned that Michael has pneumonia, outline the key clinical features of your history and examination that would support a diagnosis of pneumonia.

Symptoms include:

- Dyspnoea
- Fever
- Malaise
- Cough may be dry or moist (but is not always present)
- Pleuritic chest pain is often present
- Neck pain (if apices involved, can be confused with meningism) the diaphragmatic pleural surface is involved
- Abdominal or shoulder tip pain (if diaphragmatic pleural surface involved)

Signs include:

- Tachypnoea and respiratory distress,
- Dullness to percussion
- Auscultation: localized crackles and bronchial breathing

(Of these signs, tachypnoea is the most consistent and reliable, and pneumonia should be suspected in any child with an unexplained tachypnoea.)

Signs of complications of pneumonia include those related to:

- Pleural effusion - shifting of mediastinum or trachea, dullness to percussion (stony dullness with large effusions), reduced or absent breath sounds, and bronchial breathing above the effusion
- Pneumothorax - uncommon, shifting of mediastinum or trachea, reduced breath sound

2. Outline the clinical features that can assist in differentiating pneumonia due to strep pneumoniae, staphylococcus aureus, haemophilus influenzae B and mycoplasma pneumoniae.

Streptococcus pneumoniae	<ul style="list-style-type: none">• may be preceded by symptoms suggestive of a mild upper respiratory infection and typical symptoms and signs of pneumonia may then appear.• symptoms are more likely to include fever, tachypnoea and pleuritic chest pain and cough can be absent• signs are more likely to include nasal flaring, grunting, reduced movement of the chest wall on the affected side, dullness to percussion, reduced breath sounds and bronchial breathing over the area involved.• Dullness to percussion may indicate the presence of an empyema. If the upper lobes are involved, neck stiffness may be present and the child may be misdiagnosed as having meningitis.
Staphylococcus aureus	<ul style="list-style-type: none">• usually a more severe form. It is more common in younger children, especially those under 2 years of age• important risk factor is a socially disadvantaged or indigenous background.• Child appears more unwell, with a high fever, and is more likely to have pallor, tachypnoea and respiratory distress.• Onset is usually acute and the course more rapid. Chest signs are non-specific• chest X-ray is more likely to show severe involvement. Early in the course of the illness, staphylococcal pneumonia may have radiological features that are similar to other forms of bacterial pneumonia, including lobar consolidation, patchy shadowing and a small pleural effusion. However, within days, more serious findings may be evident, including widespread opacifications, large pleural effusions and displaced intrathoracic structures.• More specific to staphylococcal pneumonia are abscesses, either single or

	multiple, and large or encysted pleural effusions with thick walls. Air leaks are common and highly specific for staphylococcal pneumonia; they include pneumothorax, pneumomediastinum, pneumopericardium and, in particular, pneumatoceles. (Pneumatoceles can also be caused by <i>Escherichia coli</i> , <i>Klebsiella</i> sp., <i>Pseudomonas</i> sp., group A streptococci and pneumococci)
<i>Haemophilus influenzae</i> B	<ul style="list-style-type: none"> Pneumonia due to <i>H. influenzae</i> is now relatively uncommon because of immunization against this organism. Risk factors: non-immunized children, age <2y, indigenous race, lower socioeconomic group, male gender and immunodeficiency. The signs and symptoms and radiological features are not distinguishable from those found in other pneumonias.
<i>Mycoplasma pneumoniae</i>	<ul style="list-style-type: none"> The clinical course is often protracted and characterized by the gradual development of fever, malaise, upper respiratory symptoms and cough. Signs include: widespread sparse fine crackles or coarse crackles, wheeze (commonly presenting children with asthma) The chest X-ray often shows changes that are more striking than expected for the degree of clinical illness. The findings themselves are usually non-specific but can include perihilar opacification, and consolidation of one or more lobes. The diagnosis is supported by positive serology. Co-infection with <i>S. pneumoniae</i> is not uncommon.

3. Michael undergoes a CXR – Describe the radiological features of bacterial pneumonia, how does this differ from pneumonia due to *mycoplasma pneumoniae* and viral pneumonia.

Chest radiography is the most reliable investigation. If the chest radiograph is normal, pneumonia can be considered to be not present at that time, but, if the X-ray is taken very early in the disease process, this does not preclude radiological changes developing later.

In general, (specificity of these changes is relatively poor)

- patchy or peripheral consolidation may be more in keeping with a viral infection
- lobar opacification is suggestive of bacterial pneumonia
- more central peribronchial infiltrate may indicate *Mycoplasma* infection

4. What antimicrobial therapy would be commenced if Michael's diagnosis is pneumonia due to *streptococcus pneumoniae*? How would this therapy differ if the organism was *staphylococcus aureus*, *haemophilus influenzae* or *mycoplasma pneumoniae*?

Organism	Antibiotic
<i>S. pneumoniae</i>	All strains other than those demonstrated to be penicillin-resistant, use benzylpenicillin 1.2 g (child: 30 mg/kg up to 1.2 g) IV, 6-hourly until significant improvement, then amoxycillin 1 g (child: 25 mg/kg up to 1 g) orally, 8-hourly for a total treatment duration of 7 days.
<i>S. aureus</i>	For non-MRSA staphylococcal pneumonia, use: di/fluclxacillin 2 g (child: 50 mg/kg up to 2 g) IV, 6-hourly OR cephalothin 2 g (child: 50 mg/kg up to 2 g) IV, 6-hourly OR cephazolin 2 g (child: 50 mg/kg up to 2 g) IV, 8-hourly
<i>H. influenzae</i> (type B)	First-line therapy amoxycillin 1 g (child: 25 mg/kg up to 1 g) orally, 8-hourly OR

	<p><u>benzylpenicillin</u> 1.2 g (child: 30 mg/kg up to 1.2 g) IV, 6-hourly</p> <p>Second-line therapy</p> <p><u>amoxycillin+clavulanate</u> 875+125 mg (child: 22.5+3.2 mg/kg up to 875+125 mg) orally, 12-hourly</p> <p>OR</p> <p><u>cefotaxime</u> 1 g (child: 25 mg/kg up to 1 g) IV, 8-hourly</p> <p>OR</p> <p><u>ceftriaxone</u> 1 g (child: 25 mg/kg up to 1 g) IV, daily</p> <p>OR</p> <p><u>cefuroxime</u> 500 mg (child: 10 mg/kg up to 500 mg) orally, 12-hourly</p>
M. pneumoniae	<p>First-line therapy</p> <p><u>clarithromycin</u> 250 mg (child: 7.5 mg/kg up to 250 mg) orally, 12-hourly</p> <p>OR</p> <p><u>roxithromycin</u> 300 mg orally, daily (child: 4 mg/kg up to 150 mg orally, 12-hourly)</p>

5. Viruses are more commonly the cause of pneumonia in children; outline the risk factors for viral pneumonia.

Risk factors for viral pneumonia include:

- *Age.* Children under 5 years of age are at greatest risk of viral pneumonia, but the risk remains high throughout the first decade of life
- *Season.* Peak seasonal incidence is in winter
- *Passive smoke exposure.* Maternal smoking increases the risk, especially in the first year of life
- *Poor socioeconomic status.* A risk factor in both the developing and the developed worlds
- *Pre-existing chronic problems.* The risk is increased in chronic chest problems such as cystic fibrosis, chronic post neonatal lung disease, congenital heart disease and HIV infection.

6. Summarise the main pathogens and clinical features of viral pneumonia in children.

The most important causative viruses are:

- parainfluenza viruses
- influenza viruses
- respiratory syncytial virus (RSV)
- adenoviruses
- human metapneumovirus (HMV)
- rhinoviruses
- cytomegalovirus (CMV)
- measles

All of these viruses can cause other respiratory illnesses apart from pneumonia, including acute upper respiratory tract infection, acute laryngotracheitis, bronchitis and bronchiolitis. Symptoms of these illnesses can co-exist with those of pneumonia.

The radiological features of viral pneumonias are non-specific, but patchy, widespread infiltrates are more characteristic than lobar involvement. Treatment with antiviral agents is rarely indicated in normal children, but supportive measures are commonly required.