Invasive Meningococcal Disease in Children and Young People

Dr Jack Beattie

Royal Hospital for Sick Children
Glasgow
Why we needed a guideline

Persistent mortality with early rapidly progressive septicaemia.

This emphasises the need for:

- increased awareness
- disease recognition
- experienced assessment of the sick child
- an understanding of the potential for rapid disease progression
- the need for urgent & escalating intervention.
IMD Guideline – How?

Key Questions (25) addressing:

- Early Presentation
- Management and Referral
- Diagnosis and Initial Management
- Tertiary Care
- Public Health
- Surgical Management
- Infection Control
- Support Needs
Collect the evidence → Rate the evidence → Summarise the evidence → Consider the evidence → Evidence based recommendation

- Systematic reviews meta-analyses
- Randomised controlled trials
- Cohort, case control studies
- Non-experimental studies
- Expert opinion

Evidence tables → Considered judgement → Graded recommendations

Quality rating → Quality rating → Quality rating
Pre-hospital - Key questions

- KQ1: Which grouping of signs and symptoms should arouse suspicion of IMD?

- KQ2: With non-specific symptoms, what is the evidence that specific secondary assessment (after 4-6 hours), looking for disease progression, improves diagnosis?

- KQ3: …which key features indicate the need for immediate hospital assessment?
KQ1: Which grouping of signs/ symptoms should arouse suspicion of IMD?

GPs need to be alert to possible IMD
- Petechial rash
- Altered mental state
- Cold hands and feet
- Extremity pain
- Fever
- Headache
- Neck stiffness
- Skin mottling
KQ3: …which key features indicate the need for immediate hospital assessment?

An ill child with:

- Generalised petechiae beyond SVC distribution/purpura anywhere
- Clinical meningitis

As soon as meningococcal disease is suspected

- Give IV benzyl penicillin or cefotaxime
- Transfer rapidly to hospital
## Assessing the risk of serious illness in feverish children under 5 years

<table>
<thead>
<tr>
<th></th>
<th>Low risk</th>
<th>Intermediate risk</th>
<th>High risk</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Colour</strong></td>
<td>• Normal colour of skin, lips, and tongue</td>
<td>• Pallor reported by parent or carer</td>
<td>• Pale, mottled, ashen, or blue</td>
</tr>
<tr>
<td><strong>Activity</strong></td>
<td>• Responds normally to social cues</td>
<td>• Doesn’t respond normally to social cues</td>
<td>• No response to social overtures</td>
</tr>
<tr>
<td></td>
<td>• Is content or smiles</td>
<td>• Wakes only with prolonged stimulation</td>
<td>• Appears ill to a healthcare professional</td>
</tr>
<tr>
<td></td>
<td>• Stays awake or wakes quickly</td>
<td>• Decreased activity</td>
<td>• Unrousable or does not stay awake if roused</td>
</tr>
<tr>
<td></td>
<td>• Strong normal cry or not crying</td>
<td>• No smile</td>
<td>• Weak, high pitched, or continuous cry</td>
</tr>
<tr>
<td><strong>Respiration</strong></td>
<td>• Normal</td>
<td>• Nasal flaring</td>
<td>• Grunting</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Tachypnoea: respiratory rate &gt;50 breaths/min (age 6-12 months) or &gt;40 breaths/min (age &gt;12 months)</td>
<td>• Tachypnoea: respiratory rate &gt;60 breaths/min (at any age)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Oxygen saturation ≤95% in air</td>
<td>• Moderate to severe chest indrawing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Crackles on auscultation</td>
<td></td>
</tr>
<tr>
<td><strong>Hydration</strong></td>
<td>• Normal skin and eyes</td>
<td>• Dry mucous membranes</td>
<td>• Reduced skin turgor</td>
</tr>
<tr>
<td></td>
<td>• Moist mucous membranes</td>
<td>• Poor feeding in infants</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Capillary refill time ≥3 seconds</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Reduced urine output</td>
<td></td>
</tr>
<tr>
<td><strong>Other</strong></td>
<td>• No amber or red features</td>
<td>• Fever for ≥5 days</td>
<td>• Temperature ≥38°C (age 0-3 months); ≥39°C (age 3-6 months)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Swelling of a limb or joint</td>
<td>• Non-blanching rash</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Not weight bearing or not using an extremity</td>
<td>• Bulging fontanelle</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• A new lump &gt;2 cm</td>
<td>• Neck stiffness</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Status epilepticus</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Focal neurological signs</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Focal seizures</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Bile stained vomiting</td>
</tr>
</tbody>
</table>
Child presents with a possible diagnosis of invasive meningococcal disease

Unwell child
Fever and non-specific symptoms

Meningitis
Fever, vomiting, headache, neck stiffness, photophobia
- Urgent referral to secondary care
- Administer parenteral antibiotics as soon as invasive meningococcal disease is suspected

Septicaemia
Fever, petechial or purpuric rash
- Urgent referral to secondary care
- Administer parenteral antibiotics as soon as invasive meningococcal disease is suspected

Primary care assessment
- Consider carer's concerns Ask about non-specific symptoms and comparisons with usual behaviour.
- Full clinical examination
- Assess carer's abilities to deal with uncertainty and participate in management
  If the carer's capacity to share in the management is in doubt, this should increase the risk category and alter the management plan
- Consider local circumstances and out of hours provision when deciding on management

Diagnosis of invasive meningococcal disease

Not supported by assessment
"Safety netting" Advise on symptoms or signs of deterioration and how to get help in an emergency

Unlikely but may still develop
- Safety netting
- Arrange interval assessment

Likely
- Urgent referral to secondary care
- Administer parenteral antibiotics as soon as invasive meningococcal disease is suspected
Interval assessment

Children with symptoms or signs which are highly suggestive of IMD should not have their treatment delayed by interval assessment.

Children with non-specific features at initial presentation, in whom IMD cannot be excluded, should be re-assessed within 4-6h.
Key points – Pre-hospital

- Non-specific signs in children who are unwell within the first 4–6 hours should not exclude a diagnosis of IMD
- If there is suspicion of IMD, treat with antibiotics as appropriate and arrange rapid transfer for further assessment
Service delivery

- At hospital, children with suspected IMD should be reviewed/treated promptly by a senior experienced clinician.

- Children with progressive IMD should be discussed with ICU at an early stage.

- Robust local protocols should ensure the above, taking account of local services/geography.
Conflicts / Controversy

- IV Fluids
- Antibiotics
- Steroids
- Lumbar Puncture
Management of shock

- If signs of shock, give rapid IV isotonic crystalloid or colloid up to 60ml/kg as 3 x 20ml/kg boluses with reassessment.

- Fluid resuscitation in excess of 60ml/kg and inotropic support are often needed.

- Circulatory failure and need for repeated IV fluid boluses → early consultation with ICU (inotropes/ IPPV).
Antibiotics in children with IMD

- Parenteral cefotaxime initially in previously well children > 3 months old
- Ceftriaxone may be substituted if no Ca\(^{++}\) - containing IV fluids in last 48h
- In infants <3 months, cefotaxime + ampicillin or amoxicillin (listeria cover)
- Parenteral antibiotic Rx - at least 7 days
Confirming the diagnosis

- Blood for
  - Bacterial culture
  - Meningococcal PCR

No recommendation
  - Skin scraping
  - Throat swab
  - Urine antigen testing
  - Blood antibody / antigen testing
Lumbar Puncture

- LP all with clinical meningitis without septicaemia features (purpura) if no contraindications

- CSF for micro, culture and PCR

- Interval LP in IMD with septicaemia
  - If diagnosis uncertain, poor clinical progress, no contraindications
Use of steroids

- Not recommended for children with meningococcal septicaemia (except refractory septic shock in ICU).

- In children beginning Rx for meningitis of unknown aetiology, give parenteral dexamethasone (0.15mg/kg every 6h) with or within 24h of Rx, for 4 days.

- As above, for meningococcal meningitis
Clinical predictors of outcome of meningococcal sepsis

- Absence of meningitis
- Age <1 year
- Symptoms <24 hours
- Hypotension
- Poor perfusion
- Presence of petechiae
- Coma
Role of scoring systems to predict severe disease/poor clinical outcome

GMSPS best predictor of poor outcome which has been prospectively and retrospectively validated outwith ICU.

Children diagnosed with IMD should have sequential GMSPS performed
Early recognition of those who will become most ill

A high mortality has been linked to:

- A procalcitonin level of > 150ng/l

- Mortality from meningococcal meningitis is low
- There is a lower risk of adverse neurological outcome than meningitis caused by other bacteria
Follow up

- All children with IMD should have:
  - Subsequent formal hearing checks.
  - Follow-up and careful review for immediate or potential long-term complications.
- Clinicians need to be aware of potential for PTSD in both children & families
- Specific morbidities need to be considered depending on individual cases
Further areas

- ICU management
- Surgical management
- Infection control
Feverish illness in children
Assessment and initial management in children younger than 5 years

Early Management of Meningococcal Disease in Children*
Evidence for pre-hospital (ambulance) resuscitation?

Follow Joint Royal College Ambulance Liaison Committee and the Meningitis Research Foundation guidance:

**At scene**
Airways management, $O^2$ Rx, rapid transport

**En route**
IV or IM Benzylpenicillin
Treat shock with IV fluids
Test for and treat hypoglycaemia
Alert hospital & repeat patient assessments