



## PAEDIATRIC ACUTE CARE GUIDELINE

### Sepsis Management

<b>Scope (Staff):</b>	All Emergency Department Clinicians
<b>Scope (Area):</b>	Emergency Department

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# Sepsis Management

## Aim

This guideline aims to provide an outline of the initial and ongoing management of paediatric sepsis and septic shock in the emergency department or inpatient setting.

## Risk

Sepsis is a major cause of morbidity and mortality in the paediatric population and can be very challenging to diagnose and manage.

Care delivered in the first hour after presentation/sepsis identification is crucial in ensuring the optimum outcome for the patient. <sup>(2)</sup>

For every hour a child remains in septic shock the mortality risk doubles. <sup>(1)</sup>

## Key Points for Managing Sepsis and Septic Shock <sup>2</sup>

1. Early recognition and initiation of treatment.
2. Rapid vascular access, within **5 minutes** of recognition of septic shock:
  - Intravenous (IV) / intraosseous (IO) or,
  - Access central venous access device (CVAD) if present
3. Empiric antibiotic therapy: initial antibiotic within 60 min of sepsis recognition

- (administer as soon as possible after IV/IO access obtained).
4. Rapid, judicious, fluid resuscitation of shocked patients: 20mL/kg fluid boluses of normal saline as a push aiming for shock reversal.
  5. Early initiation of inotropes via peripheral access for fluid refractory shock, followed by transfer to Paediatric Critical Care (PCC).
  6. Source control (if possible).

## Defining Sepsis

- **Sepsis** can be defined as a dysregulated host response to infection leading to life threatening end organ dysfunction. <sup>(3)</sup>
- **Septic shock** is defined as sepsis with evidence of cardiovascular dysfunction (e.g. signs of either cold or warm shock as below). <sup>(2-5)</sup>
- **Hypotension** is generally a late sign and is not required to diagnose septic shock in children. However the presence of hypotension is confirmatory of shock.

## Clinical Recognition

- Sepsis can be particularly challenging to recognise in the paediatric population.
- There are a large number of mimics (e.g. viral illnesses) and infants and toddlers in particular can often appear very unwell, with significantly abnormal physiology, when febrile.
- **It is important to maintain a high index of suspicion for sepsis as prompt treatment is crucial.**
- Sepsis should be suspected on the basis of clinical features described below, leading to review by a senior clinician/Consultant.

**Sepsis or septic shock should be considered in a patient with suspected or proven infection, fever or hypothermia (Temp  $\geq 38$  degrees or  $< 36$  degrees) AND any of the following:**

- Altered mental status (e.g. reduced level of consciousness, lethargy, irritability, floppiness).
- Reduced peripheral perfusion, cool or mottled skin, prolonged central capillary refill time (CRT)  $> 2$ sec and narrow pulse pressure (which can signify “cold shock”).
- Flushed skin with brisk CRT ( $< 1$ sec), bounding pulses and wide pulse pressure (which can signify “warm shock”).
- Hypotension (if present is confirmatory of shock).
- Tachycardia (persistent above limits for age) or bradycardia in neonates/infants.
- Tachypnoea +/- hypoxia (not resulting from bronchiolitis, viral wheeze or asthma) or apnoeas in neonates/infants.
- New onset/unexplained end-organ dysfunction.
- Evolving purpuric rash.

*A high level of parental/carers concern or “unwell” appearance should also be taken into account and trigger review by a more senior clinician and consideration of escalation of care.*

## High Risk Groups

- The following children have a higher risk of sepsis and the threshold for investigation/management of sepsis should be lower:
  - Infants less than 3 months of age
  - Immunosuppression due to chemotherapy, long-term steroids, other immunosuppressants, asplenia and other chronic medical conditions
  - Children with central venous access devices, indwelling medical devices
  - Recent surgery, burn or wound
  - Unimmunised/incomplete immunisation status

## MANAGEMENT OF SUSPECTED SEPSIS/SEPTIC SHOCK

### Initial Emergency Management:



#### In Emergency Department:

- Manage all Emergency Department patients with suspected sepsis/septic shock in the resuscitation bay with senior support (Consultant or Advanced Trainee) and consideration of early PCC review.
- Overnight, the on-call Emergency Consultant must be called, as soon as possible, about all such patients.

#### On the wards:

- Urgent review by the most senior available doctor is mandatory for patients with suspected severe sepsis or septic shock on the ward. A MET call or Code Blue should be made where appropriate criteria are met.
- The responsible Consultant must be informed as soon as possible.

#### Vascular Access

- **This is a priority and should be tasked to an experienced clinician.**
- For patients with septic shock, if unable to gain peripheral intravenous access within 5 minutes or after two attempts, an [intraosseous](#) (IO) line should be inserted.
  - It may be appropriate to opt for IO access initially in critically unwell patients or those in whom access is clearly going to be difficult.
- Patients with central vascular access devices (CVAD) should have these accessed.

#### Blood tests

- If possible, blood tests should be taken at the time vascular access is obtained, with

priority given to blood culture collection.

- **Antibiotic administration and fluid resuscitation should not be delayed by repeated attempts to collect blood samples.**
- The following tests would be appropriate in most instances:
  - Peripheral blood culture (even if antibiotics already given);
  - Full blood count; blood glucose;
  - Urea, electrolytes and creatinine;
  - Liver function tests;
  - Venous blood gas (including lactate);
  - Coagulation profile
- Normal blood test results (e.g. a normal CRP, white cell count or lactate) **do not exclude** sepsis

### Other Investigations

- In an unstable/shocked child, resuscitation and treatment should not be delayed by procedures such as urinalysis and lumbar puncture. These procedures can be performed, as indicated, once the child has been stabilised and it is safe to do so.

### Hypoglycaemia

- **All children should have a blood glucose level checked.**
- **Correct hypoglycaemia**(blood glucose level <4mmol/L) with 2mL/kg 10% glucose. Repeat blood glucose level after treatment and give further treatment as indicated by repeated measurements.

### Antibiotics

- Delayed antimicrobial therapy has been shown to be an independent risk factor for mortality and prolonged organ dysfunction in paediatric sepsis.<sup>(6)</sup>
- Administer initial empiric intravenous antibiotic cover as soon as possible after vascular access is obtained, prior to or concurrently with the first fluid bolus. This should be within 60 minutes of sepsis recognition<sup>(2, 7)</sup>.
- For most patients the following empiric options will be suitable first-line antibiotic therapy, however take into account allergies, local infection and resistance patterns. Cover may need to be broadened after initial resuscitation period.

### Empiric antibiotic choice:

#### Community-acquired sepsis:

- **Infant <4 weeks old:** [Cefotaxime](#) (50mg/kg up to 2g) immediately then [Benzylpenicillin](#) (50mg/kg)
- **Infant / child >4 weeks old:** [Ceftriaxone](#) (50mg/kg up to 2g) immediately then [Vancomycin](#) (15mg/kg up to 750mg)

*Cefotaxime and ceftriaxone can be given as an IV push.*

*Vancomycin should be infused over 60 minutes OR at a rate of 10mg/minute whichever is longer.*

The recommendations above are for children at low risk for infection with a resistant organism.

The following are factors associated with an increased risk of resistance:

1. Recent infection / colonisation with a multi-resistant organisms including vancomycin-resistant Enterococci or carbapenem resistant gram negative bacteria
2. Recent prolonged antimicrobial therapy
3. Overseas travel in the past 6 months

In the presence of the above risk factors, contact the on-call Infectious Diseases medical officer for antimicrobial advice.

### **Healthcare-Associated sepsis, Febrile Neutropenia and Sepsis in the Immunocompromised host:**

- **All age groups:** [Piperacillin-Tazobactam](#) (100mg/kg up to 4.5g) followed by [Vancomycin](#) (15mg/kg up to 750mg)

*Piperacillin-Tazobactam should be administered over a minimum of 20 minutes*

*Vancomycin should be infused over 60 minutes OR at a rate of 10mg/minute whichever is longer.*

- Refer to [ChAMP antibiotic guidelines](#) for more detailed information on antibiotic choice, dosing intervals and for alternative options if allergic to first line agents.
- For antibiotic choice in septic Paediatric Oncology patients see [Febrile Neutropenia Antibiotic Guideline](#).
- Discuss Oncology/Haematology patients early with the on-call Paediatric Oncology Fellow.
- In the presence of ongoing haemodynamic instability requiring ICU admission and/or vasopressors, contact on-call Infectious Diseases medical officer.

### **Fluid resuscitation**

- Fluid resuscitation should be titrated carefully. Both inadequate and excessive fluid resuscitation may be harmful. <sup>(2,8)</sup> Fluids should be considered in the same way as any other intravenously administered medication, with the potential benefits and harms for the individual patient considered prior to administration.

- 0.9% Sodium Chloride should be used as the initial resuscitation fluid.
- Administer 20mL/kg fluid boluses rapidly as a push or via pressure bag for patients with suspected septic shock. <sup>(2)</sup>
- Target reversal of shock/normalised perfusion and restoration of heart rate to near normal values for age. <sup>(2)</sup>
- Repeated assessment of fluid status, perfusion, clinical condition and assessment for signs of fluid overload (new onset wheeze, worsening SOB, hepatomegaly etc.) should be carried out upon completion of each fluid bolus. <sup>(2)</sup>
- Discussion with PCC is mandatory if needing  $\geq 40\text{mL/kg}$  fluid resuscitation.
- Inotropes should be considered if shock persists after 40mL/kg fluid. <sup>(2)</sup>
- Fluid volumes of up to and over 60mL/kg may be needed in the first 60 minutes in some instances of septic shock. <sup>(2)</sup>

## Inotropes

- Decisions regarding commencement of inotropic/vasoactive agents should be made after discussion with (and ideally review by) the Emergency Consultant and/or PCC team
- Can be given via peripheral access (IV or IO) if central vascular access not available and whilst awaiting transfer to PCC. <sup>(2, 9, 10)</sup>
  - Vigilant monitoring of peripheral IV site is essential for early detection of extravasation.
- Should be considered in patients with persistent shock/circulatory failure after 40mL/kg of fluid resuscitation. <sup>(2)</sup>
- Ensure the peripheral access is flushing well prior to commencement of inotropes.
- Take into account the “dead-space” in lines and attached tubing when commencing infusions.

## Adrenaline Infusion

- Good first line option for most patients. <sup>(9,10)</sup>
- Make up with 0.15mg/kg [adrenaline](#) (1:1000) diluted to 50mL with 5% Glucose **or** 9% Sodium Chloride giving a solution where 1mL/hour = **0.05 micrograms/kg/min**

Usually start at 0.1micrograms/kg/min i.e. 2mL/hour.

Titrate from 0.05-0.3 micrograms/kg/min

- (Refer to [Emergency Department Infusion Calculator](#))

## Intubation

- **Intubation in sepsis/septic shock is a high risk procedure**
- May be required in the setting of:
  - Persistent shock or cardiovascular instability following fluid resuscitation or inotrope commencement.
  - Reduced level of consciousness e.g. GCS < 9 or unresponsive.

- Imminent respiratory failure or airway compromise.
- **Key points for intubation of the septic child:**
  - Ensure Emergency Consultant, PCC and Anaesthetics have been called to attend. Call a Code Blue if needing emergency assistance with airway control.
  - Clearly assign roles and maximise resuscitation efforts prior to commencement of rapid sequence induction (RSI).
  - Prepare for potential arrest with resuscitation doses of adrenaline and fluid boluses drawn up and ready to administer.
  - If appropriate commence inotropes prior to RSI.
  - All induction agents have the potential to worsen/precipitate shock in unstable septic patients. Choose medications with a relatively stable cardiovascular profile and avoid agents that are more likely to cause cardiovascular depression.<sup>(11)</sup> Reduced doses of induction agents may be sufficient in these patients.

## Steroids

- Children on long-term steroid therapy or with known adrenal insufficiency should receive stress dose steroids – refer to ED guideline Adrenal Insufficiency.
- Hydrocortisone therapy should also be considered for those with catecholamine resistant shock.<sup>(2)</sup>

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## Tags

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