

NHS CATS
Children's Acute Transport Service



Clinical Guidelines

Sepsis

Document Control Information

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Sepsis

Sepsis is defined as potentially life-threatening organ dysfunction with suspected or confirmed infection. Life threatening organ dysfunction is identified by a Phoenix Sepsis Score >2. (See appendix 2 – Phoenix Sepsis Criteria, 2024).

Septic shock

Septic shock is defined as sepsis with at least 1 cardiovascular point on the Phoenix Sepsis Score.

Recognition

- Does the child look unwell? Parental or carer concern
- Suspected infection
- Hypo or hyperthermia (temp <36° or >38.5°)
- Tachycardia
- Tachypnoea
- Altered mental status, reduced activity or very sleepy
- Decreased urine output (<1ml/kg/hr)
- Other end organ dysfunction

Children with sepsis may have non-specific, non-localised presentations, for example not feeling well, lethargy, and may not have a high temperature.

Hypotension in paediatric patients is late sign of shock. Early signs and symptoms of shock are as a result of the body's compensatory mechanisms, while late signs are indicative of decompensation.

For recognition of a child at risk of sepsis or red flag signs see Appendix 1 – Paediatric Sepsis 6.

There is evidence showing aggressive optimisation of the haemodynamic status within the first few hours of critical illness reduces subsequent organ failure, improving overall survival. For every hour a child remains septic, the mortality risk doubles.

Actions in the 1st hour

- Maintain or restore a patent airway
- Oxygen as required to achieve saturations >92%
- Obtain IV or intraosseous (IO) access x2.

- Take blood for FBC, U&E, blood culture, liver function, glucose, coagulation profile, blood gas and lactate.
- Give empiric broad spectrum antibiotics

Do not waste time - if difficult IV access, site an IO needle. More than one is frequently required.

Antibiotic choice

Clinical syndrome	Suggestion of treatment
Neonate <1 month of age with suspected sepsis	Cefotaxime, amoxicillin, and clarithromycin
Sepsis without a source	Ceftriaxone
Central nervous system	Ceftriaxone, aciclovir, clarithromycin Add vancomycin when <i>Streptococcus pneumoniae</i> resistance is relevant
Patients with central venous lines	Add vancomycin to cover <i>Staphylococcus aureus</i>
Abdominal infection	Ceftriaxone Consider adding metronidazole
Toxic shock	Consider adding clindamycin

- Ceftriaxone is contraindicated in full term babies up to the age of 28 days, due to risk of precipitation with calcium administration.
- Ceftriaxone and calcium may be given sequentially to patients older than 28 days, provided the infusion line is flushed between infusions or drugs are given via different lines, at different sites.
- Choice is based on age of the patient, site of infection, host comorbidities, recent antibiotic and hospital exposure, local epidemiology, and presence of indwelling devices.
- Nonbacterial pathogens coverage is to be considered based on the case.
- Check vaccines are up to date.
- Most common antibiotics used for community acquired infections can be found in the table above, however, always follow local guidance for best antimicrobial choice.

Resuscitate

Signs of shock should be treated *immediately*.

- Administer 10ml/kg fluid bolus, up to 40-ml/kg over the first hour of initial stabilisation.

- Use balanced isotonic crystalloids as 1st choice (Plasma-Lyte 148 or Hartmann's solution) if not available 0.9% sodium chloride is an acceptable alternative.
- Correct hypoglycaemia with 3ml/kg of 10% glucose and recheck. For neonates and infants, we recommend maintenance fluids containing minimum 5% glucose alongside other additives required.

Reassess - What are the effects of every fluid bolus?

- Has the heart rate, quality of peripheral pulses, CRT, mental state, blood pressure responded? Multiple fluid boluses may be necessary.
- Is there evidence of volume overload? (hepatomegaly, crackles, increased work of breathing or gallop rhythm), fluid is not recommended when rales or hepatomegaly are present – commence vasoactive drugs.

Clinical end points - Ongoing Fluid Resuscitation

- Fluid shift and hypotension secondary to capillary leak can continue for several days.
- Continued fluid administration should be titrated against clinical end points such as heart rate, urine output, serum lactate and ScvO₂ (oxygen percentage in blood returning to the heart, usually >70%).
- Consider fresh frozen plasma for coagulopathy. If anaemia, consider packed red cells.

Vasoactive drugs

- After fluid resuscitation (≥40ml/kg) there is still evidence of end organ dysfunction, start peripheral or IO adrenaline and/or noradrenaline at 0.1mcg/kg/min up to 0.5mcg/kg/min.
- Refer to CATS at this point, if not already done so.
- The inotrope choice should take into account the patient's haemodynamics (vasoplegia vs low cardiac output state).

Hydrocortisone Therapy

- If in vasoactive resistant shock – patient remains haemodynamically unstable despite adequate fluid resuscitations and vasoactive therapy - administer IV hydrocortisone 1mg/kg QDS (2.5mg/kg in neonates).
- Early steroids should be considered if signs of adrenal insufficiency (hypoglycaemia +/- hyponatraemia +/- hyperkalaemia).

Indications for Intubation

- Hypoxic respiratory failure
- Unprotected airway
- GCS ≤ 8 or AVPU $\leq P$
- Fluid and vasoactive refractory shock ($\geq 40\text{ml/kg}$ rapid fluid resuscitation)

Management of intubation (refer to CATS intubation checklist)

- Optimise volume replacement prior to intubation
- Ensure fluid bolus attached prior to induction drugs
- Adrenaline/noradrenaline infusion drawn up and attached if not running
- Pre oxygenation
- Use a cuffed ETT, this is necessary to ventilate in the presence of pulmonary oedema, monitor cuff inflation pressure (less than $20\text{cm H}_2\text{O}$) post intubation
- Use capnography for all intubations for early detection of mal- or displacement of tracheal tube
- Ensure the most experienced team members perform the intubation; anaesthetic / ICU consultant with paediatric consultant support
- Use ketamine or fentanyl for induction
- *Inhalational anaesthetics present a significant risk of cardiovascular depression. They should only be used if the risk of a difficult airway outweighs this.*
- *Thiopentone, propofol and benzodiazepines all carry a similar risk of significant cardiovascular depression.*

Once Intubated

- Use continuous capnography
- Secure ETT – do not pre-cut the ETT
- Check appropriate position with CXR (tip at T2-T3)
- Use sedation and neuromuscular blockade as per CATS guidelines.
- These children are at risk of acute respiratory distress syndrome (ARDS). A low tidal volume strategy of $4\text{--}7\text{ ml/kg}$ with an initial PEEP of at least $5\text{ cm/H}_2\text{O}$ should be used.
- PEEP can be titrated up to manage hypoxia (ensure adequate vascular filling).

Stabilisation

- Consider obtaining central access
- Consider inserting an arterial line for haemodynamic monitoring

Coagulopathy

- Consider treatment with 10ml/kg of fresh frozen plasma (FFP)
- Low platelet counts in the absence of active bleeding should not be supplemented unless $< 20 \times 10^6$ /microlitre
- Low fibrinogen is suggestive of disseminated intravascular coagulation (DIC), give 5-10ml/kg of cryoprecipitate

Electrolytes

- Treat hypocalcaemia (iCa < 1.0 mmol/l): 0.5ml/kg 10% calcium gluconate, maximum dose 30ml).
- Treat hypomagnesaemia: 0.5 ml/kg 20% magnesium sulphate (or 1ml/kg of 10% magnesium sulphate), can cause hypotension, administer slowly over 30 minutes with additional fluid bolus if necessary.

Indicators of disease severity

- Immunosuppression
- Thrombocytopaenia
- Neutropaenia
- Rapid onset (< 6 hours)
- Non blanching rash
- Fluid refractory shock

Differential diagnosis for refractory shock:

- Consider cardiac or metabolic disease, particularly in neonates.
- Consider adrenal insufficiency.
- Cardiac tamponade or tension pneumothorax

References

1. Weiss SL, Peters MJ et al (2020) Surviving Sepsis Campaign International Guidelines for the Management of Septic Shock and Sepsis-Associated Organ Dysfunction in Children. *Pediatr Crit Care Med*; 21:e52–e106
2. Schlapbach LJ, Watson RS et al. International Consensus Criteria for Pediatric Sepsis and Septic Shock. *JAMA*. 2024;331(8):665–674. doi:10.1001/jama.2024.0179
3. National Institute for Health and Care Excellence. Sepsis: recognition, diagnosis and early management. Guidance and Guidelines. 2024. <https://www.nice.org.uk/guidance/ng51>.

Appendix 1: Paediatric Sepsis 6

Patient name
DOB
Hospital number
Please affix label

Great Ormond Street 
Hospital for Children
NHS Foundation Trust

Paediatric Sepsis 6

Date:

Child unwell? EWS concern?
THINK Could this be Sepsis?

Recognition of child at risk

If a child with suspected or proven infection AND at least 2 of:

- Core temperature of $<36^{\circ}\text{C}$ or $>38.5^{\circ}\text{C}$ (38.0°C if Immunocompromised)
- Tachycardia (refer to Early Warning Score)
- Altered mental state (sleepiness, irritability, lethargy, floppiness)
- Prolonged capillary refill ($> 2\text{s}$)
- Immunocompromised
- Hypotension

OR

Red flag signs (Any 1 flag present)

- Lactate $>2\text{mmol/l}$
- Extreme tachycardia/tachypnoea
- $\text{SpO}_2 <90\%$ /grunting/cyanosis/apnoea
- P or U on AVPU
- Persistent hypotension (3x consecutive measurements in 1hr)
- Non blanching rash/mottled skin

CONSULT DOCTOR OR SENIOR STAFF MEMBER
– COULD THIS CHILD HAVE SEPSIS OR SEPTIC SHOCK?

START TIME	Yes or high suspicion – start Sepsis 6	No or unsure									
Commence all elements within 1 hour	1) Give high flow oxygen	Review hourly and document below									
	2) Obtain IV/IO access and take blood tests	<table border="1"> <tr> <td>■ Not sepsis – document reasons</td> <td>Time</td> <td>Sign</td> </tr> <tr> <td>■ Unsure – review within 1 hour</td> <td>Time</td> <td>Sign</td> </tr> </table>	■ Not sepsis – document reasons	Time	Sign	■ Unsure – review within 1 hour	Time	Sign			
	■ Not sepsis – document reasons	Time	Sign								
	■ Unsure – review within 1 hour	Time	Sign								
	• Blood gas and lactate ($\pm$ FBC, U&E, CRP if able) • Blood glucose – treat hypoglycaemia (2mls/kg 10% glucose) • Blood cultures	REVIEW WITHIN 1 HOUR (Repeat obs every 30mins)									
	3) Give IV or IO antibiotics	<table border="1"> <tr> <td>■ Not sepsis – document reasons</td> <td>Time</td> <td>Sign</td> </tr> <tr> <td>■ Sepsis – start Sepsis 6</td> <td>Time</td> <td>Sign</td> </tr> <tr> <td>■ Unsure – review within 1 hour</td> <td>Time</td> <td>Sign</td> </tr> </table>	■ Not sepsis – document reasons	Time	Sign	■ Sepsis – start Sepsis 6	Time	Sign	■ Unsure – review within 1 hour	Time	Sign
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■ Sepsis – start Sepsis 6	Time	Sign									
■ Unsure – review within 1 hour	Time	Sign									
4) Consider fluid resuscitation	REVIEW WITHIN 1 HOUR (Repeat obs every 30mins)										
• Aim to restore normal physiological parameters, $\text{UO} >0.5\text{mls/kg/hr}$ • Give $10\text{--}20\text{ml/kg}$ isotonic fluid over 5–10 mins • Repeat as necessary, monitor urine output	<table border="1"> <tr> <td>■ Not sepsis – document reasons</td> <td>Time</td> <td>Sign</td> </tr> <tr> <td>■ Sepsis – start Sepsis 6</td> <td>Time</td> <td>Sign</td> </tr> <tr> <td>■ Unsure – review within 1 hour</td> <td>Time</td> <td>Sign</td> </tr> </table>	■ Not sepsis – document reasons	Time	Sign	■ Sepsis – start Sepsis 6	Time	Sign	■ Unsure – review within 1 hour	Time	Sign	
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■ Sepsis – start Sepsis 6	Time	Sign									
■ Unsure – review within 1 hour	Time	Sign									
END TIME	5) Involve senior clinicians early	REVIEW WITHIN 1 HOUR (Repeat obs every 30mins)									
	• Own team Consultant	<table border="1"> <tr> <td>■ Not sepsis – document reasons</td> <td>Time</td> <td>Sign</td> </tr> <tr> <td>■ Sepsis – start Sepsis 6</td> <td>Time</td> <td>Sign</td> </tr> <tr> <td>■ Unsure – review within 1 hour</td> <td>Time</td> <td>Sign</td> </tr> </table>	■ Not sepsis – document reasons	Time	Sign	■ Sepsis – start Sepsis 6	Time	Sign	■ Unsure – review within 1 hour	Time	Sign
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■ Sepsis – start Sepsis 6	Time	Sign									
■ Unsure – review within 1 hour	Time	Sign									
	6) Consider inotropic support early	REVIEW WITHIN 1 HOUR									
	• If normal physiological parameters not restored after $\geq 40\text{ml/kg}$ fluids consider CATS referral. Ring Hotline no. 0800 085 0003										

Is there a likely source of infection?

- | | | | |
|---|--|--|--|
| ☐ Yes, but source unclear at present | ☐ Line infection | ☐ VP shunt | ☐ Pneumonia/likely chest source |
| ☐ Meningitis/encephalitis | ☐ Intra-abdominal | ☐ Urinary tract infection | |
| ☐ Febrile Neutropenia | ☐ Surgical Site | ☐ Other – details | |

Any questions, please contact Claire Fraser (Claire.Fraser@gosh.nhs.uk) or Rhiannon Follott (Rhiannon.Follott@gosh.nhs.uk)

Adapted from the Paediatric Sepsis 6 version 11.1 August 2015 in collaboration with the UK Sepsis Trust Paediatric Group



Appendix 2: Phoenix Sepsis Score

Phoenix Sepsis Score	0 points	1 point	2 points	3 points
Respiratory (0-3 points)	PF ratio $\geq$ 400 SF ratio $\geq$ 292	PF ratio<400 or SF ratio<292 and any resp support incl oxygen	PF ratio 100-200 or SF ratio 148-220 and invasive ventilation	PF ratio<100 or SF<148 and invasive ventilation
Cardiovascular (0-6 points)	No vasoactives Lactate<5mmol/L Age MAP (mmHg) <1m >30 1-11m >38 1-2y >43 2-5y >44 5-12y >48 12-17y >51	1 point each (max 3 points) if: 1 vasoactive infusion Lactate 5-10.9mmol/L Age MAP (mmHg) <1m 17-30 1-11m 25-38 1-2y 31-43 2-5y 32-44 5-12y 36-48 12-17y 38-51	2 points each (max 6 points) if: $\geq$ 2 vasoactive infusion Lactate $\geq$ 11mmol/L Age MAP (mmHg) <1m <17 1-11m <2 1-2y <31 2-5y <32 5-12y <36 12-17y <38	
Coagulation (0-2 points)	Platelets $\geq$ 100 x 10 ⁹ /L INR $\leq$ 1.3 D-dimers $\leq$ 2 Fib $\geq$ 1g/L	1 point each (max 2 points) if: Platelets<100 x 10 ⁹ /L INR>1.3 D-dimer>2 Fib<1g/L		
Neurology (0-2 points)	GCS>10, pupils reactive	GCS $\leq$ 10	Pupils fixed bilaterally	