Paediatric Sepsis Guideline

Title:	**Guideline for management of paediatric sepsis**
Version:	**3**
Supersedes: Version 2	**Summary of amendments to version 3:** Escalation of inotropes moved to new guideline for management of paediatric shock Removal of dopamine/dobutamine. Removal of cold/warm shock definition (no longer appropriate) 10% Glucose bolus dose 3mL/kg (as per APLS update 7) Antimicrobial guidance clarified/updated in new table Sepsis unknown source: addition of gentamicin if starting inotropes
Application:	The guideline is intended for use by any hospital team caring for infants, children and young people under 16 years age across the Paediatric Critical Care Network in the North-West (England) & North Wales region.
Originated /Modified By: **Designation:**	**Version 1:** Kate Parkins, PICM consultant, North-West (England) & North Wales Paediatric Transport Service (NWTS) & Alder Hey Children's Hospital NHS Foundation Trust Co-Authors: Christopher Walker, clinical nurse specialist, NWTS Matthew Christopherson, PICM consultant, NWTS Mark Entwistle, staff grade Anaesthetist, Arrowe Park Hospital **Version 2:** Kate Parkins, PICM consultant, NWTS Co-Authors: Praveen Kurup, PCCM clinical Fellow, NWTS & PCC RMCH Nisha Jacob, Anaesthetic senior clinical fellow, NWTS & AHCH Lisa Pritchard, PICM consultant, NWTS & UHNM Amicia Hill, Band 6 PCC transport nurse, NWTS Nicola Longden, Band 7 clinical nurse specialist, NWTS **Version 3:** Kate Parkins, PICM/PCC transport consultant, NWTS Gemma Burdis, Paediatric Anaesthesia/PCC Transport consultant, NWTS & UHNM Andrew Fester, PICM/PCC transport consultant, NWTS Lisa Pritchard, PICM/PCC transport consultant, NWTS & UHNM Mary-Ann Bentham, Paediatric Anaesthesia/PCC Transport consultant, NWTS & RMCH Nicola Longden, Band 7 clinical nurse specialist, NWTS Sophina Mahmood & Lewis Nicholls, Paediatric pharmacists, PCC ODN & RMCH
Reviewed by:	1. North-West (England) & North Wales Paediatric Critical Care Operational Delivery Network 2. Sophina Mahmood & Lewis Nicholls, Paediatric Pharmacist, PCC ODN & RMCH 3. Infectious Diseases & Microbiology Teams at both AHCH & RMCH
Ratified by:	1. North-West (England) & North Wales Paediatric Critical Care ODN 2. RMCH (Host Trust): Paediatric Policies & Guidelines & Pharmacy & Medicines Management Committees
Date of Ratification:	1. PCC Oversight: 14.08.24 2. PMMC: December 25 3. P&G Committee: 12.12.25
Issue / Circulation Date:	15.12.25
Circulated by:	PCC, SiC & LTV ODN
Dissemination and Implementation:	December 25
Date placed NWTS / PCC, SiC & LTV ODN websites	15.12.25
Planned Review Date:	December 2028
Responsibility of:	Clinical lead North-West (England) & North Wales Paediatric Critical Care ODN & NWTS guideline lead consultant
Minor amendment (if applicable) notified to:	
Date notified:	
EqIA Registration Number:	EQIA 2025-349

1. Detail of Procedural Document

Paediatric Sepsis guideline is for use by clinical teams managing infants, children and young people under 16 years age in the North-West (England) & North Wales region.

2. Equality Impact Assessment

Equality Impact Assessment Please record the decision whether the policy, service change or other key decision was assessed as relevant to the equality duty to: Eliminate discrimination and eliminate harassment Advance equality of opportunity Advance good relations and attitudes between people		
Relevant	YES	Guideline relevant for paediatric age group only Intended for use across North-West (England) & North Wales region for those under 16 years of age. Appropriate PEWS and observation target ranges included for all age groups. Risk of occult hypoxaemia highlighted IE that it is more than 3 times greater in Black vs White pts AND may over-estimate SpO_2 between 1.5-5%.
Where the decision was RELEVANT, please record details of the outcome of the full impact assessment and summarise the actions that will be taken to eliminate or mitigate adverse impact, advance equality or justification for the impact.		
EqIA registration Number for RMCH:		2025-349

3. Consultation, Approval and Ratification Process

This guideline was developed with input from:
- North-West (England) and North Wales Paediatric Transport Service (NWTS).
- North-West (England) and North Wales Paediatric Critical Care Operational Delivery Network
- Representatives from the Local Hospital Teams within network above.

These guidelines were circulated amongst the North-West (England) and North Wales Paediatric Critical Care Operational Delivery Network for comments on the 01.08.24

All comments received have been reviewed and appropriate amendments incorporated.

These guidelines were signed off by the PCC ODN guidelines committee on 14.08.24

For ratification process for network guidelines see appendix 1.

4. Disclaimer

These clinical guidelines represent the views of the North-West (England) and North Wales Paediatric Transport Service (NWTS) and the North-West (England) and North Wales Paediatric Critical Care Operational Delivery Network (PCC ODN). They have been produced after careful consideration of available evidence in conjunction with clinical expertise and experience.
It is intended that trusts within the Network will adopt this guideline and educational resource after review and ratification (including equality impact assessment) through their own clinical governance structures.

The guidance does not override the individual responsibility of healthcare professionals to make decisions appropriate to the circumstances of the individual patient.

Clinical advice is always available 24/7 from NWTS on a case-by-case basis via the referral line: 08000 84 83 82

Please feel free to contact NWTS (01925 853 550) regarding these documents if there are any queries.

RECOGNITION OF SEVERE SEPSIS

EARLY RECOGNITION OF SEPSIS

Sepsis = suspected or confirmed infection + potentially life-threatening end-organ dysfunction ie airway, breathing, cardiovascular, coagulation, acute kidney injury, or reduced level of consciousness

Septic shock = sepsis + cardiovascular dysfunction IE lactate > 2 mmol/L OR ↓BP OR inotrope use

Early recognition and starting treatment are vital and can prevent illness progression.

Take parental or healthcare worker concerns seriously and repeatedly assess using PEWS tool. Ensure appropriate escalation to senior colleagues.

Consider septic shock if (using national PEWS[18]):

PEWS > 9 or PEWS > 5 + lactate > 2 mmol/L

OR be aware those with ANY RED flag OR 2 AMBER flags, are at risk of septic shock (see below)

RISK FACTORS FOR SEVERE DISEASE

⇒ Age under 12 months (corrected gestational age)

⇒ Known (or risk of) immunosuppression eg Oncology diagnosis; Post-transplant pts; Asplenia; Chronic steroid use

⇒ Recent illness (especially chicken pox OR Influenza A or B), or surgery or trauma within last 6-8 weeks

⇒ Patients with any indwelling lines, catheters, tracheostomy or gastrostomy

⇒ Cardiovascular or respiratory disease

⇒ Complex urogenital anatomy or repair

Patients with chronic illness may be carriers of multi-resistant organisms (check with parents, carers, & tertiary teams).

ALWAYS check sensitivity & use appropriate anti-microbial cover.

Pts with CO-MORBIDITIES admitted to PCC for SEPTIC SHOCK we recommend ADDING AN AMINOGLYCOSIDE to antimicrobial regimen eg gentamicin 7 mg/kg (5 mg/kg in CKD/AKI)

RED FLAGS

⇒ Capillary lactate > 2 mmol/L

⇒ Grunting / Apnoeic / SpO_2 < 90% in air

⇒ Weak, high pitched or continuous cry

⇒ Doesn't wake when roused OR won't stay awake

⇒ Looks very unwell to parent or healthcare worker

⇒ Temperature < 36 ˚C

⇒ If under 3 months: temperature > 38 ˚C

⇒ Non-blanching rash or mottled/ashen/cyanotic

⇒ Not passed urine in last 6-12 hours (dry nappies)

⇒ Red HR / RR (NPEWS see appendix)

⇒ Hypotension (amber/red NPEWS see appendix)

⇒ WCC less than 2 OR more than 30

⇒ Platelets < 100; INR > 1.3; Fibrinogen < 1

AMBER FLAGS

⇒ Not responding normally or not smiling or not playing / sleepy / abnormal behaviour

⇒ Parental or carer concern

⇒ Amber HR / RR (NPEWS)

⇒ SpO_2 < 92% in air OR ↑O_2 requirement OR nasal flaring

⇒ Capillary refill ≥ 3 seconds

⇒ Reduced urine output (< 1mL/kg/hr)

⇒ Hypoglycaemia: glucose < 3 mmol/L at presentation; especially if persisting

⇒ Pale or flushed

⇒ Leg pain OR cold extremities (feet or hands)

⇒ Immunocompromised

⇒ if 3-6 months, temperature 39˚C

AGE	TARGET mean BP
37—44 weeks (neonate)	40-45
0 -11 months	45-55
1-4 yrs	55-60
5-12 yrs	60
≥ 13 yrs	60-65

Check NPEWS[18] escalation score regularly

Review trends in HR / RR / BP on NPEWS observation chart especially after any intervention.

Persistent ↑HR despite intervention = red flag

NB an unsuccessful attempt to measure BP (+ concern: parental or nurse) national PEWS scores 4

Paediatric Sepsis Guideline

0-15 mins

RECOGNISE SEPSIS/SEPTIC SHOCK & Activate Sepsis 6 which includes:

- ☐ Give 100% oxygen; if poor respiratory effort call anaes.
- ☐ Call for consultant help: review within 15 mins
- ☐ Full continuous monitoring (SpO_2, ECG, BP 3 min cycles)
- ☐ URGENT IV/IO access & take bloods (glucose, FBC, coagulation, U&E's, CRP, LFTs, group & save), culture
- ☐ Blood gas including lactate + glucose
- ☐ 10 mL/kg fluid bolus quickly, push by hand
- ☐ Reassess fluid responsiveness (shock guideline)
- ☐ IV broad spectrum antibiotics (maximum dose) & consider antivirals
- ☐ If blood glucose < 3mmol/L: give 3 mL/kg IV 10% Glucose
- ☐ Dexamethasone IV: 0.15 mg/kg MAX:10 mg/dose 6 hourly if > 3 months & suspect meningitis

15-30 mins

IF POOR RESPIRATORY EFFORT

- ☐ Start Bag Mask Ventilation (+ oral/nasal airway)
- ☐ Get urgent cons anaesthetic/ICU help
- ☐ Get 2nd IV/IO access
- ☐ Persistent signs of shock? ie ↑HR, ↑CRT, ↑Lactate, ↓UO, ↓BP
- ☐ Give 2nd 10 mL/kg bolus over 5-10 min. Ideally Plasmalyte 148 or Hartmann's solution (if not available use 0.9% NaCl)
- ☐ Prepare inotrope: IO = central; PVL= peripheral concentration
- ☐ If ↓BP start inotrope
- ☐ SEE SHOCK GUIDELINE www.nwts.nhs.uk/clinicalguidelines

Call NWTS EARLY: 08000 84 83 82

30-60 mins

ONGOING SHOCK +/- INADEQUATE BREATHING

Prepare to intubate/ventilate: see page 5 AND use intubation checklist eg intubation LocSIPPs/guideline

Optimise pre-intubation e.g. fluid bolus & inotrope infusion prepared +/- running

- ☐ Most experienced intubator = 1st intubator (for age group)
- ☐ Cuffed oral ET tube ideally for all ≥ 3 kg
- ☐ Prepare resus drugs — high risk of cardiac arrest at induction
- ☐ Dilute adrenaline (see page 5) & give 1-2 mL aliquots as needed for hypotension + 10 mL/kg fluid bolus
- ☐ If on-going shock: prepare AND start adrenaline infusion at 0.2 microgram/kg/min via IO/peripheral IV
- ☐ Ketamine 0.5-1 mg/kg + Rocuronium 0.5-1 mg/kg +/- Fentanyl 0.5-1 microgram/kg induction
- ☐ AVOID using IV Etomidate as induction agent (see page 5)
- ☐ If inotropes started ADD an aminoglycoside to antimicrobial cover eg gentamicin (as per BNFc)

> 60 mins

FURTHER MANAGEMENT: Discuss with NWTS

- ☐ Blood gas: adequate ventilation & lactate trend↓
- ☐ Urine catheter: strict input/output chart, aim UO > 0.5-1 mL/kg/hr
- ☐ Place intra-osseous for inotropes
- ☐ Consider arterial line & central line (if local expertise)
- ☐ Packed Red blood cells transfusion if:
  - Hb < 70 g/L & SpO_2 > 92%
  - Hb < 100 g/L if SpO_2 < 92% or haemodynamically unstable
- ☐ If not actively bleeding, only supplement platelets if < 20 x 10^9/L
- ☐ If bleeding/invasive procedures planned, aim platelets > 50 x 10^9/L
- ☐ Give Vitamin K if PT prolonged
- ☐ Only give FFP or cryoprecipitate if bleeding

SHOCK NOT REVERSED:

****See NWTS Shock guideline****

- ☐ Add 2nd inotrope: noradrenaline + titrate dose
- ☐ Assess if further fluid bolus is needed
- ☐ Calcium gluconate 10% bolus if iCa^{2+} < 1.2 mmol/L
- ☐ Add IV hydrocortisone if >1 inotrope OR hypoglycaemic (< 3mmol/L)
- ☐ mBP targets see page 3
- ☐ Discuss plan with NWTS

GOAL = REVERSE SHOCK

Maintain or restore airway, oxygenation & CO_2 clearance

Restore & maintain normal perfusion: HR & BP normal for age; Peripheral pulses easily felt; Central CRT ≤ 2 secs

Normal conscious level maintained (unless intubated and sedated)

Urine output > 0.5—1mL/kg/hour Serum lactate < 2 mmol/L Normal serum glucose IE > 3 mmol/L

REFRACTORY SHOCK OR OXYGENATION / VENTILATION FAILURE?
DISCUSS WITH TEAM AT REGIONAL ECMO CENTRE (AHCH)

TRIGGERS FOR INTUBATION / ANAESTHETIC REVIEW

- Decreased consciousness level (i.e. GCS ≤ 8; AVPU ≤ P) OR fluctuating consciousness level
- Increasing respiratory failure, signs of exhaustion, evidence pulmonary oedema (eg widespread crepitations, watery blood stained fluid from nose or mouth)
- Impending cardiovascular collapse e.g. persistent tachycardia despite appropriate fluid boluses; low diastolic blood pressure; borderline/ low normal mean BP (ie amber or red NPEWS pg 10)
- Hypotension is a LATE sign in paediatrics and means patient is peri-arrest. Induction may trigger cardiac arrest, so prepare appropriately (page 4 & shock guideline). Start peripheral or IO adrenaline infusion **before** induction.
- Fluid refractory shock/severe sepsis (see shock guideline)
  - 40-60 mL/kg resuscitation fluid given within the first 1-2 hours without reversal of shock
  - Increasing size of liver
  - Requirement for inotrope/vasopressor infusions

PREPARING TO INTUBATE/VENTILATE

See NWTS intubation guideline for details on intubation, ideal drugs, equipment and checklist

OPTIMISE patient PRE-INTUBATION e.g. fluid bolus prepared +/- inotrope infusion prepared and running
ALWAYS use CHECKLIST and allocate team roles

- **Most experienced intubator** (for age group eg paediatrician / neonatologist for neonate < 44 weeks CGA)
- **Microcuffed oral ET tube** for those > 3kg (ie from size 3.0 upwards)
- **Prepare resus drugs as these pts are high risk of cardiac arrest** (including calcium gluconate: emergency drug guide)
- Use Emergency Drug Guide for bolus / infusion doses via https://www.nwts.nhs.uk/emergency-drug-guides
- **Prepare dilute adrenaline & give 1-2 mL aliquots as needed for hypotension**
- **DILUTE ADRENALINE = RESUS DOSE I.E. 0.1 ML/KG OF 1:10,000 SOLUTION MADE UP TO 10ML (MAX CONCENTRATION: 1MG IN 10ML I.E. NEAT)** & give 1-2 mL aliquots as needed for hypotension / shock AND start or increase adrenaline infusion dose until stable

- **SHOCK NOT REVERSED: Repeat fluid bolus (10 mL/kg) prior to induction ideally balanced crystalloid eg Plasmalyte 148 or Hartmann's Solution. If not available use 0.9% sodium chloride.**
- **Fluid bolus up to 60 mL/kg if no hepatomegaly, crackles or gallop rhythm. If these are present start adrenaline infusion EARLIER.** Optimise dose based on clinical response (see target mBP range (for age) on page 3)
- **If on-going shock: prepare AND start adrenaline infusion at 0.2 microgram/kg/min via IO/peripheral IV**
- **Ketamine/Rocuronium +/- Fentanyl induction, reduce dose if on-going evidence of shock N.B. AVOID Etomidate**
- **Nasogastric tube** (ideally pre-intubation) **to reduce gastric distension & splinting of diaphragm**
- Alternative for emergency decompression of stomach especially if struggling to oxygenate / ventilate and if unable to place NGT, pass a large/wide bore suction catheter or section of oxygen tubing via mouth.
- **See SHOCK guideline for management and algorithm for escalation of inotropes: https://www.nwts.nhs.uk/clinicalguidelines/regionalguidelines-a-z**

WARNING: INDUCTION AGENTS

- Inhalational / volatile anaesthetics present a significant increased risk of cardiovascular depression & cardiac arrest.
- Only consider using volatile anaesthetic induction if the risk of a difficult airway outweighs this.
- Thiopentone, propofol & benzodiazepines all have similar increased risk of significant cardiovascular depression & cardiac arrest
- Avoid using etomidate induction as there is a significant risk of causing adrenal insufficiency in those under 16 years

Don't forget to wear appropriate **PPE** when intubating or doing suction (as per national NHS guidance)

SUMMARY GUIDELINE: BEYOND THE FIRST HOUR UNTIL TRANSFER

AIRWAY

- Cuffed ETT always advised if possible (Microcuff©) if > 3 kg. Essential in presence of pulmonary oedema
- Secure endotracheal tube appropriately for transfer (see NWTS guidelines)
- Nasogastric tube placed to decompress the stomach
- CXR check for any pathology. Check position ET tube tip at T2-T4 & above carina by 1 cm & NG tube in stomach
- Check using correct size heat & moisture exchanger (HME) & end-tidal CO_2 monitoring in circuit (too large => ↑CO_2)

BREATHING: monitor end-tidal CO_2 & SpO_2 continuously

- Place on ventilator with age appropriate settings, aiming for tidal volume 6-8 mL/kg
- Start with positive end expiratory pressure (PEEP) 5 cmH_2O & titrate PEEP upwards to treat pulmonary oedema or paeds ARDS (may need PEEP 10-15 cmH_2O). **ALWAYS discuss with NWTS if difficult to establish on ventilator**
- Tolerate permissive hypercapnia to pH 7.15 as long as haemodynamically stable and adequate SpO_2
- Hypoxaemia associated paediatric (paeds) ARDS may need inhaled nitric oxide
- Avoid use furosemide to treat pulmonary oedema acutely in shock as may cause hypotension +/- renal injury

CIRCULATION: monitor NIV BP min every 3-5 mins until stable & within normal/target limits

- Insert an Intra-Osseous needle early if peripheral cannulation takes more than 2-3 minutes (see IO guideline)
- Ensure two good intravenous access (ideally including intra-osseous +/- central venous access)
- Intraosseous line (IO) can be used as central access: see NWTS guidelines how/where to insert
- Start inotrope infusions via IO (or peripheral line if IO not possible), aim eventually via central line (CVL)
- Check position on CXR if an internal jugular multi-lumen central venous line is inserted
- Always include 3-way tap in inotrope line so infusions can be changed without interruption (see page 9)
- Consider arterial line: secure & transduce (if femoral, site preferably on same side as CVL so that the other site is free for renal support catheter. Caution in neonate/infant as risk poor perfusion to one leg & loss of digits/limb)
- Track response to treatment with regular blood gases including lactate
- Site urinary catheter & start monitoring strict input/output & fluid balance.

INVESTIGATIONS

- **Cultures:** blood (peripheral + any indwelling lines), PCR (Meningococcal, Pneumococcal & Herpes Simplex etc as appropriate), urine (with dipstick), stool (if indicated)
- **Sputum** cultures for M, C & S; NPA for respiratory viral screen (+ extended including Mycoplasma & Pertussis if appropriate); throat swab (rapid Group A Strep testing) & ASO titre.
- **Bloods:** Full blood count, coagulation studies, group & save, urea & electrolytes including calcium & magnesium, blood glucose, C-reactive protein, liver function tests. Blood ammonia if reduced level of consciousness
- Arterial (or capillary) **blood gas including lactate** and intermittent central venous gas including $SCVO_2$
- CSF cultures, including PCR & virology. **CAUTION:** do **NOT** do an LP if increased work of breathing, unstable blood pressure or persistent tachycardia, altered neurology, coagulopathy or platelets < 50. NB If on LMWH need to withhold heparin dose pre & post LP (d/w haematology)

DRUGS

- Check all antimicrobials given within 1st hour of presentation & time/dose documented
- Maintenance fluids containing glucose to maintain blood glucose levels ≥ 3 mmol/L
- Add IV dexamethasone if suspect meningitis & older than 3 months (within 12 hours starting antimicrobials)
- **Start high dose aciclovir if suspicion of HSV e.g. coagulopathy, deranged LFTs, hypoglycaemia, or contact history, especially if suspected meningo-encephalitis**

COMMUNICATION

- Maintain contact with NWTS for on-going advice
- **Parents:** outline diagnosis, management and prognosis. Be honest, as outcome often uncertain.
- **Document:** history, current management & response to interventions & all blood results
- **Copy current notes** (& any relevant clinic letters, ACP), blood results, observation & drug charts for NWTS
- **Send X-rays** +/- any other imaging via PACS to receiving hospital

Paediatric Sepsis Guideline: Check previous culture results (especially if co-morbidities) & treat using sensitivities

North West & North Wales Paediatric Transport Service

NWODN SiC LTV PCC NORTHWEST

SEPSIS of unknown origin

IV cefTRIAXone* OR cefOTAXime
ADD IV clindamycin IF Suspected Staphylococcal / Streptococcal toxic shock
DOSE: Over 1 month = 10 mg/kg 6 hrly
Less than 44 weeks CGA = 5 mg/kg 6hrly
ADD IV gentamicin IF:
Severe septic shock + need inotropes
OR likely resistant organism
OR Galactosaemia
UNDER 1 month (CGA < 44 weeks):
ADD IV amoxicillin (Listeriosis)
ADD IV aciclovir if any of the following:
- ALT or AST >2x upper limit normal,
- Coagulopathy, vesicles, seizures
- Suspected meningitis/encephalitis
- Recent contact with HSV (maternal/other)
- Unexplained maternal febrile illness peripartum to 14 days postpartum

NEUTROPENIC SEPSIS

1st Line: IV piperacillin with tazobactam
OR if on IV methotrexate: IV meropenem
BOTH: +/- IV gentamicin OR amikacin
PENICILLIN / CEPHALOSPORIN ALLERGY:
IV meropenem
Carbapenem allergy:
IV teicoplanin + ciprofloxacin
2nd Line: IV meropenem +/- amikacin
If suspect central line infection:
+ IV teicoplanin OR vancomycin
Discuss with parent team

CENTRAL LINE ASSOCIATED

IV cefTRIAXone*
+ IV teicoplanin OR vancomycin
On TPN via CVL:
IV piperacillin with tazobactam + IV teicoplanin
Consider antifungal if no change after 48 hrs
Source control: discuss with parent team

PNEUMONIA

UNDER 1 month (CGA < 44 weeks):
Community acquired: IV cefTRIAXone*
Healthcare Associated:
IV cefTRIAXone + gentamicin

OVER 1 month (CGA > 44 weeks):
Community acquired:
IV co-amoxiclav +/- IV clarithromycin

Previous Pseudomonas (check sensitivities)
e.g. IV piperacillin with tazobactam

Sickle cell acute chest syndrome:
IV cefTRIAXone + IV clarithromycin

Healthcare associated OR Immunocompromised:
1st line: IV cefTRIAXone unless resistance
2nd line: IV piperacillin with tazobactam

If suspected or confirmed MRSA infection:
ADD IV teicoplanin

PENICILLIN / CEPHALOSPORIN ALLERGY:
IV teicoplanin + ciprofloxacin

PERTUSSIS: IV clarithromycin

ASPIRATION PNEUMONIA: IV co-amoxiclav
PENICILLIN HIGH RISK ALLERGY:
IV clindamycin + ciprofloxacin

EMPYEMA
IV cefUROXime **OR** co-amoxiclav **PLUS** IV clindamycin
PENICILLIN / CEPHALOSPORIN ALLERGY:
IV ciprofloxacin + IV clindamycin

SOURCE control: discuss with tertiary respiratory paediatrics re chest drain
NB 1) Majority cases empyema is NOT drained locally as high-risk decompensation (↓BP + pulmonary oedema)
2) In both sepsis & empyema, clindamycin can be stopped when pt is stable

VENTRICULO-PERITONEAL SHUNT

IV cefTRIAXone* + IV vancomycin
PENICILLIN / CEPHALOSPORIN ALLERGY:
IV ciprofloxacin + IV vancomycin
Source control:
d/w paediatric neurosurgeons

BRAIN ABSCESS

Community associated:
IV cefTRIAXone* + metronidazole
PENICILLIN HIGH RISK ALLERGY:
IV meropenem
If carbapenem allergy: IV vancomycin + ciprofloxacin
Source control:
d/w tertiary paediatric neurosurgeons

Associated with chronic suppurative otitis media: antibiotics & source control: d/w tertiary paediatric ENT + neurosurgeons

MENINIGITIS / ENCEPHALITIS

< 1 month: see sepsis of unknown origin
1- 3 months: IV cefTRIAXone +/- aciclovir
Over 3 months: IV cefTRIAXone +/- aciclovir
Penicillin LOW RISK allergy:
IV cefTRIAXone* + IV co-trimoxazole < 1/12
PENICILLIN HIGH RISK ALLERGY: IV meropenem
Carbapenem allergy: IV ciprofloxacin + IV vancomycin
Healthcare Assocd or neurosurgery last 3/12: IV cefTRIAXone + vancomycin OR IV meropenem if ESBL colonised

NECROTISING FASCIITIS

1st Line: cefTRIAXone* + clindamycin IV
If previous antibiotics:
IV piperacillin / tazobactam + clindamycin
High risk ESBL: meropenem + clindamycin IV
If septic shock ADD IV gentamicin

INTRA-ABDOMINAL

IV co-amoxiclav + metronidazole
If severe sepsis: + IV gentamicin (single dose)
PENICILLIN / CEPHALOSPORIN ALLERGY:
IV ciprofloxacin + metronidazole +/- gentamicin

SEPTIC ARTHRITIS / OSTEOMYELITIS

<3 months: IV cefTRIAXone*
3 months - 5 years: IV CefUROXime
>5 years: IV flucloxacillin
PENICILLIN HIGH RISK ALLERGY:
IV cotrimoxazole
Sickle cell disease or no HiB vaccine:
IV cefTRIAXone*
Metal work: IV cefTRIAXone* +/- teicoplanin OR vancomycin (if suspected or confirmed MRSA)
PENICILLIN HIGH RISK ALLERGY:
IV cotrimoxazole + rifampicin
Source control: d/w orthopaedic team

ACUTE MASTOIDITIS

No intracranial collection:
IV co-amoxiclav
PENICILLIN HIGH RISK ALLERGY: IV clindamycin
With intracranial collection:
IV cefTRIAXone* + metronidazole
+ IV vancomycin if MRSA +ve
PENICILLIN HIGH RISK ALLERGY:
IV vancomycin + ciprofloxacin

Source control: discuss with tertiary paediatric ENT +/- neurosurgeons

PYELONEPHRITIS / UTI (upper)

IV cefTRIAXone*
If severe sepsis: + gentamicin single dose
PENICILLIN HIGH RISK ALLERGY:
IV gentamicin

*Use CefOTAXime if preterm AND under 41 weeks corrected post gestational age OR full-term with significant jaundice

Caution with IV ceftriaxone use with calcium containing solutions as risk of precipitating calcium salts (ALL age groups) if given via same route flush well

CORRECT HYPOGLYCAEMIA & ELECTROLYTES

- **Hypoglycaemia:** give **10% glucose bolus 3 mL/kg bolus if blood glucose ≤ 3 mmol/L AND** start glucose containing maintenance fluids early. Don't forget to recheck blood glucose
- NB Hypoglycaemia associated with sepsis may indicate poor stress response, therefore give IV hydrocortisone 1 mg/kg (MAX 100 mg) 6 hrly; neonate 2 mg/kg/dose 6 hrly (ideally after blood sent to check cortisol level).
- Treat **Hypocalcaemia**: 10% calcium gluconate bolus (see Emergency Drug Guide) +/- infusion. N.B. If giving via PVL 10% calcium gluconate must be diluted by 5 times (i.e. dilute each 1mL 10% solution with 4mL 0.9% sodium chloride to give a final concentration of 0.045 mmol/mL).
- Aim to maintain ionised calcium > 1.2 mmol/L (may need repeat doses +/- infusion—d/w NWTS)
- Treat **Hypomagnesaemia** (see Emergency Drug Guide). CAUTION: Magnesium causes vasodilation and may cause hypotension. Avoid if pt hypotensive. Otherwise, give slowly over 20 minutes (max rate 10mg/kg/minute) & watch for hypotension (may need a fluid bolus to correct). If giving via PVL dilute Magnesium Sulfate 50% by 5 times to a concentration of **0**.4mmol/ml

CORTICOSTEROIDS

- **If meningitis suspected** & more than 3 months old, give **IV dexamethasone 0.15 mg/kg/dose (max 10 mg/dose) 6 hourly** (ideally within 6 hours but not more than 12 hours after starting antimicrobials)
- **If actual or suspected primary adrenal insufficiency** (i.e. hyponatremia with hyperkalemia) treat with sick day dose of hydrocortisone (30 mg/m^2/DAY in 4 divided doses). Ideally check blood cortisol level first.
  N.B. Up to 25% children in septic shock may have adrenal insufficiency
- **Add hydrocortisone if >1 inotrope OR hypoglycaemia (glucose < 3 mmol/L) noted on admission or during stabilisation**
  Hydrocortisone 1 mg/kg/dose (MAX 100 mg) 6 hrly; Neonate 2 mg/kg/dose 6 hrly

BICARBONATE USE

- Not recommended for treatment of hypoperfusion-induced lactic acidaemia & pH ≥ 7.15
- Bicarbonate may be considered if pH < 7 despite fluid resuscitation and inotropes OR if known renal failure

NB MUST be diluted prior to IV administration as high risk of extravasation injury

EXTRA-CORPOREAL MEMBRANE OXYGENATION (ECMO)

Consider referral to regional ECMO team (via NWTS) at Alder Hey Children's Hospital for those with sepsis induced paediatric acute respiratory distress syndrome and refractory hypoxia OR septic shock refractory to all other treatments.

DRUG DOSES

NWTS emergency drugs guide **via** *https://www.nwts.nhs.uk/emergency-drug-guides* & **BNFc** for all other drugs.
Always seek local microbiology advice: pt specific antimicrobials especially if potentially resistant organism
Antimicrobial Paediatric Guidelines via UK Paediatric Antibiotic Stewardship: http://www.uk-pas.co.uk

PROPHYLAXIS

- Prophylaxis depends on the suspected (or confirmed) causative agent and level of exposure.
- Local Public Health England health protection team can give advice over the phone 24/7.
- Local team should arrange prophylaxis for family & staff contacts after informing local Public Health England/Wales team
- Meningococcus: patient will also need prophylaxis unless treated with IV ceftriaxone
- Consider prophylaxis for the team if appropriate PPE not utilised during resuscitation especially those involved in any aerosol generating procedures if Meningococcus or Pertussis or Measles etc suspected.
- Always check with local Public Health England health protection team for up-to-date guidance.

OUTCOMES FOR PAEDIATRIC SEPSIS

Outcomes are improved when best practice guidelines are followed[6,9,10,11].

FOLLOWING FACTORS ARE INDEPENDENTLY ASSOCIATED WITH INCREASED MORTALITY[5,7,9]:

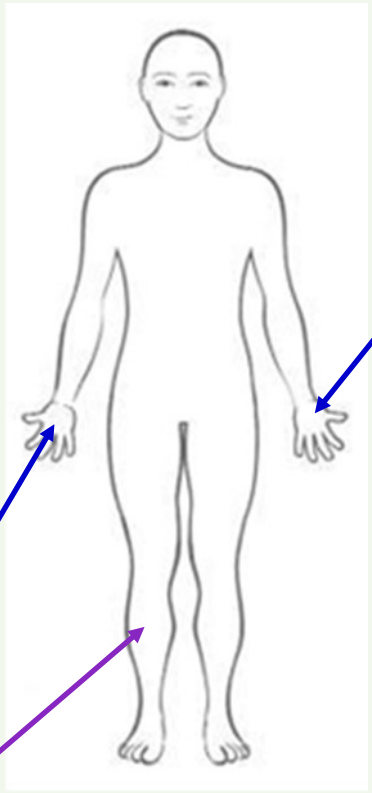
- **Failure to be looked after by senior paediatrician & failure of sufficient supervision of less experienced staff**
- **Persistent evidence of shock (2-fold increase in mortality per hour patient remains in shock)**
- **Failure to give adequate inotropes or resuscitation volume (even if inotropes started)**
- **Delays in administration of antibiotics[5] (every hour's delay increases mortality by around 7.6%)**
- **Lack of guidelines for recognition and management of children with septic shock**

Studies show improvements in mortality, length of hospital stay, development of new or progressive multiple organ dysfunction and duration of organ dysfunction when each of these factors are corrected.

APPENDIX

INTRAVENOUS INFUSIONS: PRACTICAL TIPS

- **IDEALLY** aim for 2 good peripheral venous lines (PVL) or one PVL plus one intra-osseous line.
- Using the 2 intravenous / intra-osseous lines it is possible to give all infusions and bolus drugs required safely, see example below.



PERIPHERAL VENOUS LINE:

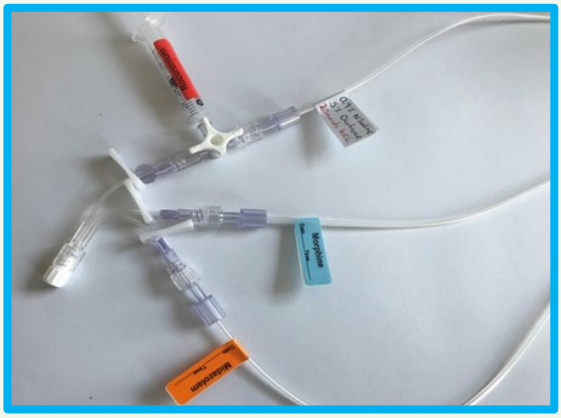
SEDATION + MAINTENANCE + BOLUS

Attach triple tail extension

Lumen 1: morphine or fentanyl infusion

Lumen 2: midazolam

Lumen 3: (with 3-way tap): maintenance fluids plus bolus drugs e.g. rocuronium



INTRAOSSEOUS LINE OR 2ND PERIPHERAL VENOUS LINE (IF NO ALTERNATIVE)

INOTROPE SET-UP

Attach a triple tail extension with 3-way tap on each lumen

Lumen 1: Adrenaline (central, IO or peripheral)

Lumen 2: Noradrenaline (central, IO or peripheral)

Lumen 3: Vasopressin (central or IO ONLY)

OR Milrinone (central, IO or peripheral line)

This enables inotrope infusions to be changed safely using the piggyback technique ie avoiding any interruption in infusions.

REMEMBER that the **PREFERRED** route for **INOTROPES** is **CENTRAL** ie **INTRA-OSSEOUS or CENTRAL line**

ONLY DELIVER INOTROPES VIA PERIPHERAL VENOUS LINES IF THERE ARE NO OTHER OPTIONS

NEVER DELAY STARTING INOTROPES WHEN INDICATED

RESOURCES: Quick reference guide for National PEWS

TARGETS for managing any critically sick child			
ALL AGES	**SpO_2 ≥ 94%**	**Lactate ≤ 2 mmol/L**	**Glucose: ≥ 3 mmol/L**

CAUTION inaccurate pulse oximetry (SpO_2) readings can occur in severe anaemia, high carbon monoxide levels and hypoperfusion. IN ADDITION, SpO_2 may inaccurately over-read in all races, especially those with darker skin pigmentation, masking occult or unrecognised hypoxaemia, i.e. ARTERIAL oxygen < 88% vs SpO_2 ≥ 92%. Occult hypoxaemia was >3xs greater in Black vs White patients and may over-estimate SpO_2 between 1.5-5%.

AGE	TARGET MEAN BP	AGE	TARGET MEAN BP
0-11 Months	45-55	5-12 Years	60
1-4 Years	55-60	>13 Years	60-65

Respiratory Rate (Score up to 4)							
Score	**4**	**2**	**1**	**0**	**1**	**2**	**4**
0-11 months	0-10	11-20	21-20	31-49	50-59	60-69	≥70
1-4 years	0-10	11-20		21-39	40-49	50-59	≥ 60
5-12 years	0-10	11-15	16-20	21-24	25-39	40-49	≥ 50
>13 years	0-10		11-15	16-24	25-29	30-39	≥ 40

All Ages Score	**Respiratory Distress (Score up to 4)**
0 = none	None
1 = mild	Nasal flaring, subcostal recession
2 = moderate	Tracheal tug, intercostal recession, inspiratory or expiratory noises
4 = severe	Supraclavicular recession, grunting, exhaustion, impending respiratory arrest

All Ages Score	**Oxygen Saturations (Score up to 4)**
0	95-100%
2	92-94%
4	≤ 91%

All Ages Score	**Oxygen Requirement (Score up to 4) - ALL AGES**
0	Room Air
2	0.01 up to 4 litres/min
4	4 or more litres/min **NB** High flow humidified NC oxygen, NIV CPAP or BiPAP score 4 (irrespective of O_2 requirement)

Heart Rate (Score up to 4)							
Score	**4**	**2**	**1**	**0**	**1**	**2**	**4**
0-11 Months	0-80	81-90	91-110	111-149	150-169	170-179	≥ 180
1-4 Years	0-60	61-70	71-90	91-139	140-149	150-169	≥ 170
5-12 Years	0-60	61-70	71-80	80-119	120-139	140-159	≥ 160
>13 Years	0-50	51-60	61-70	71-99	100-119	120-129	≥ 130

Blood Pressure Systolic (Score up to 4)							
Score	**4**	**2**	**1**	**0**	**1**	**2**	**4**
0-11 Months	0-50	51-60	61-70	71-89	90-99	100-109	≥ 110
1-4 Years	0-50	51-60	61-80	81-99	100-119	120-129	≥ 130
5-12 Years	0-70	71-80	81-90	91-109	110-119	120-129	≥ 130
>13 Years	0-80	81-90	91-100	101-119	120-129	130-139	≥ 140

Capillary Refill Time (CRT) (Score up to 2)							
Score	**4**	**2**	**1**	**0**	**1**	**2**	**4**
All Ages		≥ 3 secs		<3 secs		≥ 3	

Check if your patient has any additional Risk Factors (NPEWS)

Risk Factors	Tick	Think!	
Baseline vital signs outside normal reference ranges		Always score relevant PEWS value even if this is normal for the patient eg cyanotic heart disease	Vital Sign: Patients normal value:
Tracheostomy / Airway Risk / Difficult Intubation		Do you need additional help in an airway emergency? Needs review by local anaesthetics & ENT teams. Consider d/w NWTS early	
Invasive/Non-invasive ventilation/high flow		Check oxygen requirement on additional respiratory support. Remember High Flow/BiPAP & CPAP score max 4 on oxygen delivery	
Neutropenic/immunocompromised		Sepsis recognition & escalation has a lower threshold	
<40 weeks corrected gestational age		Sepsis recognition & escalation has a lower threshold (beware hypothermia)	
Neurological condition (ie meningitis, seizures)		Remember: check pupil response if anything other than ALERT on AVPU	
Neurodiversity or Learning Disability		Be aware of the range of responses to pain & physiological changes	

NPEWS Escalation	Actions	Medical Review	Observation / Plan
E0 – no concerns **Score = 0**	None	Not required	Continue current observations
E1 – Increased monitoring **Score = 1- 4**	Inform Nurse-in-Charge Consider medical review (ST3+ or equivalent) Ensure feedback to parents	As required Discuss with Nurse-in-Charge whether medical review required	Reassess within 60 mins & document ongoing plan
E2 – Needs clinical review (within 30 mins) **Score = 5-8**	Review by Nurse-in-Charge Ensure feedback to parents	Within 30 mins Review by ST3+ or equivalent Discuss stabilisation plan with consultant	Reassess within 30 mins & document ongoing plan Continuous SpO_2 monitoring
E3 – Needs rapid review (within 15 mins) **Score = 9-12**	Immediate review by Nurse-in-charge Discuss medical plan with consultant Senior feedback to parents	Within 15 mins Alert to ST3+ or equivalent Stabilisation plan to be agreed after review by consultant Consider NWTS referral after consultant review	Reassess every 30 mins Continuous monitoring SpO_2, RR, & ECG Record full GCS if change in AVPU
E4 – Needs emergency review (immediate) **Score > 12**	Immediate review by Nurse-in-Charge Consider immediate 2222 call for immediate emergency medical response Inform paeds consultant Senior feedback to parents	Immediate Alert to ST3+ or equivalent Consultant review ASAP Anaesthetic review Consider NWTS referral after appropriate initial interventions	Reassess every 15 mins Continuous SpO_2, ECG, & RR Record full GCS if change in AVPU

NB Escalation levels can also be selected and triggered if parent or carer expresses concern that their child needs increased monitoring +/- clinical review despite PEWS, OR parent or nursing gut instinct irrespective of score.

Medical Plan for Stabilisation:

Structured plan must be documented including:

1. Specific actions to be taken
2. Expected outcome
3. Outcome deadline / in timeframe
4. Escalation if outcome not met by deadline / in timeframe

REFERENCES

[1]Glodstein B, Giroir B, Randolph A *et al.* International pediatric sepsis consensus conference: Definitions for sepsis and organ dysfunction in pediatrics. Pediatr Crit Care Med. 2005; 6(1):2-8

[2]Watson RS, Carcillo JA, Linde-Zwirble WT, Clermont G, Lidicker J, Angus DC. The epidemiology of severe sepsis in children in the United States. Am J Respir Crit Care Med. 2003; 167:695-701

[3]Schlapbach LJ,MacLaren G, Festa M, et al. Prediction of pediatric sepsis mortality within 1 h of intensive care admission. Intensive Care Med. 2017 Aug;43(8):1085-1096.

[4] Paul R, Melendez E, Stack A, Capraro A, Monuteaux M, Neuman MI. Improving adherence to PALS septic shock guidelines. Pediatrics. 2014 May;133(5):e1358-66.

[5] Weiss SL, Fitzgerald JC, Balamuth F et al. Delayed antimicrobial therapy increases mortality and organ dysfunction duration in pediatric sepsis. Crit Care Med. 2014 Nov;42(11):2409-17

[6]Brierly J, Carcillo JA, Choong K, *et al*. Clinical practice parameters for haemodynamic support of pediatic and neonatal septic shock:2007 update from the American College of Critical Care Medicine. Crit Care Med. 2009;37(2):666-688

[7]Han YY, Carcillo JA, Dragotta MA, Bills DM, Watson RS, Westerman ME, Orr RA. Early reversal of pediatric-neonatal septic shock by community physicians is associated with improved outcome. Pediatrics. 2003;112:793-799

[8]Ninis N, Phillips C, Bailey L, *et al.* The role of healthcare delivery in the outcome of meningococcal disease in children: case-control study of fatal and non-fatal cases. BMJ. 2005;330:1475-1481

[9]Inwald DP, Tasker RC, Peters MJ, *et al.* Emergency management of children with severe sepsis in the United Kingdom: the results of the Paediatric Intensive Care Society sepsis audit. Arch Dis Child. 2009;94:348-353

[10]National Institute for Health and Clinical Excellence (NICE) 2019 (updated 2021) (CG143) Fever in under 5s: assessment and initial management London: National Institute for Health and Care Excellence

[11]NICE CG 51: Suspected sepsis: recognition, diagnosis and early management. 2016, updated 2024

[12] Masarwa R, Paret G, Perlman A, Reif, S ,Raccah BH, Matok I. Role of vasopressin and terlipressin in refractory shock compared to conventional therapy in the neonatal and pediatric population: a systematic review, meta-analysis, and trial sequential analysis. Crit Care. 2017; 21: 1.

[13] Scott HF, Brou L, Deakyne SJ, Fairclough DL, Kempe A, Bajaj L. Lactate Clearance and Normalization and Prolonged Organ Dysfunction in Pediatric Sepsis. J Pediatr. 2016 Mar;170:149-55

[14] Jiang L, Jiang S, Zhang M, et al. Albumin versus other fluids for fluid resuscitation in patients with sepsis: a meta-analysis. PLoS One. 2014;9(12):1–21.

[15] Velissaris D, Pierrakos C, Scolletta S, De Backer D, Vincent JL. High mixed venous oxygen saturation levels do not exclude fluid responsiveness in critically ill septic patients. Crit Care. 2011;15(4

[16] Weiss LS, Peters MJ, Alhazzani W et al. Surviving Sepsis Campaign International Guidelines for the Management of Septic Shock and Sepsis-Associated Organ Dysfunction in Children. Pediatr Crit Care Med.2020: 21 (2):e52-e106.

[17]National Paediatric Early Warning Score NHS England, November 2023

[18]Sepsis Screening Tool (under 16 years) 2024.

[19]ALSG (2023) Advanced Paediatric Life Support a practical approach to emergencies, seventh edition, Wiley Blackwell.

[20] https://www.nwts.nhs.uk/emergency-drug-guides

[21]https://sepsistrust.org/professional-resources/our-clinical-tools/

[22]Hildreth AN, Mejia VA, Maxwell RA, et al. Adrenal suppression following a single dose of etomidate for rapid sequence induction: A prospective randomized study. J Trauma. 2008; 65:573–579

ANTIMICROBIAL RECOMMENDATION SOURCES:

[1]Scottish Intercollegiate Guidelines Network (SIGN). Care of deteriorating patients. Edinburgh: SIGN; 2014. (SIGN publication no.139).

[2]Infection Management Guideline: Empirical antibiotic therapy in children. Greater Glasgow & Clyde Antimicrobial Utilisation Committee, ADTC. November 2020. Review November 2023.
https://www.clinicalguidelines.scot.nhs.uk/media/2534/263098_3_1_inf-mgmt_empirical-antibiotic-ther_children_s.pdf/Guidelines

[3] UK Paediatric Antibiotic Stewardship updated Feb '25 (UK PAS)—website: http://www.uk-pas.co.uk/

RESOURCES

FOR DRUG DOSES:

British National Formulary for Children

Emergency Drug Guide **(wt based) via NWTS website home page** - for intubation drugs / sedation regime / inotropes
https://www.nwts.nhs.uk/emergency-drug-guides

GUIDELINES FOR <16 YEARS: www.nwts.nhs.uk/clinicalguidelines/regionalguidelines-a-z
STOPP tool: Safe Transfer of Pediatric Patients which includes risk assessment prior to transfer, and checklists
NWTS LocSIPPS: includes sizes of ETT, suction, NGT, CVL & arterial lines and checklist for paediatric intubation
Guidelines include: intubation and difficult airway, sepsis, shock, insertion of intraosseous needle, collapsed neonate or infant, management of under 16 years outside PCC level 3 unit, and transfer

Education: www.nwts.nhs.uk/education-website
Includes recordings of NWTS education eg time critical transfers, sepsis, airway management etc
Login details for NWTS education site are available from your nursing, AHP and medical paediatric critical care operational delivery network links
OR via email: info@nwts.nhs.uk

CONTACT NUMBERS:

NWTS (North-West (England) & North Wales Paediatric Transport Service): **Referrals 08000 84 83 82**
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For the most up to date version of this guideline please visit PCC / SiC / LTV https://northwestchildrensodnhub.nhs.uk
Or NWTS website: https://www,nwts.nhs.uk/clinicalguidelines/regionalguidelines-a-z

Ratification Process