

Sepsis in Children

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Note:

This guideline provides advice of a general nature. This statewide guideline has been prepared to promote and facilitate standardisation and consistency of practice, using a multidisciplinary approach. The guideline is based on a review of published evidence and expert opinion.

Information in this statewide guideline is current at the time of publication.

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Health practitioners in the South Australian public health sector are expected to review specific details of each patient and professionally assess the applicability of the relevant guideline to that clinical situation.

If for good clinical reasons, a decision is made to depart from the guideline, the responsible clinician must document in the patient's medical record, the decision made, by whom, and detailed reasons for the departure from the guideline.

This statewide guideline does not address all the elements of clinical practice and assumes that the individual clinicians are responsible for discussing care with consumers in an environment that is culturally appropriate and which enables respectful confidential discussion. This includes:

- The use of interpreter services where necessary,
- Advising consumers of their choice and ensuring informed consent is obtained,
- Providing care within scope of practice, meeting all legislative requirements and maintaining standards of professional conduct, and
- Documenting all care in accordance with mandatory and local requirements

Explanation of the aboriginal artwork:

The aboriginal artwork used symbolises the connection to country and the circle shape shows the strong relationships amongst families and the aboriginal culture. The horse shoe shape design shown in front of the generic statement symbolises a woman and those enclosing a smaller horse shoe shape depicts a pregnant woman. The smaller horse shoe shape in this instance represents the unborn child. The artwork shown before the specific statements within the document symbolises a footprint and demonstrates the need to move forward together in unison.



Cultural safety enhances clinical safety.

To secure the best health outcomes, clinicians must provide a culturally safe health care experience for Aboriginal children, young people and their families. Aboriginal children are born into strong kinship structures where roles and responsibilities are integral and woven into the social fabric of Aboriginal societies.

Australian Aboriginal culture is the oldest living culture in the world, yet Aboriginal people currently experience the poorest health outcomes when compared to non-Aboriginal Australians.

It remains a national disgrace that Australia has one of the highest youth suicide rates in the world. The over representation of Aboriginal children and young people in out of home care and juvenile detention and justice system is intolerable.

The cumulative effects of forced removal of Aboriginal children, poverty, exposure to violence, historical and transgenerational trauma, the ongoing effects of past and present systemic racism, culturally unsafe and discriminatory health services are all major contributors to the disparities in Aboriginal health outcomes.

Clinicians can secure positive long term health and wellbeing outcomes by making well informed clinical decisions based on cultural considerations.

The term 'Aboriginal' is used to refer to people who identify as Aboriginal, Torres Strait Islanders, or both Aboriginal and Torres Strait Islander. This is done because the people indigenous to South Australia are Aboriginal and we respect that many Aboriginal people prefer the term 'Aboriginal'. We also acknowledge and respect that many Aboriginal South Australians prefer to be known by their specific language group(s).



Purpose and Scope of PCPG

The Sepsis in Children Paediatric Clinical Practice Guideline (PCPG) is primarily aimed at medical staff working in any of the primary care, local, regional, general or tertiary hospitals. It may however assist the care provided by other clinicians such as nurses.

The information is current at the time of publication and provides a minimum standard for the assessment (including investigations) and management sepsis; it does not replace or remove clinical judgement or the professional care and duty necessary for each specific case.

Important points

- > **Sepsis is a syndrome of life-threatening organ dysfunction caused by a dysregulated host response to infection (Sepsis-3 International Consensus Definition). These features distinguish it from an uncomplicated infection.**
- > Sepsis in the paediatric population can be particularly difficult to recognise given the large number of mimics and the fact that children will often appear very unwell, including significantly abnormal physiology, when febrile.
- > Sepsis is the primary cause of long-term morbidity and mortality from infection.
- > **Clinician judgement is currently the best tool we have for early recognition of sepsis.**
- > Recognition of sepsis therefore mandates urgent attention.
- > There are presently no clinical criteria, laboratory features or diagnostic tests that uniquely identify a septic patient.
- > Initial management includes urgent vascular access, early empiric antibiotics, careful fluid resuscitation with early progression to inotropic or vasopressor support where required.
- > In an unwell child, procedures such as urinalysis and lumbar puncture should not delay resuscitation and empiric antibiotics.

Common Pathogens

< 3 months of age: Escherichia Coli, Group B Streptococcus, Listeria monocytogenes

> 3 months of age: Neisseria meningitidis, Streptococcus pneumoniae, Group A Streptococcus, Staphylococcus aureus, Methicillin Resistant Staphylococcus aureus



Flowchart - Paediatric Sepsis Pathway

Child UNWELL? Concerned with observations?
CONSIDER SEPSIS

RECOGNISE

Does your patient have ANY of the following signs or symptoms of infection?

- Fever ($\geq 38^{\circ}\text{C}$) or hypothermia ($< 36^{\circ}\text{C}$)
- Altered conscious state
- Marked or persistent tachycardia
- Signs of toxicity:**
Decreased alertness, arousal or activity; pale or mottled; cool peripheries; weak cry; grunting; rigors; bounding or weak pulses; wide pulse pressure
- Non-blanching rash
- Hypotension
- Lactate 2-4 mmol/L concerning, > 4 mmol/L high risk
- Unexplained generalised pain

AND

- ANY Purple Zone observation on RDR chart**
OR
- TWO OR MORE Red Zone observations**
OR
- Additional response criteria** (on Rapid Detection and Response Chart)
OR
- SERIOUS CLINICAL CONCERN**

Consider Risk Factors
 (See Box A)

CONSULT SENIOR DOCTOR
COULD THIS CHILD HAVE SEPSIS?

LIKELY SEPSIS

- 1. Send For Help** **0 min**
- 2. Assess Airway/Breathing** **<5 min**
 - Apply oxygen if required to keep $\text{SaO}_2 \geq 92\%$
 - Attach cardiorespiratory monitoring
 - Senior operator if intubation required
- 3. Vascular Access** **<15 min**
 - Perform IO after 2 failed IV attempts
 - Send bloods: blood gas (lactate, BSL), FBE, blood cultures, UEC/LFTs, CRP, sterile site PCR, +/- coags, +/- procalcitonin
- 4. Empiric Antibiotics +/- Antivirals** **<30 min**
 - [See Page 7](#) for empiric antimicrobial guidelines
 - If no IV/IO access, consider IM antibiotics
- 5. Cautious Fluid Resuscitation** **<30 min**
- 6. Consider Early Inotropic Support** **<60 min**
 - Careful fluid resuscitation: Senior clinician to decide on need for fluid bolus (10-20 ml/kg 0.9% NaCl).
 - Each time assess response
 - Aim: improved HR, mentation, perfusion
 - Overload: hepatomegaly, crepitations, oedema
 - Decide need for early inotropic/vasopressor support for persisting circulatory failure. See Page 2 for inotropic guidelines.
 - Treat hypoglycaemia (2 ml/kg 10% dextrose)
- 7. Further Investigations**

Safely perform appropriate investigations seeking potential source (e.g. CXR, urine, NPA, LP, stool, wound swabs, etc.)

NO or UNSURE

- 1. Repeated Medical Review** **Every hour**
- 2. Repeat Observations** **Every 30 mins**
- 3. Consider Differential Diagnoses**
 - Anaphylaxis
 - Cardiac causes
 - Toxins/Ingestion
 - Metabolic conditions (incl. DKA)
 - Trauma/NAI
 - Surgical causes (incl. intussusception)
 - Paediatric Multisystem Inflammatory Syndrome

**IF SEPSIS THOUGHT LIKELY,
 COMMENCE SEPSIS MANAGEMENT**

RESPOND AND ESCALATE

Commence all elements within 1 hour

Box A — Risk Factors for Sepsis

- Age < 3 months
- Indwelling medical device
- Indigenous
- Unimmunised
- Immunocompromised
- Chronic disease or congenital disorder
- Recent trauma, surgery, invasive procedure or wound
- Known malignancy

Note that the absence of risk factors DOES NOT exclude sepsis

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Abbreviations

CRP	C-Reactive Protein
CSF	Cerebrospinal Fluid
CXR	Chest x-ray
DKA	Diabetes Ketoacidosis
EUC	Electrolytes, Urea, Creatinine
FBC	Full Blood Count
HSV	Herpes Simplex Virus
IM	Intramuscular
IO	Intraosseous
IV	Intravenous
kg	Kilogram
LFT	Liver Function Test
LP	lumbar puncture
MC&S	Microscopy, Culture & Sensitivity
Mg	Magnesium
NAT	Nucleic Acid Testing
NPA	Nasopharyngeal Airway
PCR	Polymerase Chain Reaction
PCT	Procalcitonin
PICU	Paediatric Intensive Care Unit
WCH	Women's and Children's Hospital

Definitions

Inotropes	Medicines that change the force of your heart's contractions (such as adrenaline or a beta-blocker). There are 2 kinds of inotropes: <ol style="list-style-type: none"> 1. Positive inotropes strengthen the force of the heartbeat. 2. Negative inotropes weaken the force of the heartbeat
ISBAR	ISBAR (Identify, Situation, Background, Assessment and Recommendation) is a mnemonic created to improve safety in the transfer of critical information. It originates from SBAR, the most frequently used mnemonic in health and other high risk environments such as the military. The "I" in ISBAR is to ensure that accurate identification of those participating in handover and of the patient is established.
Vasopressors	A drug or other agent which causes the constriction of blood vessels.



Summary of Practice Recommendations

When to suspect Sepsis

Sepsis is a life-threatening condition that arises when the body's response to infection injures its own tissue.

- > **Potential sepsis** should be considered in any paediatric patient who shows signs/symptoms of infection **AND** have any purple zone observation or ≥ 2 observations within the red zone OR additional response criteria as per rapid detection and response chart OR if there is a serious clinical concern (See [Paediatric Sepsis Pathway flowchart](#)).
- > **Potential septic shock** should be considered if the patient fulfils the above criteria and is haemodynamically unstable.

Suspected Sepsis

All potential sepsis patients should be alerted to the team leader of the area where the patient is being cared for. The senior doctor (eg. paediatric registrar) must be notified and the patient reviewed as soon as possible.

Suspected Septic Shock

All potential septic shock patients should be attended emergently by a response team according to local hospital protocols

Management for suspected sepsis and suspected septic shock

If sepsis is suspected:

1. **Send for Help**
2. **Assess Airway/Breathing**
 - Medical and nursing staff to begin a systematic assessment (See [Paediatric Sepsis Pathway flowchart](#)).
 - Ensure airway patency is maintained.
 - Maintain oxygen saturations $\geq 92\%$ and administer oxygen as required.
3. **Obtain Urgent Vascular Access**
 - Ensure IV access is obtained as soon as possible.
 - If unsuccessful after 2 attempts (maximum 90 seconds for 2 attempts at paediatric cannulation in APLS), perform intraosseous access to ensure rapid blood sampling and for fluid/antibiotic administration.

The following **blood samples** should be collected;

- Blood gas (venous or arterial. If an IO sample is taken, notify lab)
- Lactate (note that a normal lactate does not exclude sepsis)
- Blood glucose level



- Blood cultures; should be collected PRIOR to antibiotic administration and sent to the laboratory. However if it is difficult to obtain, do not delay administration of IV antibiotics.

**If the patient has a central venous access device (CVAD), obtain one set from the CVAD and one set peripherally.*

- FBC, EUC, CRP (or PCT if available), LFTs, sterile site NAT (if available) and where relevant, coagulation studies.

**Note that a sterile site NAT must be collected and put in a separate tube. The sample requires 0.5mls of blood to be placed in the EDTA (purple) tube and sent to the laboratory.*

4. Administer Empiric Antibiotics ± Antivirals

- Antibiotics should be prescribed and initiated within 30-60 minutes of sepsis recognition. **DO NOT** wait for investigation results to be available prior to commencing the first dose.
- **<2 months old:**
 - Amoxicillin 50 mg/kg (max 2 g) IV/IO/IM **PLUS**
 - Cefotaxime 50 mg/kg IV/IO/IM (max 2 g). If Cefotaxime is not available and the patient is between ages 28 days to 2 months, Ceftriaxone 100mg/kg (max 4 g) IV/IO/IM can be given.
- **>2 months old:**
 - Cefotaxime 50 mg/kg (max 2 g) IV/IO/IM or Ceftriaxone 100 mg/kg (max 4 g) IV/IO/IM **PLUS**
 - Vancomycin 30 mg/kg (max 2 g) IV/IO (**do not give IM**)
 - **IF** critically ill, **ADD** Gentamicin (7.5 mg/kg ≤ 10 years (max 320 mg), 7 mg/kg >10 years (max 560 mg)) IV/IO/IM
 - **IF** bacterial meningitis is suspected clinically then add Dexamethasone 0.15mg/kg/dose up to 10 mg IV before or with the first dose of antibiotics and continue steroid only if proven S.Pneumoniae or H.Influenzae.

For patients with a documented penicillin or cephalosporin allergy, consult with Infectious Diseases at your closest tertiary hospital.

- **IF** child has an altered consciousness state AND/OR clinically suspect HSV:
 - **ADD** Aciclovir IV/IO (20 mg/kg ≤5 years, 15 mg/kg >5 years) (**do not give IM**).

5. Cautious Fluid Resuscitation

- Senior clinician to decide on need for fluid bolus (10-20 ml/kg 0.9% sodium chloride).
- Each time assess response
 - Aim: improved HR, mentation, perfusion
 - Overload: hepatomegaly, crepitations, oedema
- If blood glucose level is <2.5mmol/L, treat with 2ml/kg 10% glucose



6. Consider Early Inotropic Support

- Decide the need for early inotropic/vasopressor support for persisting circulatory failure after 40ml/kg fluid resuscitation. Consider early commencement of inotropic support for children with limited response to fluid resuscitation.
 - Adrenaline for cold shock (0.05-0.2 micrograms/kg/min).
 - Noradrenaline for warm shock (0.05-0.2 micrograms/kg/min).
 - For children ≤ 28 days old, see the SA Statewide Neonatal Medication guidelines for [Adrenaline](#) and [Noradrenaline](#).
- Inotropes and vasopressors may be safely administered via a peripheral IV during initial resuscitation.
- **Cold shock** is due to myocardial dysfunction due to sepsis, and is more common in infants and neonates. Children present with cardiovascular collapse.
- **Warm shock** is due to peripheral vasodilation/vasoplegia, and is more common in older children. Children present with a wide pulse pressure, flushed, with a rapid capillary refill and bounding pulses.

7. Further Investigations

Decide which of the following investigations are appropriate for that patient::

- Urine (MC&S)
- Chest x-ray
- Throat swab (MC&S, enterovirus and respiratory virus PCR)
- CSF (Micro, C&S, sterile site multiplex PCR)
 - Consider contraindications for LP
- Cutaneous virology (HSV I, HSV II and varicella zoster)
- Faeces (MC&S, enterovirus and viruses PCR)
- Skin swab (MC&S)

No response to initial treatment

- a) If patient is critically unwell or does not respond to the above, make an urgent request for MedSTAR Kids consultation and seek immediate advice for further management.
- b) Update all team members using ISBAR (See [Clinical Handover Procedure](#)).

Ongoing Monitoring

Patients with presumed sepsis are at a high risk of deteriorating despite initial resuscitation with intravenous antibiotics and fluids. These patients require a management plan which needs to be discussed with the admitting consultant paediatrician. This plan needs to be communicated to the paediatric registrar, team leader, allocated nursing staff, patient and patient's family.

Ensure vital signs are performed at a minimum every 30 mins or until instructed otherwise by a Medical Officer. Re-assess for response to therapy and monitor for signs of deterioration which may include one or more of the following;

- > Tachypnoea (Red or Purple zone)
- > Persistent tachycardia (Red or Purple zone), slow capillary refill (>2 seconds) and hypotension
- > Decreased or no improvement in level of consciousness



- > Urine output less than 1 ml/kg/hour
- > Acidosis, increasing serum lactate or procalcitonin
- > Hypoglycaemia, leucopenia or abnormal coagulation

If patient is deteriorating, escalate as per local escalation protocols to ensure prompt review of the patient.

Reassess the patient regularly. Ensure senior clinician review on regular basis during the admission and more frequent medical reviews if any deterioration to the patient's clinical condition.

Ensure adequate handover of patient's condition and plan of care are delivered at each handover times (see [Clinical Handover Procedure](#)).

Ongoing Investigations, Treatment and Management

In regards to ongoing investigations, management and treatment of the following must be addressed, particularly within the first 48 hours;

- > Lactate must be repeated at 4 hours and 8 hours post initial lactate, unless otherwise instructed by the treating medical team.
- > Repeat biochemistry as required.
- > Strict fluid balance must be maintained.

**Balances must be calculated 4 hourly with hourly urine output also calculated at this time and reported to the medical officer until instructed otherwise by the treating medical team.*

- > Ongoing fluid to be given either via intravenous, nasogastric or oral route to ensure adequate hydration.

**When administering IV fluids, monitor for signs of fluid overload, pulmonary oedema and/or inappropriate antidiuretic hormone.*

- > Ongoing administration of antibiotics until instructed otherwise by the treating medical team.
- > Pain relief and anti-pyretic administered as required as per paediatric medication chart.
- > If the source of sepsis is clear, change the antibiotics to target the source and seek infectious diseases advice as needed.

It is important to consider the following in a patient's ongoing management;

- > Confirm diagnosis and consider other causes of deterioration.
 - eg. Dehydration, hypovolaemia, haemorrhage or overdose/over-sedation.
- > Once a diagnosis is confirmed, document source of sepsis in the health care record.
- > Actively seek microbiology/investigation results and review.
- > Discuss with on-call paediatric consultant if further advice required.
- > Consider seeking advice from the ID physician.
- > Document plan to continue, change or cease antibiotics.
- > Obtain approval for restricted antibiotics.
- > Continue monitoring for deterioration including urine output.

It is absolutely imperative that parents/caregivers and the patient, if of an appropriate age, are updated regularly in regards to the care that is being provided to the patient and that ongoing support is offered to the patient and family members as required.



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