



Sepsis and Septic Shock (Pediatrics)

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1. Definition

Sepsis

Life-threatening **organ dysfunction** caused by a **dysregulated host response to infection**.

Septic shock

A severe form of sepsis characterized by **persistent circulatory failure despite adequate fluid resuscitation**, requiring vasoactive drugs to maintain perfusion, usually accompanied by elevated lactate (more applicable in adults).

Remember: In children, **hypotension is a late sign** of septic shock.

2. Clinical Presentation

Key history

Ask about:

- Fever or hypothermia
 - Recent infection
 - Immunodeficiency
 - Recent surgery or trauma
 - Central venous catheter
 - Chronic illness
 - Poor feeding (infants)
 - Reduced urine output
 - Altered mental status
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Physical examination

General

- Toxic appearance
- Lethargy or irritability
- Altered consciousness

Vital signs

- Tachycardia (early)
- Tachypnea
- Fever or hypothermia
- Hypotension (late)

Perfusion

Assess:

- Capillary refill (>2–3 sec)
 - Peripheral pulses
 - Skin temperature
 - Urine output
 - Mental status
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Warm shock (less common)

- Warm extremities
 - Flash capillary refill
 - Bounding pulses
 - Wide pulse pressure
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Cold shock (more common in children)

- Cold extremities
 - Delayed capillary refill
 - Weak pulses
 - Narrow pulse pressure
 - Mottled skin
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Signs of organ dysfunction

- Confusion
- Respiratory distress

- Oliguria
 - Cyanosis
 - Hepatomegaly
 - Petechiae/purpura (meningococemia)
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Red Flags

- ✓ Altered mental status
 - ✓ Delayed capillary refill
 - ✓ Poor urine output
 - ✓ Persistent tachycardia
 - ✓ Hypotension
 - ✓ Purpuric rash
 - ✓ Respiratory failure
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3. Diagnostic Approach

Suspected infection?

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Assess ABCDE

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Look for signs of poor perfusion

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Evaluate for organ dysfunction

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If sepsis suspected:

- Obtain cultures (if this does not delay therapy)
- Send initial investigations
- Start antibiotics **within 1 hour**
- Begin fluid resuscitation
- Reassess after every bolus

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Persistent shock?

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Start vasoactive infusion

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PICU admission

4. Differential Diagnosis

Consider:

- Hypovolemic shock
 - Cardiogenic shock
 - Anaphylaxis
 - Adrenal crisis
 - Diabetic ketoacidosis
 - Severe dehydration
 - Myocarditis
 - Pulmonary embolism (rare)
 - Toxic ingestion
 - Trauma
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5. Investigations

Essential laboratory tests

- CBC
 - Blood culture (before antibiotics if feasible)
 - CRP
 - Procalcitonin (if available)
 - Serum lactate
 - Blood gas
 - Electrolytes
 - Glucose
 - Renal function
 - Liver function
 - Coagulation profile
 - Urinalysis ± urine culture
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Additional tests (when indicated)

- CSF examination (only if stable)
- Chest X-ray
- Abdominal ultrasound
- Echocardiography (if myocardial dysfunction suspected)
- Viral PCR

- Wound cultures
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Assess organ dysfunction

Monitor:

- Urine output
 - Mental status
 - Oxygenation
 - Blood pressure
 - Lactate trend
 - Liver and renal function
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6. Management Algorithm

First Hour ("Golden Hour")

Step 1

ABCDE assessment

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High-flow oxygen

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Continuous monitoring

Step 2

Obtain IV/IO access immediately

Step 3

Draw blood cultures (do not delay antibiotics)

Step 4

Start broad-spectrum IV antibiotics **within 1 hour**

Step 5

Fluid resuscitation

Give:

10–20 mL/kg isotonic crystalloid over 10–20 minutes

Reassess after every bolus.

Usually up to **40–60 mL/kg during the first hour** if there are no signs of fluid overload. Use smaller aliquots and closer reassessment if cardiac dysfunction is suspected.

Watch carefully for:

- Pulmonary edema
 - Hepatomegaly
 - New crackles
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Step 6

Persistent shock?

Start vasoactive medications.

Current pediatric guidance favors **early vasoactive support** when shock persists despite appropriate fluids or when large fluid volumes may be harmful.

Step 7

Identify source

Examples:

- Drain abscess
- Remove infected catheter
- Surgical consultation
- Debridement if needed

Step 8

Supportive care

- Correct hypoglycemia
 - Correct electrolyte abnormalities
 - Mechanical ventilation if needed
 - Blood products if indicated
 - Nutrition
 - Temperature control
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7. Drug Summary Table

Drug	Typical Pediatric Dose	Main Use
Ceftriaxone	50–100 mg/kg/day IV (max 2 g/day; meningitis may require higher dosing according to local guidelines)	Community-acquired sepsis
Cefotaxime	50 mg/kg IV every 6–8 h	Neonates/infants (where appropriate)
Vancomycin	15 mg/kg IV every 6 h (adjust by age, renal function, and therapeutic drug monitoring)	Suspected MRSA
Piperacillin–tazobactam	80–100 mg/kg (piperacillin component) IV every 6–8 h	Broad Gram-negative/anaerobic coverage
Meropenem	20–40 mg/kg IV every 8 h	Severe hospital-acquired infection or resistant organisms
Epinephrine	Continuous IV infusion, titrated	First-line vasoactive agent for cold shock with low cardiac output
Norepinephrine	Continuous IV infusion, titrated	First-line vasoactive agent for warm/distributive shock
Hydrocortisone	1–2 mg/kg IV every 6 h (or stress-dose equivalent)	Catecholamine-resistant shock or suspected adrenal insufficiency

Always follow local antimicrobial guidelines and adjust therapy based on cultures and sensitivities.

8. Admission Criteria

Hospital admission is indicated for any child with:

- Suspected sepsis
- Need for IV antibiotics
- Abnormal perfusion
- Organ dysfunction
- Persistent tachycardia
- Need for oxygen
- Dehydration requiring IV fluids
- Significant comorbidities
- Infants with suspected serious bacterial infection

PICU admission if:

- Septic shock
- Vasoactive medications required
- Mechanical ventilation
- Altered consciousness
- Multiple organ dysfunction

9. Referral Criteria

Urgent referral to pediatric intensive care or a tertiary center if:

- Persistent shock
 - Refractory hypotension
 - Lactate remains elevated or rising
 - Respiratory failure
 - Need for intubation
 - DIC
 - Renal failure
 - Suspected meningococemia
 - ECMO consideration (selected refractory cases)
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10. Follow-up

During admission:

- Hourly vital signs (or continuous monitoring if critically ill)
- Strict urine output monitoring (target **>1 mL/kg/hour** in most children)
- Repeat lactate if initially elevated
- Daily laboratory monitoring as clinically indicated
- Review culture results and narrow antibiotics ("de-escalation") when appropriate
- Assess response to treatment frequently

After discharge:

- Confirm completion of antibiotic course (if required)
 - Monitor recovery and organ function if affected
 - Arrange follow-up for complications or persistent symptoms
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11. Clinical Pearls

- **Hypotension is a late sign** in pediatric septic shock.
 - Capillary refill, mental status, and urine output are early indicators of perfusion.
 - Antibiotics should be started **within 1 hour** of recognizing septic shock or high-likelihood sepsis.
 - Reassess after **every fluid bolus**.
 - Early vasoactive therapy improves outcomes when fluids alone are insufficient.
 - Always search for the source of infection.
 - Source control is as important as antibiotics.
 - Reassess the patient repeatedly—management is dynamic.
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12. Common Mistakes in Exams and Practice

- ✗ Waiting for hypotension before diagnosing septic shock
- ✗ Delaying antibiotics while awaiting investigations
- ✗ Administering excessive fluids without reassessment
- ✗ Failure to recognize cold shock in children

- ✗ Not obtaining cultures when feasible before antibiotics
 - ✗ Ignoring urine output
 - ✗ Failing to identify and control the infection source
 - ✗ Continuing broad-spectrum antibiotics despite culture results when de-escalation is appropriate
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13. Key Take-Home Messages

1. Sepsis is a **medical emergency** requiring immediate recognition and treatment.
 2. **Hypotension is a late finding** in pediatric septic shock.
 3. Perform an **ABCDE assessment** immediately.
 4. Assess **perfusion**, not just blood pressure.
 5. Start **broad-spectrum IV antibiotics within 1 hour**.
 6. Give **10–20 mL/kg isotonic crystalloid** boluses with reassessment after each bolus; avoid indiscriminate fluid loading.
 7. Begin **early vasoactive support** if shock persists despite appropriate fluids or if fluid overload is a concern.
 8. Obtain cultures **without delaying treatment**.
 9. Monitor urine output, mental status, capillary refill, and lactate trends to assess response.
 10. Early recognition, prompt antimicrobial therapy, appropriate hemodynamic support, and timely source control are the cornerstones of survival.
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High-Yield Exam Checklist

Recognize	Do Immediately
Fever or hypothermia	ABCDE assessment
Tachycardia	High-flow oxygen
Poor perfusion	IV/IO access
Delayed capillary refill	Blood cultures (if feasible)
Altered mental status	IV antibiotics within 1 hour
Oliguria	10–20 mL/kg crystalloid bolus
Cold or warm shock	Reassess after each bolus
Hypotension (late)	Start vasoactive infusion if shock persists
Organ dysfunction	Admit to PICU if unstable