

Shock

Definition / Supporting Information

Shock is a medical emergency requiring prompt recognition and treatment. It is the result of inadequate perfusion of oxygen and nutrients (eg, glucose) to vital organs. This is a progressive process of compensated, decompensated, and irreversible states defined by clinical signs and symptoms.

Keywords / also known as: hypotension, hypovolemia

Essential History

Evaluation should progress only after the 'Airway, Breathing, Circulation, Disability, Exposure' (ABCDE) approach of resuscitation has been undertaken.

Ask about:

- History of any current infection
- Known conditions, such as:
 - Cardiac disease, such as hypoplastic left heart and coarctation of the aorta
 - Inborn errors of metabolism
 - Adrenal abnormalities
- Family history of severe infection
- Gastrointestinal losses
- Excess urine output, diuretic administration
- Burns
- History of travel
- Medications
 - Steroids within the previous 6 months
- Allergies
 - Possible contact with allergens (eg, peanuts, egg, medications, pets etc.)
 - Look for medical alert bracelet
- Exposure to organophosphates (see Drug Overdose and Poisoning)
 - Indicated by weakness at presentation

'Red Flag' Symptoms and Signs

Ask about:

- Temperature
 - High or low
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- Difficulty breathing (see Dyspnoea)
 - Fast breathing
 - Grunting while breathing
 - Working hard to breathe (eg, sucking the stomach in under the ribs)
- Altered responsiveness (see Altered Conscious Level)
 - Irritable
 - Lethargic / drowsy
 - Lack of responsiveness, marked slowdown in activity, or increased floppiness (see Hypotonia)
 - High-pitched, weak, or continuous cry in infants
- In babies, a bulging or sunken fontanelle
- Neck stiffness
- Jittery movements
- Convulsions
- Decreased urine output
 - Number of wet nappies per 24 hours
- Increased thirst / fluid intake
 - Not drinking for more than 8 hours (taking solid food is not as important)
 - Note that an increased thirst and increased fluid intake can be present in early (compensated) shock
- Skin colour
 - Turning blue, very pale, mottled, or ashen
- A spotty, purple-red rash anywhere on the body (see Meningitis (Bacterial) and Meningococcal Septicaemia and Bacterial meningitis and meningococcal septicaemia in under 16s overview [[NICE pathway](#)])
- Repeated diarrhoea or vomiting / bile-stained (green) vomit (see Diarrhoea and vomiting caused by gastroenteritis in under 5s: diagnosis and management [[NICE clinical guideline 84, section 1.2; NICE pathway](#)])

Look for:

- Abnormalities as per the 'Airway, Breathing, Circulation, Disability, Exposure' (ABCDE) approach (see Table 1 for normal ranges)
- Signs the airway is compromised (eg, unrousable patient)
- Tachypnoea (or altered / irregular breathing pattern)
- Tachycardia (bradycardia is a sign of decompensation)
- Hypotension
 - Sign of decompensated shock as compensatory mechanisms are exhausted
- Prolonged capillary refill time
- Reduced skin turgor
- Sunken eyes
- Pale or mottled skin

- Cold extremities
- Dehydration
- Mental state / altered responsiveness (see Altered Conscious Level)
 - Assess AVPU (alert, verbal, pain, unresponsive) scale
- Posture / decreased muscle tone (see Hypotonia)
- Fever
- Features that may point to certain causes (see Table 2)
- Non-blanching rash
 - Haemorrhagic purpura may be seen in severe sepsis of other aetiologies, particularly pneumococcal sepsis
 - Generalised erythema, conjunctivitis and mucositis may be indicative of toxic shock syndrome

Table 1. Normal Ranges by Age

Age group (years)	Weight (kg) (50 th centile)		Respiratory rate	Heart rate	Systolic blood pressure 50 th centile height*	
	Boys	Girls	At rest Breaths per Minute 5 th –95 th centile	Beats per minute 5 th –95 th centile	5th centile	50th centile
Birth	3.3	3.2	25–50	120–170	65–75	80–90
1 month	4.5	4.2	25–50	120–170	65–75	80–90
3 months	6.4	5.8	25–45	115–160	65–75	80–90
6 months	7.9	7.3	20–40	110–160	65–75	80–90
12 months	9.6	8.9	20–40	110–160	70–75	85–95
18 months	10.9	10.2	20–35	100–155	70–75	85–95
2 years	12.2	11.5	20–30	100–150	70–80	85–100
3 years	14.3	13.9	20–30	90–140	70–80	85–100
4 years	16.3	16.1	20–30	80–135	70–80	85–100
5 years	18.3	18.2	20–30	80–135	80–90	90–110
6 years	20.5	20.2	20–30	80–130	80–90	90–110
7 years	22.9	22.4	20–30	80–130	80–90	90–110
8 years	25.4	25.0	15–25	70–120	80–90	90–110
9 years	28.1	28.2	15–25	70–120	80–90	90–110
10 years	31.2	31.9	15–25	70–120	80–90	90–110
11 years	35.0	35.0	12–24	70–120	80–90	90–110
12 years	43.0	43.0	12–24	65–115	90–105	100–120

14 years	50.0	50.0	12–24	60–110	90–105	100–120
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*Birth to 10 years based on WHO growth data

These normal ranges are for children without underlying medical conditions. The children with underlying medical conditions will have their own normal ranges which are not yet identified in all areas but may be part of an individualised plan

Adapted from: Advanced Paediatric Life Support -The Practical Approach, 6th Edition

Table 2. Key Features of the Child in Shock

Non-haemorrhagic fluid loss	History of vomiting and / or diarrhoea points to fluid loss either externally (eg, gastroenteritis) or into the abdomen (eg, volvulus, intussusception, ruptured appendix)
Septic shock	Presence of fever and / or rash points to septicaemia
Anaphylaxis	Presence of urticaria, angioneurotic oedema or history of allergen exposure points to anaphylaxis
Duct dependence congenital heart disease	Presence of cyanosis unresponsive to oxygen or a grey colour with signs of heart failure in a baby < 4–6 weeks points to duct-dependent congenital heart disease
Cardiomyopathy	Presence of heart failure in an older infant or child points to cardiomyopathy or myocarditis
Profound anaemia, Sickle cell crisis	History of sickle cell disease or a recent diarrhoeal illness and a very low haemoglobin points to acute haemolysis. A history of sickle cell disease, abdominal pain and enlarged spleen points to acute splenic sequestration
Trauma	Immediate history of major trauma points to blood loss and, more rarely, tension pneumothorax, haemothorax, cardiac tamponade or spinal cord transection
Abnormal pulse rate	Presence of severe tachycardia and an abnormal rhythm on the ECG points to a cardiac cause for shock
Diabetic ketoacidosis (fluid and electrolytes)	History of polyuria and the presence of acidotic breathing and a very high blood glucose points to diabetes ketoacidosis
Poisoning	History of drug ingestion points to poisoning

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Differential Diagnosis / Conditions

- Hypovolaemic causes of shock
 - Gastroenteritis (severe diarrhoea / vomiting)
 - Intussusception / volvulus / bowel obstruction
 - Hypoalbuminaemia
 - Nephrotic syndrome
 - Burns / scalds
 - Third-space fluid losses (eg, peritonitis)
 - Haemorrhage
 - Traumatic / non-traumatic blood loss
- Cardiogenic causes of shock
 - Mechanical obstruction
 - Tamponade (air, blood, or effusion)
 - Tension pneumothorax / haemopneumothorax / chest trauma
 - Massive pulmonary embolus
 - Rare in children, but can occur in adolescents
 - 'Pump' failure
 - Arrhythmia
 - Congenital heart disease
 - Decreased contractility acquired in shock of any cause
 - Myocardopathy
 - Myocarditis
 - Anomalous coronary artery
 - Cardiac contusion
 - Glycogen storage disease
- 'Distributive' causes of shock (global loss of vasomotor control)
 - Anaphylaxis
 - Spinal cord injury
 - Bacterial sepsis (most common)
 - Bacterial meningitis
 - Meningococcal sepsis
 - Streptococcal sepsis
 - Septic focus / abscess (eg, joint, abdomen, lung, brain)
 - Urinary tract sepsis
 - Fungal sepsis
 - Candida albicans
 - Viral sepsis
 - Herpes simplex virus

- Different age groups require special consideration
 - Infants
 - Recognising the symptoms of shock in an infant can be difficult as the symptoms may be non-specific
 - A high index of suspicion and a broad differential diagnosis should be considered for infants aged < 6 weeks presenting with symptoms / signs suggestive of shock / critical illness
 - Toddlers
 - Poisoning
 - Ingestion of medications
 - Inhalation and swallowing of foreign bodies
 - Trauma resulting from falls
 - Playground and household accidents
 - Child maltreatment (see [Child maltreatment: when to suspect maltreatment in under 18s \[NICE clinical guideline 89\]](#))
 - Adolescents
 - May not be forthright in volunteering an accurate history, and risk-taking behaviour of the teen years should be taken into consideration
 - [Poisoning](#) after attempted suicide or experimentation with drugs and alcohol may not be reported
 - Antipsychotic medications can cause cardiovascular collapse and arrhythmias
 - Ingestion of antihypertensive agents and opiates in the home should be considered

Investigations

Evaluation should progress only after the 'Airway, Breathing, Circulation, Disability, Exposure' (ABCDE) approach of resuscitation has been assessed

To be undertaken by non-specialist practitioners (eg, General Practitioner (GP) Team):

- Arrange emergency transfer of children and young people with suspected shock to secondary care.

To be undertaken by specialist practitioners (eg, Paediatric / Paediatric Emergency Department Team(s)):

- Plasma sodium, potassium, urea, creatinine, and glucose concentrations
- Venous blood acid–base status and lactate concentration
- Full blood count
- C-reactive protein (CRP)
- Coagulation screen
- Blood culture

- Further investigations can be guided based on background and presentation

Treatment Approach

To be undertaken by non-specialist practitioners (eg, GP Team):

- Arrange emergency transfer of children and young people with suspected shock to hospital and support with an ABCDE approach in the meantime if trained to do so
- Initial treatment of underlying cause may be possible (but do not delay urgent transfer to hospital), for example:
 - Anaphylaxis
 - Remove allergen, administer intramuscular adrenaline according to Resuscitation Council (UK) guidelines
 - See Anaphylaxis and Emergency treatment of anaphylactic reactions: Guidelines for healthcare providers [[Resuscitation Council \(UK\) guidelines](#)]
 - Give parenteral antibiotics (intramuscular or intravenous benzylpenicillin or ceftriaxone) at the earliest opportunity if meningococcal disease is suspected
 - See [Meningitis \(Bacterial\) and Meningococcal Septicaemia](#) and Bacterial meningitis and meningococcal septicaemia in under 16s overview [[NICE pathway](#)]

To be undertaken by specialist practitioners (eg, Paediatric / Paediatric Emergency Department / Paediatric Intensive Care Team(s)):

- Attend to 'Airway, Breathing, Circulation, Disability, Exposure' (ABCDE) approach of resuscitation, including administration of 100% oxygen
- Establish venous access within 5 minutes of recognition of shock
 - An intraosseous device or peripheral intravenous device suffices for this purpose; central access is not part of the first response
- Treat with a rapid intravenous infusion of 20 mL/kg of 0.9% sodium chloride solution (see Intravenous fluid therapy in children and young people in hospital [[NICE guideline NG29](#)])
- If a child remains shocked after the first rapid intravenous infusion:
 - Immediately give another rapid intravenous infusion of 20 mL/kg of 0.9% sodium chloride solution **and**
 - Call urgently for anaesthetic assistance **and** (consider):
 - Placement of a central venous catheter
 - Further intravascular fluids and inotropic support

Specific Treatment

- Septic shock (see [Meningitis \(Bacterial\) and Meningococcal Septicaemia and Bacterial meningitis and meningococcal septicaemia in under 16s overview](#) [[NICE pathway](#)])

- Initial management as described above
- Intravenous (IV) antibiotics (3rd generation cephalosporin, such as ceftriaxone / cefotaxime + / - amoxicillin for under 3 months)
- Urgent advice from a Paediatric Intensivist should be sought for children and young people with shock that is unresponsive to vasoactive agents. Do not use corticosteroids without PICU intensivist advice.
- Anaphylaxis
 - Remove allergen, administer intramuscular adrenaline/epinephrine (see Anaphylaxis)
 - See Emergency treatment of anaphylactic reactions: Guidelines for healthcare providers [[Resuscitation Council \(UK\) guidelines](#)]

When to Refer

Refer (arrange emergency transport) to specialist practitioners (eg, Paediatric / Paediatric Emergency Department / Paediatric Intensive Care Team(s)) if shock of any cause in a child is suspected.

Consult and escalate care to tertiary Paediatric Intensive Care / Regional Paediatric Critical Care transport service if:

- There is no response to > 40 mL/kg intravenous fluid resuscitation (do not stop administering further fluid resuscitation while speaking to tertiary services)
- Requirement for inotropic support
- If the child has required > 60 mL/kg intravenous fluid administration in the first 4 hours, whether clinically stable or not
- These children require diagnostic evaluation for cardiac function and will require:
 - Central venous access
 - Echocardiography
 - Monitoring of mixed venous oxygen saturation

‘Safety Netting’ Advice

See Does your child have a serious illness? [[the NHS website](#)]

- Advise parent(s) / carer(s) to seek urgent medical advice if:
 - Any ‘red flag’ signs and symptoms develop
- Advise parent(s) / carer(s) to call ambulance if their child:
 - Has difficulty breathing
 - Fast breathing
 - Grunting while breathing
 - Working hard to breathe (eg, sucking the stomach in under the ribs)
 - Is unconscious / will not wake up or seems unaware of what is happening
 - Has a first seizure, even if he / she appears to recover

Patient / Carer Information

****Please note: whilst these resources have been developed to a high standard they may not be specific to children.***

- [Dealing with an allergic reaction](#) (Web page), Patient
- [Dealing with shock](#) (Web page), Patient
- [Does your child have a serious illness?](#) (Web page), the NHS website
- [Septic shock](#) (Web page), the NHS website
- [Sepsis](#) (Web page), Patient
- [Anaphylaxis](#) (Web page), the NHS website

Resources

National Clinical Guidance

[Diarrhoea and vomiting caused by gastroenteritis in under 5s: diagnosis and management](#) (Web page), NICE clinical guideline CG84, National Institute for Health and Care Excellence

[Meningitis \(bacterial\) and meningococcal septicaemia in under 16s: recognition, diagnosis and management](#) (Web page), NICE clinical guideline 102, National Institute for Health and Care Excellence

[Bacterial meningitis and meningococcal septicaemia in under 16s overview](#) (Web page), NICE pathway, National Institute for Health and Care Excellence

[Emergency treatment of anaphylactic reactions: Guidelines for healthcare providers](#), Resuscitation Council (UK)

Medical Decision Support

[Child Protection Companion](#) (Web page), Royal College of Paediatrics and Child Health 2013

Suggested Resources

****Please note: these resources include links to external websites. These resources may not have national accreditation and therefore PCO UK cannot guarantee the accuracy of the content.***

[Gastroenteritis](#) (Web page), NICE clinical knowledge summary, National Institute for Health and Care Excellence

[Burns and scalds](#) (Web page), NICE clinical knowledge summary, National Institute for Health and Care Excellence

[What is sepsis?](#) (Web page), Sepsis Trust

Acknowledgements

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Update information

Created: 2015

Date last updated: 2019

Next review due: 2022