

INTRODUCTION

Recognising the signs and symptoms of serious illness in a child is much more important than seeking a diagnosis.

The most important skill in managing paediatric emergencies is patient assessment. Good assessment allows the child with actual or potential life-threatening illness or injury to be rapidly identified and managed.

Early recognition and management of developing respiratory distress, circulatory impairment or decreased level of consciousness will alert the Ambulance Clinician to the need for transferring the child rapidly to hospital for further urgent assessment and treatment.

Adults often suffer sudden cardiac arrest while fairly well perfused and in a relatively normal metabolic state, because the heart suddenly stops with an arrhythmia. A child, in contrast, is much more likely to have a cardiac arrest because of hypoxia, the heart eventually stopping because of the severity of the hypoxia and acidosis. In this situation a child is much less likely to respond to resuscitation as the body is already so metabolically abnormal. **Thus if a child is to have a good chance of survival, it is essential that their illness is recognised long before cardiac arrest occurs.**

Recognition of the seriously ill or injured child involves the identification of a number of key signs affecting the child's airway, breathing, circulatory or neurological systems. **If these signs are present, the child must be regarded as time critical.**

ASSESSMENT

Primary Assessment

Airway – Assessment of the Airway

Check the airway for obstruction, foreign material or vomit.

Position the head to open the airway

The younger the child the less head extension will be required. A newborn will require the head to be in the neutral position and a small child will “sniff the morning air”. If trauma is suspected, a jaw thrust should be used.

Abnormal upper airway sounds should be sought:

- inspiratory noises (**stridor**) indicate airway obstruction near the larynx
- a snoring noise (**stertor**) may be present when there is obstruction in the pharynx – e.g. massive tonsils.

Breathing – Assessment and Recognition of Potential Respiratory Impairment

Measure the respiratory rate

Rapid breathing rate (tachypnoea) in a child at rest indicates that increased ventilation is due to:

- airway problems
- lung problems
- circulatory problems
- metabolic problems.

Table 1 – Normal Respiratory Rate

Age	Respiratory Rate
<1 year	30 – 40 breaths per minute
1–2 years	25 – 35 breaths per minute
2–5 years	25 – 30 breaths per minute
5–11 years	20 – 25 breaths per minute

Recession (indrawing, retraction)

Children have pliable rib cages so when respiratory effort is high, indrawing is seen between the ribs (intercostal recession) and along the costal margins where the diaphragm attaches (subcostal recession). In tiny babies even the sternum itself may be drawn in (sternal recession) – as children get older, the rib cage becomes less pliable and signs of accessory muscle use (see below) will be seen. Recession in older children may suggest that there is severe respiratory difficulty.

Accessory Muscle Use

As in adult life, the sternomastoid muscle may be used as an accessory respiratory muscle when the work of breathing is increased. In infants this may cause the head to bob up and down with each breath.

Flaring of the Nostrils

This is a subtle sign that is easily missed. It indicates significant respiratory distress.

Inspiratory or Expiratory Noises

Wheezing indicates **lower** airway narrowing and is most commonly heard on expiration. The **volume** of stridor or wheezing is **NOT** an indicator of severity and indeed may diminish with increasing distress because less air is being moved.

Inspiratory noises (stridor) can indicate an imminent danger to the airway due to reduction in airway circumference to approximately 10% of normal.¹

Grunting is produced by exhalation against a partially closed laryngeal opening (glottis). This is a sign of severe respiratory distress and is characteristically seen in infants.

Effectiveness of Breathing – chest expansion and breath sounds.

Note the degree of chest expansion on both sides of the chest and whether it is equal.

Auscultate the chest with a stethoscope.

A silent chest is a pre-terminal sign, as it indicates that very little air is going in or out of the chest.

Pulse oximetry

This can be used at all ages to measure oxygen saturation (readings are less reliable in the presence of shock, hypothermia and some other conditions such as carbon monoxide poisoning and severe anaemia).

Table 2 – The effects of respiratory inadequacy on other systems.

Heart Rate	<ul style="list-style-type: none"> • Tachycardia or eventually bradycardia may result from hypoxia and acidosis. • Bradycardia in a sick child is a pre-terminal sign.
Skin Colour	<ul style="list-style-type: none"> • Flushed skin may be noted due to increased respiratory effort in early stages. • Skin pallor may be due to vasoconstriction due to hypoxia. • Cyanosis is pre-terminal sign of hypoxia.

Mental Status

- The hypoxic child will be agitated, drowsy.
- Drowsiness gradually increases and eventually leads to unconsciousness. Agitation may be difficult to identify due to the child's distress. Parents may be helpful in making this assessment.

Circulation – Recognition of Potential Circulatory Failure (Shock)

Assessment of the circulation may be very difficult in children as each physical sign may have a number of confounding variables. It is important to make an assessment of all the signs below and take each into account when assessing whether a child is shocked.

Heart Rate:

- **tachycardia** may result from circulatory volume loss. The rate, particularly in infants, can be very high (up to 220 beats per minute)
- **bradycardia** will be apparent before cardiac arrest (*see above*).

Table 2 – Normal Heart Rate

Age	Heart Rate
<1 year	110 – 160 beats per minute
1–2 years	100 – 150 beats per minute
2–5 years	95 – 140 beats per minute
5–11 years	80 – 120 beats per minute

Pulse Volume:

- peripheral pulses will become weak then absent with advancing shock
- children shut down their circulation segmentally, and increasing shock will result in cool /cold skin, initially distally and becoming more proximal as shock advances
- there is no validated relationship between the presence of certain peripheral pulses and the systemic blood pressure in children.

Capillary Refill:

- this should be measured on the forehead, sole of the foot or sternum
- a capillary refill time of >2 seconds indicates poor perfusion, although this may be influenced by a number of factors, particularly cold.

Blood pressure:

- should not routinely be measured in pre-hospital care as it is complex to undertake correctly and may delay on scene time
- varies with age
- it drops very late in shock in children and thus other signs of circulatory inadequacy will be present long before hypotension occurs
- hypotension is a pre-terminal sign.

Table 3 – The effects of circulatory inadequacy on other systems

Respiratory Rate	<ul style="list-style-type: none"> • A rapid respiratory rate but without recession, may be due to circulatory insufficiency leading to poor tissue perfusion which results in acidosis. • Tachypnoea is due to the body trying to correct the metabolic abnormality.
Skin	<ul style="list-style-type: none"> • Mottled, cold, pale skin indicates poor perfusion.
Mental Status	<ul style="list-style-type: none"> • Initially, in shock, the child will become agitated and, as it progresses, drowsy. The child may ultimately become unconscious as a result of poor cerebral perfusion.

Disability – Recognition of Potential Central Neurological Failure

Level of Consciousness/ Alertness

- A** Alert
- V** Responds to voice
- P** Responds to painful stimulus
- U** Unresponsive

Response to a painful stimulus:

Pinch a digit or pull frontal hair; a child who is unconscious or who only responds to pain has a significant degree of coma (*refer to Glasgow Coma Scale – Appendix 1*).

Posture:

Observe the child's posture; children may be:

- **floppy (hypotonic)** – any child with new onset of floppiness must be assumed to be seriously ill until proven otherwise
- **stiff (hypertonic) or back arching (opisthotonic)** – new onset stiffness must be regarded as a sign of severe cerebral upset
- **decerebrate or decorticate posturing** – indicates serious cerebral abnormality.

Pupils:

- pupil size and reaction must be tested
- pupils should be equal and of a normal size and react briskly to light
- any abnormality or change in the pupil size or reaction may be significant.

Table 4 – The effects of central neurological impairment on other systems.

Respiratory System	<ul style="list-style-type: none"> • An abnormal respiratory pattern (hyperventilation, Cheyne-Stokes breathing or apnoea) may indicate cerebral malfunction.
Circulatory System	<ul style="list-style-type: none"> • Bradycardia may be due to dangerously raised intracranial pressure • Blood glucose level in any seriously ill child.

NOTE: the whole assessment should take less than two minutes unless intervention is required.

Frequent re-assessment of ABCD's is necessary to assess the response to treatment or to detect deterioration.

MANAGEMENT

INTRODUCTION

Any child believed to have a serious problem involving:

- Airway
- Breathing
- Circulation
- Disability

must be considered to have a **TIME CRITICAL** condition and receive immediate management of airway, breathing and circulation, and be rapidly transferred to an appropriate receiving hospital with a suitable pre-alert message.

Remember: **A** and **B** problems should be corrected on scene and **C** problems managed en-route to further care.

AIRWAY MANAGEMENT

- the child's airway should be managed in a stepwise manner
- if epiglottitis is possible then extreme caution must be exercised.

Manual manoeuvres, chin lift/extension, or jaw thrust in cases of trauma:

- it is important not to place pressure on the soft tissues under the chin and in front of the neck, as this may obstruct the airway.

Aspiration, removal of any foreign body:

- finger sweeps should be avoided as they may push material further down the airway or damage the soft palate
- paediatric suction catheters should be used where available.

Oropharyngeal airway (OPA):

- ensure the OPA is of the appropriate size and inserted using the correct technique. Discontinue insertion or remove if the child gags (*refer to paediatric resuscitation charts*)

Nasopharyngeal airway:

- correct sizing is essential
- care should be taken not to cause trauma to the tonsillar/adenoidal tissue in small children, a smaller size may be required.

Endotracheal intubation:

- the hazards associated with intubation in children are considerable and the disadvantages usually outweigh the advantages. It should **ONLY** be attempted where other more basic methods of ventilation have failed (*refer to paediatric resuscitation charts for ET sizes*).

Needle cricothyroidotomy:

- surgical airways should not be performed in children under 12 years of age
- needle cricothyroidotomy is a method of last resort
- the initial oxygen (O₂) flow rate in litres per minute should be set equal to the child's age in years and gradually increased until the chest wall moves adequately.

Refer to foreign body airway obstruction in children guideline.

BREATHING MANAGEMENT

Ensure adequate oxygenation:

- adequate oxygenation is essential to all very sick children; administer high concentration oxygen (O₂) (*refer to oxygen protocol for administration and information*) via a non-re-breathing mask, using the stoma in laryngectomee and other neck breathing patients to maintain an oxygen saturation of 95%
- high concentration O₂ should be administered routinely, whatever the oxygen saturation, in children with sickle cell disease or a history of cardiac disease
- if the child is distressed by the presence of a mask, ask the parent to help by holding the mask as close to the face as possible. If this still produces distress, wafting O₂ across the face directly from the tubing (with the facemask detached from the tubing) is better than nothing
- consider assisted ventilation at a rate equivalent to the normal respiratory rate for the age of the child (*refer to paediatric resuscitation charts for normal values*) if:
 - the child is hypoxic (SpO₂ is <90%) and remains so after 30-60 seconds on high concentration O₂
 - respiratory rate is <half normal or >three times normal
 - expansion is inadequate.

- ensure a good mask seal with an appropriate size mask. Avoid hyperventilation to reduce the risk of gastric insufflation or causing barotrauma. The bag-valve-mask should have a pressure release valve as an added safety measure. If this is not available **extreme** care must be taken not to cause over expansion of the lungs. No bag smaller than 500ml volume should be used for bag valve mask ventilation unless the child is less than 2.5kg (preterm baby size).

Wheezing

The management of asthma is discussed elsewhere (*refer to asthma in children guideline*)

CIRCULATION MANAGEMENT

Arrest external haemorrhage

NOTE: Do not waste time on the scene attempting to gain intravenous (IV) or intraosseous (IO) access. This should be done en-route unless delay is unavoidable e.g. entrapment.

Cannulation:

Attempt cannulation with the widest bore cannula that can be confidently placed. The vehicle can be stopped briefly to allow for venipuncture and disposal of the sharp with transport being recommenced before the IV dressing is applied. The intraosseous route may be required where venous access has failed on two occasions or no suitable vein is apparent within a reasonable timeframe. The intraosseous route is the preferred route for vascular access in all cases of cardiac arrest in young children.

Blood glucose level should be measured in all children in whom vascular access is being obtained and must be measured in children with decreased conscious level (*refer to decreased level of consciousness guideline*).

Fluid administration

Fluids should be:

- 0.9% saline or Hartmann's solution when treating shock
- where possible warmed
- measured in millilitres and documented as volume administered, not the volume of fluid chosen
- generally administered as boluses rather than "run in".

Handover at the receiving unit must include details of volume and type of fluid administered.

Fluid volumes

Central pulse **ABSENT**, radial pulse **ABSENT** is an absolute indication for urgent fluid.

Central pulse **PRESENT**, radial pulse **ABSENT** is an indication for urgent fluid depending on other indications including tissue perfusion and blood loss.

Central pulse **PRESENT**, radial pulse **PRESENT – DO NOT** commence fluid replacement² **UNLESS** there are other signs of circulatory failure (cold peripheries, delayed capillary refill time, mottled skin, weak thready pulse) then commence 20ml/kg bolus of crystalloid.

- 20ml/kg should be given as a bolus to restore vital signs to normal
- no more than three boluses should be given except on medical advice.

Exceptions:

- in diabetic hyperglycaemia special caution is required (*refer to glycaemic emergencies in children*)
- if evidence of heart failure or renal failure give bolus of 10ml/kg and stop if patient deteriorates. Transfer to hospital as a priority
- in hypoglycaemia fluid should be withheld unless life threatening shock is present when 10ml/kg should be administered over 10-15 minutes (*refer to glycaemic emergencies in children guideline*)
- if there are exceptional circumstances, e.g. long transfer time, on-line advice should be obtained.

DISABILITY MANAGEMENT

The aim of management of any child with a cerebral insult is to minimise further insult by optimising their circumstances.

"Treat the treatable"; apart from the above, in pre-hospital care this generally means management designed to:

- prevent hypoxia (*see above*)
- normalise circulation (but do not overload)
- check for and treat hypoglycaemia (*refer to glycaemic emergencies in children guideline*).

Other conditions which can be treated before hospital and are discussed elsewhere include:

- convulsions (*refer to convulsions in children guideline*)
- opiate poisoning (*refer to naloxone protocol for dosages and information*)
- meningococcal septicaemia (*refer to meningococcal septicaemia in children guideline*).

SUMMARY

Primary assessment of the child will determine **whether the child is time critical or not**.

Immediate correction of A and B problems must be undertaken without delay at the scene. C problems can be corrected en-route to hospital.

Children who are found to be seriously ill must be considered **TIME CRITICAL and MUST BE taken to the nearest suitable receiving hospital without delay**.

A Hospital Alert Message should be given whenever a seriously ill child is transported.

NOTE: paediatric drug doses are expressed as mg/kg, (*refer to specific drug protocols for dosages and information*). These protocols **MUST** be checked prior to **ANY** drug administration, no matter how confident the practitioner may be.

ADDITIONAL INFORMATION

Remember that the patient history may give you valuable insight into the cause of the current condition. The following may be of great help in your diagnosis:

- relatives, carers or friends with knowledge of the child's history
- packets or containers of medication or evidence of administration devices (e.g. inhalers, spacers etc.)
- medic alert type jewellery (bracelets or necklets) which detail the child's primary health risk (e.g. diabetes, anaphylaxis etc) but also list a 24 hour telephone number to obtain a more detailed patient history
- also *refer to safeguarding children guideline*.

Key Points – Medical Emergencies in Children

- The patient history may give you valuable insight into the cause of the current condition.
- The airway can usually be controlled without the need for intubation.
- Hypoxia and hypovolaemia need urgent correction in the seriously ill child.
- Always check the blood glucose in seriously ill children or those with a decreased level of consciousness.
- A and B should be corrected on scene and C problems managed en-route to further care.

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METHODOLOGY

Refer to methodology section.

APPENDIX 1 – Glasgow Coma Scale and modified Glasgow Coma Scale.

GLASGOW COMA SCALE	
Item	Score
Eyes Opening:	
Spontaneously	4
To speech	3
To pain	2
None	1
Motor Response:	
Obeys commands	6
Localises pain	5
Withdraws from pain	4
Abnormal flexion	3
Extensor response	2
No response to pain	1
Verbal Response:	
Orientated	5
Confused	4
Inappropriate words	3
Incomprehensible sounds	2
No verbal response	1

MODIFICATION OF GLASGOW COMA SCALE FOR CHILDREN UNDER <4 YEARS OLD	
Item	Score
Eyes opening:	as per adult Scale
Motor response:	as per adult Scale
Best verbal response:	
appropriate words or social smiles, fixes on and follows objects	5
cries, but is consolable	4
persistent irritable	3
restless, agitated	2
Silent	1