1.11 Structured approach to managing emergencies in pregnancy and childhood

Approach to emergencies

Training

Members of the clinical team must know their roles. They will ideally have trained together in:

- clinical situations and their diagnoses and treatments
- drugs and their use, administration and side effects
- emergency equipment and how it functions.

The ability of a facility to deal with emergencies should be assessed and reinforced by the frequent practice of emergency drills.

Initial management

- Stay calm.
- Do not leave the patient unattended.
- Have a team leader in charge to avoid confusion.
- Shout for help. Ask one person to go for help and another to get emergency equipment and supplies (e.g. oxygen cylinder and emergency kit). Ideally resuscitation equipment and drugs should be available on one dedicated trolley.
- Assess and resuscitate in sequence using the structured approach – Airway, Breathing, Circulation, Disability (Neurological Status) (see below).
- If the patient is conscious, ask what happened and what symptoms they have.
- Constantly reassess the patient, particularly after any intervention.

Structured approach to any pregnant woman, infant or child presenting as an emergency

Approach emergencies using the structured ABCD (Airway, Breathing, Circulation, Disability) approach, which ensures that all patients with a life-threatening or potentially life-threatening problem are identified and managed in an effective and efficient way whatever their diagnosis or pathology.

The structured approach to the seriously ill patient, which is outlined here, allows the health worker to focus on the appropriate level of diagnosis and treatment during the first hours of care. Primary assessment and resuscitation are concerned with the maintenance of vital functions and the administration of life-saving treatments, whereas secondary assessment and emergency treatment allow more specific urgent therapies to be started.

Secondary assessment and emergency care require a system-by-system approach in order to minimise the risk of significant conditions being missed.

Following cardiac and/or respiratory arrest, the outcome both for pregnant women and for children is poor. Earlier recognition and management of potential respiratory, circulatory or central neurological failure which may progress rapidly to cardiac and/or respiratory arrest will reduce mortality and secondary morbidity. The following section outlines the physical signs that should be used for the rapid primary assessment, resuscitation, secondary assessment and emergency treatment of pregnant women, and of babies and children.

Primary assessment and resuscitation involves sequential assessment and resuscitation of vital functions – Airway, Breathing and Circulation.

If there are no life-threatening signs, the primary assessment can be completed within about 1 minute. If life-threatening signs are identified, resuscitation procedures are required.

If you are working on your own and have been unable to summon help, you must resuscitate Airway before Breathing, and Breathing before Circulation. This is because oxygen cannot be carried around in the blood to the vital organs if the blood is not oxygenated first, and the lungs cannot oxygenate the blood if there is no airway to allow air containing oxygen to enter the lungs.

If assistance is available, one person can deal with Airway, another with Breathing and a third with Circulation, all working simultaneously, but there must be a ‘team leader’ to take overall control.

During resuscitation, interventions that are either life-saving or designed to prevent the patient reaching a near-death situation are performed (see below). These include such procedures as basic airway opening procedures, suction, oropharyngeal airway insertion, intubation, assisted ventilation, venous cannulation and fluid resuscitation (when safe and appropriate). At the same time, oxygen is provided to all patients with life-threatening Airway, Breathing or Circulatory problems, vital signs are recorded, and essential monitoring is established.

This sequential primary assessment and any necessary resuscitation occur before any illness-specific diagnostic assessment or treatment takes place. Once the patient’s vital functions are working safely, secondary assessment and emergency treatment can begin.

After each intervention, its effects should be tested by reassessment. Regular reassessments are a key component of the structured approach.

During secondary assessment, illness-specific pathophysiology is sought and emergency treatments are instituted. Before embarking on this phase, it is important that the resuscitative measures are fully under way. During the secondary assessment, vital signs should be checked frequently to detect any change in the patient’s condition. If there is deterioration, primary assessment and resuscitation should be repeated in the “Airway, Breathing, Circulation” sequence.

Primary assessment and resuscitation

Assessment and resuscitation occur at the same time. The order of assessment and resuscitation enables identification of immediately life-threatening problems, which are treated as they are found.
A rapid examination of vital ABC functions is required. If at any stage a life-threatening A, B, or C problem is identified: CALL FOR HELP.

After ABC, always assess for neurological problems, and resuscitate their components (sometimes referred to as “D” for disability of the ABC approach).

Primary assessment and resuscitation of airway
The first priority is establishment or maintenance of airway opening. If there is a need for resuscitation in a patient who is bleeding (e.g. in cases of massive postpartum haemorrhage or trauma), try to stop this at the same time as you are opening the airway.

PRIMARY ASSESSMENT
LOOK – for chest or abdominal movement.
LISTEN – for breath sounds.
FEEL – for breath.
Talk to the patient.
A patient who can speak or cry has a clear airway.

Be alert for foreign bodies (see Section 1.12 on choking).

Airway obstruction is most commonly due to obstruction by the tongue in an unconscious patient.

Resuscitation
Open the airway and keep it open.

If there is no evidence of air movement, open the airway using the following:
● a head tilt, chin lift or jaw thrust manoeuvre (see Section 1.12 on basic life support). If this opens the airway and breathing starts, keep the airway open manually until it can be secured. Be careful when using head tilt if the cervical spine is at risk, but opening the airway is always the priority
● suction/removal of blood, vomit or a foreign body.

If there is no improvement after adjusting the airway manually and trying different techniques, place an oropharyngeal airway, which may be helpful if the patient is unconscious and has no gag reflex. Avoid using a nasopharyngeal airway if there is any suspicion of base of skull injury.

If the airway is still obstructed, a definitive airway by intubation or surgical airway may be needed.

Give oxygen to all patients.

Be careful not to distress young children with partial upper airway obstruction due to infections such as epiglottitis and severe croup, as this may precipitate acute worsening of their airway obstruction. Having a parent or other known adult present will help to keep the child calm.

Identify the ‘at-risk’ airway
Reassess the airway after any airway-opening manoeuvres. If there continues to be no evidence of air movement, then airway opening can be assessed by performing an airway-opening manoeuvre while giving rescue breaths. Proceed to Breathing (see below).

Advanced airway management
Advanced airway management techniques for securing the airway by intubation may be required in patients with any of the following:
● persistent airway obstruction
● altered level of consciousness, with failure to protect the airway, especially from vomiting
● facial trauma, including burns, penetrating neck trauma with expanding haematoma, and severe head injury (see Section 7).

This should be performed by skilled professionals such as an anaesthetist (if available) (see Section 1.24 for details). The following sequence should be followed:
1 pre-oxygenation with 100% oxygen with manual lung inflation if required
2 administration of a carefully judged, reduced dose of an anaesthetic induction agent
3 application of cricoid pressure
4 suxamethonium 1–2 mg/kg
5 intubation with a correctly sized tracheal tube.

Confirmation of correct placement of the tube
Signs such as chest movement and auscultation remain helpful, but are occasionally misleading, especially in inexperienced hands. The most important point is to see the tube pass through the vocal cords. The correct size is a tube that can be placed easily through the cords with only a small leak. Intubation of the right main bronchus is best avoided by carefully placing the tube only 2–3 cm below the cords and noting the length at the teeth before checking by auscultation (best in the left and right lower axillae). Capnography, if available, is a useful adjunct for helping to confirm correct tube placement.

If it is not possible to provide an airway using intubation, a surgical airway may be required.

NOTE: It is extremely risky to proceed to Circulation (and IV/IO cannulation) when partial upper airway obstruction is present in young children (e.g. due to epiglottitis, severe croup or a foreign body), as invasive procedures can precipitate complete airway closure. Stabilise the airway first. This will require help from an anaesthetist.

Emergency treatment situations
1 For severe croup, nebulised adrenaline can be helpful (5 mL of 1 in 1000). Always give oral steroid as soon as possible (150 micrograms/kg of dexamethasone or 1 mg/kg of prednisolone).
2 For upper airway obstruction due to anaphylaxis, nebulised adrenaline (5 mL of 1 in 1000) and IM adrenaline (1 mg IM in pregnancy and 10 micrograms/kg in children).
3 Inhaled foreign body (see Section 1.12).
4 For severe bronchiolitis, clear the nasal airways by using gentle suction.
If the patient has major trauma or postpartum haemorrhage and is obviously bleeding rapidly, to the point of exsanguination (see Section 7.3.A), measures to stop the exsanguination must be instituted at the same time as Airway resuscitation.

Throughout primary assessment and resuscitation, protect the cervical spine with a collar, sand bags and tape if the patient is likely to have an unstable cervical spine and if subsequent surgical stabilisation is possible (see Section 7.3.A.).

**Primary assessment and resuscitation of breathing**

An open airway does not guarantee adequate ventilation. The latter requires an intact respiratory centre and adequate pulmonary function augmented by coordinated movement of the diaphragm and chest wall.

**Primary assessment**

Assess whether breathing is adequate by:

- assessing **effort**:
  - recession
  - rate
  - added noises
  - accessory muscles
  - alar flaring
- assessing **efficacy**:
  - listening for reduced or absent **breath sounds**, or any wheezing, with a stethoscope or ear on chest wall
  - chest and/or abdominal expansion (symmetrical or asymmetrical)
  - abdominal excision
  - SaO₂, if available
- assessing effects on **heart rate**
- assessing effects on **skin colour** (check the possibility of cyanosis)
- assessing effects on **mental status**.

**Evidence of life-threatening respiratory difficulty**

This includes the following:

1. absence of breathing (apnoea)
2. very high or very low respiratory rates
3. gasping, which is a sign of severe hypoxaemia, and may indicate impending respiratory arrest and death
4. severe chest wall recession, usually with increased respiratory rate, but pre-terminally with a fall in rate
5. severe hypoxaemia (cyanosis)
6. signs of tension pneumothorax (respiratory distress with hyper-resonant percussion) (see Section 7.3.A)
7. major trauma to the chest (e.g. tension pneumothorax, haemothorax, flail chest) (see Section 7.3.A)
8. signs of severe asthma (severe respiratory distress with wheezing, but a silent chest in severe asthma can be a near-fatal situation).

**Evidence of respiratory difficulty which can progress if not treated**

This includes the following:

1. increased respiratory rate
2. inspiratory stridor
3. reduced or absent breath sounds on auscultation
4. expiratory wheezing
5. chest expansion (most important), and reduced abdominal excursion
6. pulse oximetry showing oxygen saturation (SaO₂) of less than 94% (normal SaO₂ in a patient at sea level is 94–100% in air).

**Fast breathing** is caused by either an airway problem, lung disease or metabolic acidosis.

**TABLE 1.11.1 Respiratory rate ‘at rest’ for different age groups**

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Respiratory rate (breaths/minute)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 1</td>
<td>30–40</td>
</tr>
<tr>
<td>1–2</td>
<td>25–35</td>
</tr>
<tr>
<td>2–5</td>
<td>25–30</td>
</tr>
<tr>
<td>5–12</td>
<td>20–25</td>
</tr>
<tr>
<td>&gt; 12</td>
<td>15–20</td>
</tr>
<tr>
<td>In pregnancy</td>
<td>15–20*</td>
</tr>
</tbody>
</table>

* In pregnancy, respiratory rate does not change although tidal volume increases resulting in approximately 50% increase in minute ventilation.

The WHO suggests a breathing rate of 30 per minute or more in pregnancy as evidence of shock.

Care should be taken when interpreting single measurements. Infants can show rates of between 30 and 90 breaths/minute depending on their state of activity. It is more useful to use trends in measurements as an indicator of improvement or deterioration.

**WHO definitions of fast breathing in young children are as follows:**

- < 2 months: ≥ 60 breaths/minute
- 2–12 months: ≥ 50 breaths/minute
- 12 months to 5 years: ≥ 40 breaths/minute

Slow breathing rates may result from fatigue or raised intracranial pressure, or may immediately precede a respiratory arrest due to severe hypoxaemia.

**Other signs of breathing difficulty**

- Intercostal, subcostal or sternal recession reflects increased effort of breathing, which is seen in particular in infants, who have more compliant chest walls.
- The degree of recession indicates the severity of respiratory difficulty.
- In the patient with exhaustion, chest movement and recession will decrease.

**Inspiratory or expiratory noises**

- Stridor, usually inspiratory, indicates laryngeal or tracheal obstruction.
- Wheeze, predominantly expiratory, indicates lower airway obstruction.
- Volume of noise is not an indicator of severity.

**Grunting**

- This is observed in infants and children with stiff lungs to prevent airway collapse (it represents the noise made by closure of the larynx during expiration, which is the body’s attempt to increase lung volume).
- It is a sign of severe respiratory distress.
Accessory muscle use
- In infants, the use of the sternocleidomastoid muscle creates ‘head bobbing’ and does not help ventilation.
- Flaring of the alae nasi is also seen in infants with respiratory distress.

Exceptions
Increased effort of breathing does not occur in three circumstances:
1. exhaustion
2. central respiratory depression (e.g. from raised intracranial pressure, poisoning or encephalopathy)
3. neuromuscular disease (e.g. poliomyelitis).

Effects of breathing failure on other physiology
Heart rate: this is increased with hypoxia, but decreases when hypoxia is severe, when bradycardia is a sign of impending cardiorespiratory arrest.

Skin colour: hypoxia first causes vasoconstriction and pallor. Cyanosis is a late sign and may indicate impending cardiorespiratory arrest. In an anaemic patient it may never be seen, however hypoxic the patient is.

Mental status: hypoxia causes initial agitation, then drowsiness, followed by loss of consciousness.

Resuscitation of breathing
In the patient with absent or inadequate breathing, it is essential to breathe for the patient using:
- mouth-to-mouth or mouth-to-mouth-and-nose ventilation, or
- bag-valve-mask ventilation: if using oxygen, add a reservoir to increase the oxygen concentration.

Intubate (if skilled professionals are available) and provide assisted ventilation through the tube if long-term ventilation is needed or bag-mask ventilation is ineffective.

However, do not persist with intubation attempts without ventilating the patient intermittently with a bag and mask as necessary to prevent hypoxaemia during the intubation process.

Give high-flow oxygen to all patients with respiratory difficulty.

Give as much oxygen as possible through a mask with a reservoir bag to any patient who is breathing but has respiratory difficulty or the other signs of hypoxia (e.g. cyanosis).

Situations in which emergency treatment is given
1. Perform needle thoracocentesis if the diagnosis is tension pneumothorax (see Figure 8.3.1). This should be followed by a chest drain.
2. Consider inserting a chest drain if there is major trauma to the chest (see Figure 8.3.2).
3. Give nebulised salbutamol if the patient has severe, life-threatening asthma (2.5 mg for children < 5 years of age, or 5 mg for children > 5 years of age and pregnant mothers). If a nebuliser is not available, use a spacer and metered-dose inhaler (100 micrograms/puff; 10 puffs initially for all age groups).
4. Give nasal continuous positive airway pressure (CPAP) if a neonate has severe respiratory distress (see Section 8.3).
5. Give IM adrenaline (1 mg in pregnancy and 10 micrograms/kg in children) and nebulised salbutamol (see above) if wheezing is due to anaphylaxis.
6. Give anticoagulant (IV unfractionated heparin) if pulmonary embolus is diagnosed in pregnancy or post delivery (see Section 2.5.H).
7. Give calcium gluconate (10 mL 10% IV over 10 minutes) if respiratory arrest is due to magnesium toxicity in a patient treated for eclampsia with magnesium sulphate.

Primary assessment and resuscitation of circulation
Primary assessment
The circulatory system is more difficult to assess than airway and breathing, and individual measurements must not be over-interpreted.

If there is no palpable pulse, a very slow heart rate (< 60 beats/minute in an infant, or < 40 beats/minute in a child or pregnant woman) or no ‘signs of life’ (e.g. movements, coughing, normal breathing), cardiac arrest or near-cardiac arrest is likely, and basic life support must be started (see Section 1.12).

Agonal gasps (irregular, infrequent breaths) do not provide adequate oxygenation and are not for these purposes a ‘sign of life’.

In addition to cardiac arrest or near-arrest, shock and heart failure are additional life-threatening issues that it is important to identify.

Shock
The following clinical signs can help to identify shock (inadequate circulation) (see Sections 2.5.A and 5.5.A).

<table>
<thead>
<tr>
<th>TABLE 1.11.2</th>
<th>Heart rates ‘at rest’ at different ages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>Heart rate (beats/minute)</td>
</tr>
<tr>
<td>&lt; 1</td>
<td>110–160</td>
</tr>
<tr>
<td>1–2</td>
<td>100–150</td>
</tr>
<tr>
<td>2–5</td>
<td>95–140</td>
</tr>
<tr>
<td>5–12</td>
<td>80–120</td>
</tr>
<tr>
<td>&gt; 12</td>
<td>60–100</td>
</tr>
<tr>
<td>Pregnancy</td>
<td>70–115*</td>
</tr>
</tbody>
</table>

* The heart rate in pregnancy increases by 10–15 beats per minute.

Heart rate
- Heart rate increases in shock and heart failure.
- Severe bradycardia due to hypoxaemia may be a sign of near cardiorespiratory arrest.

The WHO definition of tachycardia is a heart rate of > 160 beats/min in children aged under 1 year, and > 120 beats/minute in those aged 1–5 years.

The WHO defines a heart rate in pregnancy of 110 beats per minute or more as evidence of shock.
Pulse volume
Absent peripheral pulses or reduced strength of central pulses may signify shock.

Capillary refill time (CRT)
- Pressure on the centre of the sternum or fingernail for 5 seconds should be followed by return of the circulation to the skin within 3 seconds or less. CRT may be prolonged by shock, cold environment, or the vasoconstriction that occurs as a fever develops.
- Prolonged CRT is not a specific or sensitive sign of shock, and should not be used alone as a guide to the need for or the response to treatment.

Blood pressure
- The cuff should cover at least 80% of the length of the upper arm, and the bladder should be more than two-thirds of the arm’s circumference. In pregnant mothers, the largest possible cuff should be used to avoid missing a raised blood pressure.
- Korotkoff phase 5 (K5, disappearance of sound) should be used to measure diastolic pressure. Korotkoff phase 5 (K5A, muffling or softening of sound) should only be used if the sound does not disappear until near to zero cuff pressure.
- In pregnancy the patient should ideally be sitting or lying in the lateral tilt positions when pressure is measured. In both of these positions, the cuff must be level with the heart.
- Hypotension is a late sign of circulatory failure in both children and pregnant mothers, and will be rapidly followed by cardiorespiratory arrest unless it is treated urgently.

The cardiovascular system in children and pregnant mothers compensates well initially in shock. Hypotension is a late and often sudden sign of decomposition and, if not reversed, will be rapidly followed by death. Serial measurements of blood pressure should be performed frequently.

Effects of circulatory failure on other organs
Respiratory system: tachypnoea and hyperventilation occur as a result of the acidosis caused by poor tissue perfusion.
- Skin: pale or mottled skin indicates poor perfusion.
- Mental status: circulatory failure causes initial agitation, then drowsiness, followed by unconsciousness.
- Urine output: a reduction in urine output to < 2 mL/kg/hour in infants, < 1 mL/kg/hour in children or < 30 mL/hour in pregnant mothers indicates inadequate renal perfusion.
In pregnancy: fetal compromise can be the first sign of shock in the mother.

The WHO definition of shock is cold hands, plus CRT of > 3 seconds, plus a weak and rapid pulse.

Life-threatening shock is usually associated with:
- severe tachycardia
- a weak-volume pulse (ideally assess centrally: brachial, femoral or carotid)
- low blood pressure (this is a late sign, and very difficult to measure in young children)
- extreme central pallor (if due to severe anaemia)
- raised respiratory rate (due to acidosis)
- poor skin circulation, with a CRT of > 3 seconds
- reduced conscious level.

Remember that anaphylaxis is one cause of shock, and typically there is a relevant history and other signs such as angio-oedema and urticaria.

Remember that if shock is due to heart failure, fluid overload will be fatal (for information on how to recognise and manage shock caused by heart failure, see Section 2.7.A).

Resuscitation in shock
For cardiac arrest or near arrest, chest compressions should be undertaken (for information on basic and advanced life support, see Sections 1.12 and 1.13).

Ensure that there is an open and secure airway. Give high-flow oxygen to any patient who has an inadequate circulation (whether due to shock or to heart failure). This should be administered via a face mask with a reservoir bag (or an endotracheal tube if intubation has been necessary).

Venous or intra-osseous access should be obtained and blood for essential tests taken (haemoglobin, cross-matching, blood clotting factors, and urea and electrolytes if possible).

Lateral tilt
In pregnancy and after 20 weeks’ gestation (whenever the uterus can be palpated abdominally), place the patient in the left lateral tilt position to prevent uterine pressure on the abdominal and pelvic veins stopping blood return to the heart.

In all patients with shock, lie them flat (or tilted) and elevate the legs.

Fluids in shock
In most cases of shock, if obvious bleeding is the cause then

| TABLE 1.11.3 Systolic and diastolic blood pressure in children |
|------------------|------------------|------------------|
| Age (years)      | Systolic blood pressure (mmHg) 5th centile | Systolic blood pressure (mmHg) 50th centile |
| < 1              | 65–75            | 80–90            |
| 1–2              | 70–75            | 85–95            |
| 2–5              | 70–80            | 85–100           |
| 5–12             | 80–90            | 90–110           |
| > 12             | 90–105           | 100–120          |

Blood pressure may be difficult to measure and interpret, especially in infants and children under 5 years of age. The following formula can be used to calculate average systolic blood pressure in children (50th centile):

\[ 85 + (2 \times \text{age in years}) \]

WHO defines normal adult BP as 120/80 mmHg. Blood pressure falls early in pregnancy due to a decrease in systemic vascular resistance. It is usually 10 mmHg below baseline and reaches a lowest mean value of 105/60 mmHg in the second trimester. During the third trimester it gradually returns to the pre-pregnancy level at term.

The normal systolic blood pressure in pregnancy is in the range 95–135 mmHg. The normal diastolic blood pressure is in the range 60–85 mmHg.

The WHO suggests a systolic BP of < 90 mmHg in pregnancy as evidence of shock. A systolic BP < 95 mmHg should prompt a search for other possible indicators of developing shock.
should be achieved in pregnant women or in children who are in shock due to haemorrhage. Adequate perfusion of vital organs may best be indicated by a radial pulse that can be palpated and a conscious level of A or V on the AVPU scale (i.e. the woman or child is either awake or will respond by opening their eyes when spoken to). During pregnancy, the adequacy of the fetal heart rate may also be helpful.

In children under 2–3 years of age, the radial pulse may be difficult to feel and the presence of a palpable brachial pulse may be the best available indicator at present.

In this situation, therefore, and to maintain a palpable radial pulse in pregnancy, start with IV boluses of 500 mL of crystalloid or ideally blood, and reassess after each bolus.

In children, in order to maintain a radial or brachial pulse give 10 mL/kg IV boluses of crystalloid or ideally blood, and reassess after each bolus.

In situations where there is brisk active blood loss and delay in obtaining blood or effective intervention to halt the bleeding, several boluses of crystalloids may be required. The importance of undertaking measures to halt the bleeding and obtaining blood for transfusion rapidly cannot be overstated.

If shock is due to septicaemia with purpura (meningo-coccus or dengue), give IV or IO boluses of Ringer-lactate or Hartmann’s solution as rapidly as possible, reassess, and then repeat if necessary. In cases of cholera, up to 60 mL/kg might be required in children, and 3 litres in pregnant mothers. Additional potassium will usually be required (see Section 5.12.A).

If shock is due to anaphylaxis, give adrenaline, 10 micrograms/kg (0.1 mL/kg of 1 in 10 000) IM in children, in order to maintain a radial or brachial pulse in pregnancy, start with IV boluses of 500 mL of crystalloid or ideally blood, and reassess after each bolus.

If shock is due to diabetic ketoacidosis, there will usually be evidence of severe dehydration and coma. Give 10 mL/kg of 0.9% saline (or Ringer-lactate or Hartmann’s solution) as an initial IV bolus as rapidly as possible, reassess, and then repeat if necessary. Once shock has been initially managed, give fluid more cautiously, as overloading can cause cerebral oedema and death in patients with this condition.

If shock is due to severe anaemia, IV crystalloid boluses such as Ringer-lactate or Hartmann’s solution must be given with extreme care (due to the risk of heart failure). As soon as possible, give blood carefully (10 mL/kg in children and 50 mL in pregnant mothers, over 15 minutes) and then reassess and repeat if it is safe to do so.

Partial exchange transfusion may be helpful in this situation, especially if it is possible to access a large superficial vein in the antecubital fossa. Successively remove 20-mL aliquots of the patient’s blood and replace each 20 mL with 40 mL of packed donor red blood cells until shock has resolved.

Heart failure

This life-threatening situation can be seen in severe anaemia, after fluid overload, in the presence of structural heart disease and with severe hypertension (usually in pregnancy). It is important to distinguish heart failure from...
shock, as the resuscitation required is different. Some of the following signs will be present in heart failure:
- tachycardia out of proportion to respiratory difficulty
- severe palmar pallor (if anaemia is the cause)
- raised jugular venous pressure
- gallop rhythm on auscultation of the heart
- some heart murmurs (if structural heart defect is responsible)
- an enlarged, sometimes tender, liver
- crepitations on listening to the lung bases
- cyanosis that does not respond to oxygen in the case of infants with cyanotic congenital heart disease.

In pregnancy, severe hypertension can cause heart failure (check the blood pressure; patients with values above 170/110 mmHg can present with heart failure).

Resuscitation for heart failure
1. Sit the patient up.
2. Give oxygen.
3. Give furosemide 1–2 mg/kg by IV/IO injection in children and 40 mg IV in pregnant mothers.
4. Consider giving morphine (50 micrograms/kg in children and 3 mg in pregnant mothers), and reassess. Morphine should be used with caution, especially in patients with altered mental status and impaired respiratory drive.
5. If the patient has severe anaemia, consider exchange transfusion.

Situations where emergency treatment is given in heart failure with shock
1. Supraventricular tachycardia (usually in a child) can cause both shock and heart failure. The heart rate will be > 180 beats/minute, and in infants can reach > 220 beats/minute. If available, ECG will confirm tachycardia. Treat by vagal manoeuvres, defibrillation if available, or adenosine if rapid IV access is available (see Section 5.4.C).
2. In ventricular tachycardia, defibrillation is needed if shock is present (see Section 1.13).
3. If congenital or rheumatic heart disease or cardiomyopathy is the cause of heart failure, inotropes or digoxin may be appropriate, but specialist advice will be necessary.
4. If cyanotic congenital heart disease in the newborn is the cause of shock, give prostaglandin E2, but specialist paediatric advice will be necessary (see Section 5.4.A).

Primary assessment and resuscitation of neurological failure (disability)
Always assess and treat Airway, Breathing and Circulation problems before undertaking neurological assessment.

Primary assessment
Conscious level: AVPU
- Alert is the normal state for an awake person. If the patient does not respond to Voice (i.e. being spoken to and asked ‘Are you all right?’), it is important that assessment of the response to Pain is undertaken next. A painful central stimulus can be delivered by sternal pressure, by supra-orbital ridge pressure or by pulling frontal hair. A patient who is Unresponsive or who only responds to pain has a significant degree of coma which can seriously interfere with vital Airway and Breathing functions.
- Voice
- Pain
- Unresponsive
- Unconscious

Fits
Generalised convulsions, also known as ‘fits’ or ‘seizures’, can seriously interfere with vital Airway and Breathing functions, both during the fit itself and immediately afterwards, when lowered levels of consciousness may be present.

Posture
Many patients who have a serious illness in any system are hypotonic. Stiff posturing, such as that shown by decorticate (flexed arms, extended legs) or decerebrate (extended arms, extended legs) posturing, is a sign of serious brain dysfunction. These postures can be mistaken for the tonic phase of a convolution. Alternatively, a painful stimulus may be necessary to elicit these postures.

Severe extension of the neck due to upper airway obstruction can mimic the opisthotonus that occurs with meningeal irritation. In infants, a stiff neck and full fontanelle are signs that suggest meningitis.

Pupils
Many drugs and cerebral lesions have effects on pupil size and reactions. However, the most important pupillary signs to seek are dilatation, unreactivity and inequality, which suggest possible serious brain disorders.

Always check blood glucose levels or suspect hypoglycaemia in any unwell infant or young child, especially if they have impaired consciousness.

Hypoglycaemia with a blood glucose level of less than 2.5 mmol/L (45 mg/dL) can cause impaired consciousness, coma or fits.

Respiratory effects of central neurological failure
The presence of any abnormal respiratory pattern in a patient with coma suggests mid- or hindbrain dysfunction.

Circulatory effects of central neurological failure
Systemic hypertension with sinus bradycardia (Cushing’s response) indicates compression of the medulla oblongata caused by herniation of the cerebellar tonsils through the foramen magnum. This is a late and pre-terminal sign.

Raised intracranial pressure (ICP) may cause:
- hyperventilation
- slow sighing respirations
- apnoea
- hypertension
- bradycardia.

Resuscitation
1. If the patient is unconscious (P or U on the AVPU scale) but their airway and breathing are adequate, place them in the recovery position, so that if they vomit there is less likelihood of aspiration because when unconscious, the gag reflex may not be operative.
2. If the patient is unconscious or fitting, always give oxygen.
3. If hypoglycaemia is a cause of reduced consciousness (or a suspected cause, but immediate blood glucose measurements are not possible), treatment with glucose is urgently required. Give 2–5 mL/kg of 10% glucose IV or IO in children (see Section 5.8.B) and 100 mL of 25% glucose IV or IO in pregnant mothers. (Make 100 mL of 25% glucose by adding 50 mL of 50% glucose to 50 mL of Ringer-lactate or Hartmann’s solution).

If IV or IO access is not immediately available in a...
child, give sublingual sugar, 1 teaspoonful moistened with 1 to 2 drops of water. Children should be monitored for early swallowing which leads to delayed absorption, and in this case another dose of sugar should be given. Continue to attempt IV or IO access, as parenteral glucose is a more reliable method of treating hypoglycaemia.

If sublingual sugar is given, repeat the doses at 20-minute intervals.

Recheck the blood glucose level after 20 minutes, and if the level is low (< 2.5 mmol/litre or < 45 mg/dL), repeat the IV/IO glucose (5mL/kg) or repeat the sublingual sugar.

4 If fitting occurs in pregnancy, give magnesium sulphate (see Section 2.5.E).

5 If fitting occurs in an infant or child and continues in your presence for more than 5 minutes and there is no hypoglycaemia, give IV or rectal anticonvulsants. Always make sure that a bag and mask are available in case the patient stops breathing, which is a possibility. Commonly used anticonvulsants in this situation are diazepam or, if there is no IV access, rectal diazepam, rectal paraldehyde or buccal midazolam (see Section 5.16.E).

- IV or IO diazepam: 250 micrograms/kg IV over 5 minutes
- rectal diazepam: 500 micrograms/kg
- rectal paraldehyde: 0.4 mL/kg
- buccal midazolam: 300 micrograms/kg.

6 To gain time in *acutely raised intracranial pressure* (e.g. in cases of head injury), consider the use of IV mannitol, 250 –500mg/kg, which will draw fluid out of the brain for a short while, thereby temporarily reducing the ICP. Because the effect of mannitol is only short-lived (a matter of hours), it is used to gain time while definitive care is being set up (e.g. surgical intervention to drain an extradural or subdural haematoma).

7 In any case where meningitis orencephalitis is suspected, it is vital that suitable antibiotics and/or antiviral drugs are started IV or IO as soon as the condition is suspected (see Sections 2.7.E, 3.4, 5.16.B and 5.16.C). Antibiotic choices might include cefotaxime or chloramphenicol, penicillin, amoxicillin and gentamicin in the newborn. Consider adjunctive treatment with dexamethasone 150 micrograms/kg every 6 hours for 4 days starting before or with the first antibiotic dose. Do not use dexamethasone in cases where there is also septic shock (e.g. in meningococcal disease).

**Secondary assessment and emergency treatments**

The secondary assessment takes place once vital functions have been assessed and the initial resuscitation of those vital functions has been started. Primary assessment and resuscitation can usually be undertaken in less than 1 minute if the patient does not have a life-threatening airway, breathing, circulation or neurological problem.

Secondary assessment includes a focused medical history, a focused clinical examination and specific investigations. It differs from a standard medical history and examination in that it is designed to establish which emergency treatments might benefit the patient. Time is limited, and a focused approach is essential. At the end of secondary assessment, the practitioner should have a better understanding of the illness or component of injury likely to be affecting the patient, and may have formulated a differential diagnosis. Emergency treatments will be appropriate at this stage – to treat either specific disorders (e.g. asthma) or conditions (e.g. raised intracranial pressure). Emergency treatments will be undertaken at this stage in addition to those given as part of resuscitation/life-saving treatments, in order to manage specific components of serious illnesses or injuries (e.g. steroids for asthma, Caesarean section for antepartum haemorrhage). The establishment of a definite diagnosis is part of definitive care.

The history often provides the vital clues. In the case of infants and children, the history is often obtained from an accompanying parent, although a history should be sought from the child if possible. Do not forget to ask any health worker who has seen the patient about the initial condition and about treatments and the response to treatments that have already been given.

Some patients will present with an acute exacerbation/complication of a known condition, such as pregnancy, asthma or epilepsy. Such information is helpful in focusing attention on the appropriate system, but the practitioner should be wary of dismissing new pathologies in such patients. The structured approach avoids this problem. Unlike trauma (see Section 7), illness affects systems rather than anatomical areas. The secondary assessment must reflect this, and the history of the complaint should be sought with special attention to the presenting system or systems involved. After the presenting system has been dealt with, all of the other systems should be assessed and any additional emergency treatments commenced as appropriate.

The secondary assessment is not intended to complete the diagnostic process, but rather it aims to identify any problems that require emergency treatment.

An outline of a structured approach in the first hour of emergency management is given below. It is not exhaustive, but addresses the majority of emergency conditions that are amenable to specific emergency treatments in this time period.

The symptoms, signs and treatments relevant to each emergency condition are elaborated further in the relevant sections of the textbook.

**Secondary assessment of airway and breathing**

<table>
<thead>
<tr>
<th>TABLE 1.11.4 Airway and breathing: signs and symptoms</th>
</tr>
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<tbody>
<tr>
<td><strong>Common symptoms</strong></td>
</tr>
<tr>
<td>----------------------</td>
</tr>
<tr>
<td>Breathlessness</td>
</tr>
<tr>
<td>Coryza</td>
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<tr>
<td>Tachypnoea</td>
</tr>
<tr>
<td>Choking</td>
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<tr>
<td>Cough</td>
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<tr>
<td>Abdominal pain</td>
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<tr>
<td>Chest pain</td>
</tr>
<tr>
<td>Apnoea</td>
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<tr>
<td>Feeding difficulties</td>
</tr>
</tbody>
</table>

(continued)
Examples of emergency treatment for airway and breathing

- If in a young child there is a harsh stridor associated with a barking cough and severe respiratory distress, upper airway obstruction due to severe group should be suspected. Nebulised adrenaline will already have been given as resuscitation, but now give oral prednisolone as emergency treatment (see Section 5.1.A).
- If there is a quiet stridor and drooling in a sick-looking child, consider epiglottitis or bacterial tracheitis. Intubation is likely to be urgently required, preferably by an anaesthetist, and is initial resuscitation if the airway is completely closed. Do not put the airway at risk by performing unpleasant or frightening interventions. Give intravenous antibiotics as emergency treatment, but only after the airway has been secured (see Section 5.1.A). A surgical airway may also be needed as emergency treatment or as resuscitation if intubation is not possible, so contact a surgeon.
- With a sudden onset and significant history of inhalation, consider a laryngeal foreign body. If the “choking” protocol has been unsuccessful, the patient may require laryngoscopy (see Section 1.12). Do not put the airway at risk by performing unpleasant or frightening interventions, but contact an anaesthetist/ENT surgeon urgently. However, in extreme, life-threatening cases, immediate direct laryngoscopy as part of resuscitation to remove a visible foreign body with Magill’s forceps may be necessary.
- Stridor following ingestion or injection of a known allergen suggests anaphylaxis (see Section 5.1.B). Patients in whom this is likely should have received IM and nebulised adrenaline (10 micrograms/kg for a child and 1 mg for an adult) as resuscitation treatment. IV or oral steroids would then be part of emergency treatment.
- Patients with a history of asthma or with wheeze, significant respiratory distress and/or hypoxia should receive inhaled salbutamol and oxygen as resuscitation, but then need oral steroids and further inhaled bronchodilators as emergency treatment (see Section 5.2.B).
- Infants with wheeze and respiratory distress are likely to have bronchiolitis, and require oxygen, as well as clearing of nasal secretions as resuscitation, and IV or NG fluids as emergency treatment (see Section 5.2.A).
- In acidic breathing, measure blood glucose levels to confirm diabetic ketoacidosis. A bolus of IV Ringer lactate or Hartmann’s solution will already have been given as resuscitation for any shock due to dehydration and insulin can now be given as emergency treatment (see Section 5.8.A).
- In clinically suspected pulmonary embolus in pregnancy, IV unfractionated heparin should be given as resuscitation, and subcutaneous low-molecular-weight heparin should be given as emergency treatment (see Section 2.5.H).

Examples of emergency treatment for shock

- If in a young child there is a harsh stridor associated with a barking cough and severe respiratory distress, upper airway obstruction due to severe group should be suspected. Nebulised adrenaline will already have been given as resuscitation, but now give oral prednisolone as emergency treatment (see Section 5.1.A).
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- In clinically suspected pulmonary embolus in pregnancy, IV unfractionated heparin should be given as resuscitation, and subcutaneous low-molecular-weight heparin should be given as emergency treatment (see Section 2.5.H).

Examples of emergency treatment for circulation

- Further IV/IO boluses of fluid should be considered in shocked patients with hypovolaemia from gastroenteritis or with sepsis who have not shown a sustained improvement in response to the first bolus given at resuscitation (see Sections 2.5.A, 5.5.B and 5.5.C).
- However, in trauma, if there is uncontrolled internal bleeding, early surgical intervention has priority, and too much IV fluid may be harmful. Continued blood transfusion is an emergency treatment after the initial resuscitation (see Section 7.3.A).
- Consider inotropes, intubation and central venous pressure monitoring, if available, as emergency treatment for shock (see Section 2.5.A).
- Consider IV broad-spectrum antibiotics as emergency treatment for shock in patients with no obvious fluid loss, as sepsis is likely. Antibiotics are essential if purpura is present, as a diagnosis of meningococcal infection is likely (see Section 6.1.G).
- If a patient has a cardiac arrhythmia, the appropriate protocol should be followed after initial resuscitation (see Section 5.4.C).
- If anaphylaxis is suspected, IM adrenaline 10 micrograms/kg in children, or 1 mg in pregnant mothers, in addition to fluid boluses, should be given as resuscitation treatment, and steroids and antihistamines should be given as emergency treatment (see Sections 5.1.B and 2.7.C).
- Targeted treatment is needed for obstetric emergencies.
that are known to cause shock. These include sepsis (for which antibiotics are needed), and antepartum or postpartum haemorrhage (for which specific treatment including medication and urgent surgery is needed together with replacement of lost blood (see Sections 2.5.D.i, iii and iv).

- Surgical advice and interventions for certain gastrointestinal emergencies such as volvulus would constitute emergency treatment. The following symptoms and signs may suggest intra-abdominal emergencies: vomiting, abdominal pain, abdominal tenderness and/or rigidity, lack of bowel sounds, rectal bleeding, abdominal mass (see Section 5.19).

### Secondary assessment of neurological failure (disability)

#### TABLE 1.11.6 Neurological failure: signs and symptoms

<table>
<thead>
<tr>
<th>Common symptoms</th>
<th>Signs</th>
<th>Emergency investigations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Headache</td>
<td>Altered conscious level</td>
<td>Blood glucose</td>
</tr>
<tr>
<td>Drowsiness</td>
<td>Convulsions</td>
<td>Oxygen saturation</td>
</tr>
<tr>
<td>Vomiting</td>
<td>Bradycardia</td>
<td>Blood culture</td>
</tr>
<tr>
<td>Behavioural changes</td>
<td>Abnormal pupil size and reactivity</td>
<td>(if infection is suspected)</td>
</tr>
<tr>
<td>Visual disturbance</td>
<td>Meningism</td>
<td>Haemoglobin</td>
</tr>
<tr>
<td></td>
<td>Fever</td>
<td>Urea and electrolytes (if available)</td>
</tr>
<tr>
<td></td>
<td>Papilloedema or retinal haemorrhage</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Altered deep tendon reflexes</td>
<td>Malarial parasites</td>
</tr>
<tr>
<td></td>
<td>Hypertension</td>
<td></td>
</tr>
</tbody>
</table>

### Examples of emergency treatment for neurological failure

- If convulsions persist after initial anticonvulsant drugs, treatment with further doses of anticonvulsants (see Sections 2.5.E, 2.7.E and 5.16.E) represents emergency treatment.
- If there is evidence of raised intracranial pressure (i.e. decreased conscious level, abnormal posturing and/or abnormal ocular motor reflexes), the patient should receive oxygen and bag-valve-mask ventilation as resuscitation, if they have apnoea or slow or poor breathing. Emergency treatment could include:
  - nursing with head in-line and 20–30 degrees head-up position (to aid cerebral venous drainage)
  - repeat IV infusion with mannitol 250–500mg/kg over 15 minutes; however, the treatment becomes less effective with each dose (see Section 7.3.C)
  - in more long-standing raised ICP, caused by tumours in the brain, dexamethasone will help to reduce raised ICP for a few days while specialist neurosurgical intervention is sought, or as palliation (see Section 5.14).
  - The initial dose is 25mg for patients over 35kg and 20mg for patients less than 35kg, followed by a sliding scale of 4mg every 3 hours for 3 days, then every 6 hours for 1 day, and continuing to decrease by 1–2mg per day.
- In patients with a depressed conscious level or convulsions, antibiotics are urgently required, but then consider encephalitis and give acyclovir as appropriate, as emergency treatment (see Sections 2.7.E and 5.16.C).
- In unconscious patients with pinpoint pupils, consider the possibility of opiate poisoning. After supporting breathing if necessary, a trial of naloxone should be given as emergency treatment (see Section 1.15).

### Developmental and family history

Particularly in a small child or infant, knowledge of the child’s developmental progress and immunisation status may be useful. The family circumstances may also be helpful, and asking about these may sometimes prompt parents to remember other details of the family’s medical history.

### Drugs and allergies

Any medication that the patient is currently taking, or has taken, should be recorded. In addition, if poisoning is a possibility, ask about any medication in the home that a child might have had access to. A history of allergies should be sought.

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**1.12 Basic life support for children and pregnant mothers**

**Introduction**

Basic life support (BLS) is a technique that can be employed by one or more rescuers to support the respiratory and circulatory functions of a collapsed patient using no or minimum equipment.

**Resuscitation from cardiac arrest in pregnant women and in children**

The international guidelines for resuscitation from cardiac arrest (European Resuscitation Council, 2010) detail two approaches to basic life support. One is for adults and the other for children.