SECTION 8: The structured approach to managing emergencies in pregnancy and childhood (WHO Pregnancy C-1)

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 one person in charge to avoid confusion.
- **SHOUT FOR HELP.** Have one person go for help and another to get emergency equipment and supplies, for example oxygen cylinder and emergency kit. It is ideal to have resuscitation equipment and drugs on one dedicated trolley.
- Assess and resuscitate in sequence **Airway, Breathing, Circulation, Disability (Neurological status), using the structured approach (***see* below**).**
- If patient is conscious, ask what happened and what symptoms he/she has.
- **Constantly reassess the patient,** particularly after any intervention.

The 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 administration of life-saving treatments, while secondary assessment and emergency treatment allow more specific urgent therapies to be started.

Secondary assessment and emergency care requires a system-by-system approach; this minimises the chance of significant conditions being missed.

The outcome for pregnant women or children following cardiac and/or respiratory arrest is poor. Earlier recognition and management of potential respiratory, circulatory, or central neurological failure which may progress rapidly to cardio 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, babies and children.

1. **Primary assessment with Resuscitation (that is, life -saving treatment which prevents progression to cardio-respiratory arrest)**
2. **Secondary assessment with Emergency treatment**

Primary assessment* and *resuscitation involves sequential assessment and resuscitation of vital functions.

Airway is assessed and resuscitated before Breathing, which is assessed and resuscitated before Circulation, which is then assessed and resuscitated.

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

If you are single handed and no-one has come to your shouts for help, then 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 or oxygen to enter the lungs.

If there are more assistants, one can deal with A, another with B and a third with C simultaneously, but there must be a "Team Leader" to take overall control.

During resuscitation, interventions which 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 assessment and resuscitation occurs before any illness-specific diagnostic assessment or treatment takes place. Once the patient's vital functions are working safely, secondary assessment and emergency treatment begins. The primary assessment and any necessary resuscitation must be completed before the more detailed secondary assessment is performed.

After every 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, then primary assessment and resuscitation should be repeated.

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 its components (sometimes referred to as the D for disability of the ABC approach).

Primary assessment and resuscitation of the airway A

The first priority is establishment or maintenance of airway opening

Primary assessment

LOOK
LISTEN
FEEL
Talk to the patient
A patient who can speak or cry must have a clear airway.

The signs associated with airway obstruction may include:

- an absence of breathing
- stridor, snoring or gurgling in the throat
- cyanosis
- chest wall recession
- agitation, reduced consciousness, coma

Be alert for foreign bodies (see Section 6)

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, then open the airway using the following:

- a head tilt, chin lift or jaw thrust manoeuvre (see Basic Life Support-Section 6). If this opens the airway and breathing starts, keep the airway open manually until it can be secured. Be careful with head tilt if 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 nasopharyngeal airway if suspicion of base of skull injury.
- if the airway is still obstructed, a definitive airway by intubation or surgical airway might be needed.
- **give oxygen to all patients. (Careful not to distress young children with partial upper airway obstruction due to infections such as epiglottitis and severe croup since this may precipitate acute worsening of their airway obstruction).**

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 examined by performing an airway-opening manoeuvre while giving rescue breaths. (Proceed to Breathing below).

Need for advanced airway management
Advanced airway management techniques for securing the airway by **intubation** might be required

when there is:

- persisting airway obstruction .
- altered level of consciousness, with failure to protect airway particularly from vomiting.
- facial trauma – including burns, penetrating neck trauma with haematoma. (expanding), severe head injury. (See Section 13).

This should be performed by those with skills such as an anaesthetist (if available). 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 issue 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).

Inability to provide an airway using intubation might require a **surgical airway**.

NOTE: There is danger in proceeding to Circulation and its procedures (IV/IO cannulation) when partial upper airway obstruction is present in young children (examples epiglottitis, severe croup, foreign body) as invasive procedures can precipitate complete airway closure.

Situations where emergency treatment is given

1. For **severe croup,** nebulised adrenaline can be helpful (5ml of 1 in 1000). Always give oral steroid as soon as possible (150 micrograms/Kg of dexamethasone or 1mg/Kg prednisolone)
2. For upper airway obstruction due to **anaphylaxis,** nebulised adrenaline (5ml of 1 in 1000) and IM adrenaline (1mg IM in pregnancy and 10micrograms/Kg in childhood).
3. For **inhaled foreign body**
4. For **severe bronchiolitis,** clear the nasal airways by gentle suction.

If the patient has major trauma and is obviously bleeding rapidly to exsanguination (*see* Section 13), measures to stop the exsanguination must be undertaken at the same time as AIRWAY resuscitation.

Throughout primary assessment and resuscitation, protect the cervical spine with collar, sand bags and tape ***if the patient is likely to have an unstable cervical spine and if subsequent surgical stabilisation is possible****.*

Primary assessment and resuscitation of breathing B

An open airway does not ensure 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 that breathing is adequate by:

Assessment of breathing
- **Effort** – recession, rate, added noises, accessory muscles, alar flaring
- **Efficacy** – breath sounds, chest expansion; abdominal excursion; SaO2 if available
- **Effects** – on heart rate, skin colour (?cyanosis), mental status

- *looking* for chest and/or abdominal expansion (symmetrical or asymmetrical)
- *listening* for breath sounds (with a stethoscope or ear on chest wall) (reduced or absent, any wheeze?)
- *looking at skin colour*

Evidence of life-threatening respiratory difficulty

1. Absence of breathing (apnoea)
2. Very high or very low respiratory rates
3. Gasping. 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* Sections 7 and 13)
7. Major trauma to the chest (tension pneumothorax, haemothorax, flail chest *see* Section 13)
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

1. Increased respiratory rate
2. Inspiratory stridoe
3. Breath sounds on auscultation reduced or absent
4. Expiratory wheezing
5. Chest expansion (**most important**) / abdominal excursion reduced
6. Pulse oximetry showing < 94% (normal oxygen saturation (SaO2) in a patient at sea level is 94 – 100% in air).

Fast breathing results *from either an airway problem , lung disease or metabolic acidosis*

Rates “at rest” at different ages are:

Age (yrs)	Respiratory rate/minute
<1	30-40
1-2	25-35
2-5	25-30
5-12	20-25
>12 and Pregnancy	15-20

Care should be taken in interpreting single measurements. Infants can show rates of between 30 and 90 breaths per minute depending on their state of activity. More useful are trends in measurements *as an indicator of improvement or deterioration.*

WHO definitions of Fast Breathing are:

< 2 months	is ≥ 60 breaths per minute
2 – 12 months	is ≥ 50 breaths per minute
12 months to 5 years	is ≥ 40 breaths per 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

Chest wall recession

- intercostal, subcostal or sternal recession reflects increased effort of breathing particularly seen in infants, who have more compliant chest walls
- degree of recession indicates 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

- seen in infants and children with stiff lungs to prevent airway collapse (represents the noise made by closure of the larynx during expiration which is the body's attempt to increase lung volume on expiration)
- 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 3 circumstances:

1. exhaustion
2. central respiratory depression eg. from raised intracranial pressure, poisoning or encephalopathy
3. neuromuscular disease eg. poliomyelitis

Effects of breathing failure on other physiology

Heart rate: increased with hypoxia, but decreases when hypoxia is severe, when it is a sign of impending cardio-respiratory arrest.

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

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

Resuscitation of breathing

In the patient with absent or inadequate breathing then 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 O_2 concentration

Intubate (if skills 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 (eg cyanosis).

Situations where emergency treatment is given

1. Perform **needle thoracocentesis** if the diagnosis is tension pneumothorax. This should be followed by a chest drain.

2. Consider **chest drain** if major trauma to chest (see Section 13)

3. Give **nebulised salbutamol** for severe, life threatening asthma (2.5mg if < 5 years, 5mg if > 5 years or in pregnancy). If a nebuliser is not available, use spacer and metered dose inhaler (100 micrograms/puff; 10 puffs initially at all ages).

4. Give **nasal CPAP** if a neonate has severe respiratory distress (see Section 11)

5. Give **IM adrenaline** (1mg 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 9).

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 C

Primary assessment of the circulation

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 / minute in an infant, < 40/minute in a child or pregnant woman) or no signs of life (such as movements, coughing or normal breathing, cardiac arrest or near-cardiac arrest is likely and BLS must be started (see Section on basic life support 6).
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.

Heart rate

- Heart rate increases in shock and heart failure.
- Severe bradycardia due to hypoxaemia may be a sign of near cardio-respiratory arrest.
- Heart rates "at rest" at different ages are:

Age (yrs)	Heart rate (beats/min)
<1	110-160
1-2	100-150
2-5	95-140
5-12	80-120
>12	60-100
Pregnancy	65-115

WHO definitions for tachycardia are: > 160 bpm aged under 1 year and >120 bpm aged 1 to 5 years.

Pulse volume

Absent peripheral pulses or reduced strength of central pulses can 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 in ≤ 3 seconds. CRT may be prolonged by shock, cold environment, or the vasoconstriction that is present 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 response to treatment.

Blood pressure

- cuff should cover at least 80% of the length of the upper arm, and the bladder more than two thirds of the arm's circumference (in pregnancy to avoid missing a raised blood pressure the largest possible cuffs should be used).
- Korotkoff 5 (K5) sound (disappearance) should be used for measuring diastolic pressure. K4 sound (muffling-softening of the sounds) should only be used if the sound does not disappear until near zero.
- **hypotension is a late sign of circulatory failure in both children and pregnant girl or women and will rapidly be followed by cardio-respiratory arrest unless treated urgently**

Age (yrs)	Systolic blood pressure	Diastolic blood pressure
<1	70-90	
1-2	80-90	
2-5	80-95	
5-12	90-110	
>12	100-120	
Pregnancy	90 -120	50-70

Blood pressure may be difficult to measure and interpret, especially in infants and children <5 years of age. A formula for calculating normal systolic blood pressure in children is

80 + (2 x Age in years)

The cardiovascular system in a child and **pregnant girl or woman** compensates well initially in shock. **Hypotension is a late and often sudden sign of decompensation 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 occurs due to the acidosis resulting from poor tissue perfusion

Skin*:* pale or mottled skin indicates poor perfusion

Mental status*:* agitation, then drowsiness, then unconsciousness

Urine output*:* reduced - <2ml/kg/hour in infants <1ml/kg/hour in a child and <30ml/hour in pregnancy indicates inadequate renal perfusion

In pregnancy*:* fetal compromise can be the first sign of shock in the **pregnant girl or woman**.

WHO defines **shock** as cold hands, **plus** CRT>3 seconds, **plus** weak and fast pulse.

In summary:

Life- threatening shock is usually associated with:

- severe tachycardia,
- a weak- volume pulse (ideally central: brachial, femoral or carotid)
- low BP (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 raised capillary refill time (CRT) > 3 seconds
- reduced conscious level.

Remember 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 may be fatal.

Resuscitation in shock

For cardiac arrest or near arrest, **chest compressions** should be undertaken (see Basic and Advanced Life Support Sections 6 and 7).

Ensure an open and secure airway.
Give **high-flow oxygen** to every patient with an inadequate circulation (whether due to shock or to heart failure). This will be through either a face mask with a reservoir bag (or an endotracheal tube if intubation has been necessary).

Venous or intraosseous access should be gained and essential blood for tests taken (Hb, cross match, blood clotting and urea and electrolytes if possible).

Lateral tilt
If pregnant and after 20 weeks gestation (whenever the uterus can be palpated abdominally to have reached or be above the umbilicus) 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 flat (or tilted) and **elevate the legs.**

Fluids in shock

In most cases of shock, IV or IO fluids are the immediate resuscitation treatment, once the airway has been opened and secured and oxygen is being given. However, different causes of shock need different considerations.

1. If **hypovolaemia** is the cause of shock: for infants and children give an immediate **IV/IO bolus of 10 to 20ml/Kg of crystalloid** as appropriate for weight (see below) provided that heart failure is not present (*see* above). For pregnant women and girls give IV bolus of 500-1000ml of crystalloid.

For a child, weight can be estimated as follows:

Birth weight
- doubles by 5 months
- triples by 1 year
- quadruples by 2 years

After 12 months, the following formula can be applied, but needs to be modified according to whether the child is small or large compared with the average

Weight (Kg) = 2 x (age in years + 4).

a. If shock is due to **severe gastroenteritis,** there will usually be evidence of severe dehydration and history of profound or long standing diarrhoea. Give **20ml/Kg of Ringer-Lactate or Hartmann's as an initial IV or IO bolus** as rapidly as possible, reassess and then repeat if necessary. In cholera, up to 60ml/Kg might be required in children, and 3 litres in pregnancy.

b. If shock is due to bleeding, which is one of the **commonest causes in pregnancy**, give crystalloid immediately then try to obtain **blood** for transfusion as rapidly as possible. Fresh blood is ideal. Give O negative if available.

2. If shock is due to septicaemia with purpura (meningococcus or Dengue), give IV or IO boluses as fast as possible of **Ringer-Lactate or Hartmann's** (or normal saline if these are not available) 20ml/Kg in children and 1 litre in pregnancy, then reassess. Usually at least 40ml/Kg in children and 2-3 litres in pregnancy will be required to overcome shock. In this situation, **inotropes** may be valuable if available and safe to use.

3. If shock is due to **anaphylaxis,** give a**drenaline** 10 micrograms/Kg (0.1ml/Kg of 1 in 10,000) IM in a child and 1mg (1ml of 1 in 1000) IM in pregnancy in addition to IV or IO fluid.

4. If shock is due to **diabetic ketoacidosis,** there will usually be evidence of severe dehydration and coma. Give **10ml/Kg of 0.9% saline * as an initial IV bolus** as rapidly as possible, reassess and then repeat if necessary. Once shock has been initially managed in diabetic keto-acidosis, give fluid more cautiously, as overloading can cause cerebral oedema and death in this condition.

5. If shock is due to severe anaemia, IV crystalloid boluses such as 0.9% saline, Ringer-Lactate or Hartmann's must NOT be given (due to danger of heart failure).As soon as possible, give blood carefully (perhaps 10ml/kg in a child and 50ml in pregnancy over 15 minutes) and then reassess and repeat if safe to do so.

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 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)

- enlarged, sometimes tender, liver
- crepitations on listening to the bases of the lungs
- 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 BP: values above 170/110 mmHg can present with heart failure)

Resuscitation for heart failure

1. **Sit the patient up**.
2. **Give oxygen**
3. Give **frusemide** 1-2 mg/Kg by IV/IO injection for a child and 40mg IV for a pregnant woman or girl.
4. Consider **morphine** (50micrograms/Kg in a child and 3mg in pregnancy), and reassess. Morphine should be used with caution, especially in patients with altered mental status and impaired respiratory drive.
5. If severe anaemia, consider **exchange transfusion**.

Situations where emergency treatment is given in heart failure with shock

1. **Supraventricular tachycardia (usually in a child)** can produce both shock and heart failure. Heart rates will be > 180 and in an infant reach >220/minute. ECG if available will confirm. Treat by **vagal manoeuvres**, defibrillation if available, or adenosine if IV access available quickly (see Section 7)
2. In **ventricular tachycardia**, defibrillation is needed if shock is present (see Section 7}
3. If **congenital** or **rheumatic heart** disease or **cardiomyopathy** are the cause of heart failure, inotropes or digoxin may be appropriate, but specialist advice will be needed.
4. If cyanotic congenital heart disease in the newborn is the cause of shock give prostaglandin E2 but specialist paediatric advice will be necessary

Primary assessment of and resuscitation for Neurologic failure (Disability)

Always assess and treat **A**irway, **B**reathing and **C**irculatory problems before undertaking neurological assessment.

Primary assessment of neurological function

Conscious level: AVPU

A	**ALERT**
V	**responds to VOICE**
P	**responds to PAIN**
U	**UNRESPONSIVE**

Alert is the normal state for an awake person. If the patient does not respond to **Voice**, that is, being spoken to "are you alright?, it is important that assessment of the response to **Pain** is next undertaken. 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 seriously interferes with vital Airway and Breathing functions.

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 are suffering from 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), are signs of serious brain dysfunction. *These postures can be mistaken for the tonic phase of a convulsion.* 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. A stiff neck and full fontanelle in infants are signs which 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 or suspect hypoglycaemia, in any unwell infant or young child and especially one with impaired consciousness.

Hypoglycaemia of less than 2.5 mmol/litre 45mg/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 hind-brain 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 of neurological function

1. If the patient is unconscious (P or U on AVPU scale) but airway and breathing are adequate, place in the **recovery position** which will ensure that if the patient vomits there is less likelihood of aspiration. In this situation, the gag reflex may not be operative.

2. If unconscious or fitting, always give **oxygen**

3. If **hypoglycaemia** is a cause of reduced consciousness (or suspected to be but immediate blood glucose measurements are not possible), it is urgent to treat with glucose. Give 10ml/Kg of 5% **glucose** IV or IO in a child and 100ml of 25% glucose in pregnancy IV or IO.

If IV or IO access is not immediately available in a child, give sublingual sugar 1 teaspoon moistened with 1-2 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 secure method of treating hypoglycaemia If sublingual sugar is given, repeat doses at 20 minute intervals.
Recheck the blood glucose in 20 minutes and if the level is low (<2.5 mmol/litre or <45 mg/dl), repeat the IV/IO glucose (5 ml/kg) or repeat sublingual sugar.

4. If fitting occurs in pregnancy, give **magnesium sulphate** (see Section 9)

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 is available in case the patient stops breathing, which is possible in this situation. Commonly used anticonvulsants in this situation are diazepam, paraldehyde and, if no IV access, rectal diazepam or buccal midazolam.(see Section 12)
    a. IV or IO diazepam: 250 micrograms/Kg IV over 5 minutes
    b. Rectal diazepam: 500 micrograms/Kg
    c. Rectal paraldehyde:0.4ml/Kg
    d. Buccal midazolam: 300 micrograms/Kg

6. To gain time in **acutely raised intracranial pressure,** for example in head injury consider IV **mannitol**: 250 -500 mg/Kg, which will draw fluid out of the brain for a short while, reducing the ICP temporarily. The effect of mannitol is short-lived, hours only. Its place is to gain time while definitive care is set up e.g. surgical intervention to drain an extradural or sudural haematoma.

7. In any case where **meningitis or encephalitis** is suspected it is vital that suitable antibiotics and/or antivirals are started IV or IO as soon as the condition is suspected. Antibiotic choices might include cefotaxime or chloramphenicol, penicillin, amoxicillin and gentamycin in the newborn. Consider adjunctive treatment with dexamethasone 150micrograms /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 A, B, C 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 – either to treat specific conditions (such as asthma) or processes (such as 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 treat specific components of serious illnesses or injuries (for example steroids for asthma, Caesarean section for ante-partum haemorrhage etc.) 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 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 prevents this problem. Unlike trauma (which is dealt with later in Section 13), 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 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 is intended to identify any problems that require emergency treatment.

The following gives an outline of a structured approach in the first hour of emergency management. It is not exhaustive but addresses the majority of emergency conditions that are amenable to specific emergency treatments in this time period.

Airway and Breathing: secondary assessment

Common symptoms	**Clinical Signs**	**Emergency investigations**
Breathlessness Coryza Tachypnoea Choking Cough Abdominal pain Chest pain Apnoea Feeding difficulties Hoarseness Chest pain	Bubbly noises in throat Cyanosis Recession Noisy breathing – grunting, stridor Drooling and inability to drink Wheeze Tracheal shift Abnormal percussion note Crepitations on auscultation Acidotic breathing Grunting	O2 saturation Blood culture if infection suspect Chest X-ray (selective) ECG if suspected pulmonary embolus (selective and if available)

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 croup should be suspected. Nebulised adrenaline would have been given as resuscitation, but now give oral prednisolone as emergency treatment.

- 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 unpleasant or frightening interventions. Give intravenous antibiotics as emergency treatment but only after the airway is secured. 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. Do not put the airway at risk by 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/injection of a known allergen suggests anaphylaxis. Patients in whom this is likely should have received IM and nebulised adrenaline (*10 microgram/kg for a child* and 1mg 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.

- 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.

- In acidotic breathing, take blood glucose to confirm diabetic ketoacidosis. An IV 0.9% saline bolus will already have been given as resuscitation for any shock due to dehydration, and insulin can now be given as emergency treatment.

- In clinically suspected pulmonary embolus in pregnancy, IV unfractionated heparin is resuscitation, and subcutanous low molecular weight heparin is emergency treatment.

Circulation: Secondary assessment

Common symptoms	**Signs**	**Emergency investigations**
Haemorrhage Breathlessness Palpitations Feeding difficulties Abdominal pain Chest pain Apnoea Feeding difficulties Hoarseness Drowsiness	Tachycardia or bradycardia Abnormal pulse volume or rhythm Abnormal skin perfusion or colour Haemorrhage or hidden haemorrhage Severe malnutrition Fever Hypo- or hypertension Cyanosis Pallor Enlarged liver Lung crepitations Poor urine output Cardiac murmur Peripheral oedema Raised jugular venous pressure Dehydration	O2 saturation Blood culture if infection suspect Chest X-ray (selective) ECG (selective and if available) HB Urea and electrolytes (if available) Clotting studies (if available) Malarial parasites

	Purpuric rash	

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 had a sustained improvement to the first bolus given at resuscitation.

- However in trauma, if there is uncontrolled internal bleeding, early surgical intervention has priority, and too much IV fluids may be harmful. Continued blood transfusion is an emergency treatment after the initial resuscitation.

- Consider inotropes, intubation and central venous pressure monitoring, if available, as emergency treatment for shock.

- Consider IV broad spectrum antibiotics as emergency treatment in shocked 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.

- If a patient has a cardiac arrhythmia, the appropriate protocol should be followed after initial resuscitation.

- If anaphylaxis is suspected, IM Adrenaline 10 micrograms/kg in a child, or 1mg in a pregnant girl or woman, in addition to fluid boluses, is resuscitation treatment, and steroids and antihistamines are emergency treatment.

- Targeted treatment for obstetric emergencies known to cause shock. These will largely include sepsis (for which antibiotics are needed) and ante- or post-partum haemorrhage (for which specific treatment including medication and urgent surgery are needed along with replacement of lost blood.

- Surgical advice and intervention for certain gastro-intestinal emergencies such as volvulus would constitute emergency treatment. The following symptoms and signs may suggest intra-abdominal emergencies: vomiting, abdominal pain, abdominal tenderness/rigidity, lack of bowel sounds, rectal bleeding, abdominal mass.

Neurological failure: Secondary assessment

Common symptoms	**Signs**	**Emergency investigations**
Headache Drowsiness Vomiting Change in behavior Visual disturbance	Altered conscious level Convulsions Bradycardia Altered pupil size and reactivity Abnormal postures Meningism Fever Papilloedema or retinal haemorrhage Altered deep tendon reflexes Hypertension	Blood glucose O2 saturation Blood culture if infection suspected Hb Urea and electrolytes (if available) Malarial parasites

Examples of emergency treatment for neurologic failure

- If hypoglycaemia of less than 2.5 mmol/litre (45mg/dl) is a possible diagnosis, it would have been treated as part of resuscitation, but the prevention of further hypoglycaemia by IV glucose infusion is emergency treatment. Remember, there will be a reason for the hypoglycaemia, so further monitoring and treatment is needed until the child is drinking appropriate fluids or has an IV infusion in place through which dextrose can be given.

- If convulsions persist after initial anticonvulsant drugs as resuscitation, treatment with further doses of anti-convulsants represents emergency treatment.

- If evidence of raised intracranial pressure (decreasing conscious level, abnormal posturing and/or abnormal ocular motor reflexes), then the patient should receive oxygen and bag valve mask ventilations as resuscitation, if apnoea or slow or poor breathing. Emergency treatment could include:
  - nursing with head in-line and 20–30 degree head-up position (to help cerebral venous drainage)
  - repeat IV infusion with mannitol 250 to 500 mg/kg over 15 minutes, but the treatment becomes less effective with each dose
  - in longer 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. The initial dose is 25mg for patients over 35kg and 20mg for patients less than 35kg followed by a sliding scale of 4 mg every 3 hours for three days then every 6 hours for one day and continuing to decrease by 1-2 mg per day.

- In a patient with a depressed conscious level or convulsions, antibiotics are urgent but then consider encephalitis and give acyclovir as appropriate, as emergency treatment.

- In unconscious patients with pin-point pupils, consider opiate poisoning. After supporting breathing if necessary, a trial of naloxone should be given as emergency treatment.

Further history: developmental and social 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, sometimes prompting parents to remember other details of the family's medical history.

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

SECTION 8 QUIZ 1

1. **When undertaking assessments during emergencies the following statements are true**
   a) resuscitation occurs at the same time
   b) airway patency is assessed by looking, listening and feeling
   c) reassessments occur at frequent intervals

2. **When assessing and providing emergency treatment for the airway, which of the following may be required**
   a. oxygen
   b. suction
   c. oropharyngeal airway
   d. gastric tube

ANSWERS:

1. abc 2. abc

SECTION 8 QUIZ 2

1) **When assessing and providing emergency treatment for breathing the following are correct maximum healthy respiratory rates**
   a) 60/minute if aged 1 – 5 years
   b) 50/minute if aged 1 month – 1 year

2) **Which of the following are some signs of serious breathing abnormalities**
   a) gasping
   b) grunting

3) **A soft inspiratory stridor cannot be due to severe upper airway obstruction**
   a) true
   b) false

4) **Which of the following are true statements: in respiratory failure increased effort of breathing may not occur**
   a) when exhausted
   b) when central respiratory depression
   c) in neuromuscular disease

ANSWERS:

1. b 2. ab 3. b (in the most severe obstruction stridor may be difficult to hear) 4. abc

SECTION 8 QUIZ 3

1. **When assessing the patient for circulatory failure the following statements are true**
   a. bradycardia is more serious than tachycardia
   b. capillary refill time is not a specific marker of shock and may be increased by a cold environment or during the development of fever
   c. hypotension is an early sign of circulatory failure in children and in pregnancy

2. **The following are normal values for systolic blood pressure**
   a. 80 + (4 x age in years)
   b. 90 – 120mm Hg in pregnancy
   c. 70 – 90 mm Hg in infancy

3. **When measuring BP, the cuff should cover more than 80% of the length of the upper arm and the bladder more than one third of the arm's circumference**
   a. true
   b. false

ANSWERS

1. ab 2. bc 3. b

SECTION 8 QUIZ 4

1) **Which of the following are values for urine output which might indicate under perfusion of the kidneys as a result of circulatory failure?**
   a) < 4 ml/kg/hour in infancy
   b) < 1 ml/kg/hour in a child
   c) < 30 ml/hour in pregnancy

2) **Which of the following are signs of cardiac failure?**
   a) Raised JVP
   b) enlarged liver
   c) crepitations in the upper zones of the lungs
   d) gallop rhythm

ANSWERS:

1. bc 2. abd

SECTION 8 QUIZ 5

1) **Fill in the following table with respect to the assessment of conscious levels**
   a) A----------
   b) V ----------
   c) P ----------
   d) U ----------

2) **Raised intracranial pressure usually causes**
   a) both hyperventilation and slow sighing respiration
   b) apnoea
   c) tachycardia
   d) hypertension

ANSWERS:

1. a) Alert b) responding to Voice c) responding to Pain d) Unresponsive

2. abd