Assessment

- APGAR
- Easy Cap™ II CO₂ Detector
- Glasgow coma score
- Glucometry
- Mental state assessment
- Neurological status assessment
- Paediatric assessment
- Pain assessment
- Perfusion status assessment
- Pre-hospital ultrasound
- Primary and secondary survey
- Pulse oximetry assessment
- Respiratory status assessment
- Sedation assessment tool (SAT)
- Vital signs survey
- Waveform capnography
The APGAR score is a valuable method to determine the health of newborns immediately after birth. It is determined by allocating scores to five simple criteria:

- colour (Appearance)
- heart rate (Pulse)
- reflex irritability (Grimace)
- muscle tone (Activity)
- breathing (Respiration)

The purpose of the APGAR score is to determine whether a newborn needs immediate medical care. It is not designed to make long-term predictions of a child’s health.[1]
• Using the table provided, assign the newborn a score (0 – 2) for each of the five criteria. Add all individual scores to calculate the total APGAR score (0 – 10).\textsuperscript{[2]}

<table>
<thead>
<tr>
<th>Action</th>
<th>0</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appearance</td>
<td>Look at skin colour</td>
<td>Blue/pale (extremities blue)</td>
<td>All pink</td>
</tr>
<tr>
<td>Pulse</td>
<td>Count heart rate</td>
<td>Absent</td>
<td>&lt; 100</td>
</tr>
<tr>
<td>Grimace</td>
<td>Monitor response</td>
<td>No response</td>
<td>Grimace</td>
</tr>
<tr>
<td>Activity</td>
<td>Look at muscle tone</td>
<td>Limp</td>
<td>Some flexion/extension</td>
</tr>
<tr>
<td>Respiration</td>
<td>Count and assess</td>
<td>Absent</td>
<td>Slow/irregular</td>
</tr>
</tbody>
</table>

• An APGAR score of:
  - 0 – 3 represents severe distress, (refer to CPG Resuscitation – newborn).
  - 4 – 7 indicates moderate distress, (refer to CPG Resuscitation – newborn).
  - 7 – 10 indicates an absence of difficulty in adjusting to extrauterine life.
  - 10 at 1 minute is uncommon due to the prevalence of transient cyanosis.\textsuperscript{[1]}

• Document the APGAR score accordingly on the eARF.
Authorisation to practice

Easy Cap™ II CO₂ Detector

The Easy Cap™ II is a disposable colourmetric EtCO₂ detector that measures EtCO₂ by colour comparison during patient inspiration and expiration.

At depths greater than 380 m (1250 ft) the LIFEPAK® 12 waveform capnography is unable to be used for ETT placement confirmation due to mechanical error. In this setting (ie. underground mining operations such as Mt Isa) the Easy Cap™ II is mandatory for confirmation of correct ETT placement.

This device is to be used continuously during ongoing care of the ventilated patient until such a time that the waveform capnography (LIFEPAK® 12) is consistently operational (above 380 m underground).

Indications

- Endotracheal intubation (placement confirmation when working at depths below 380 m (1250 ft) underground)

Contraindications

- Patients weighing < 15 kg
- Is not suitable for interpretation by individuals with blue-yellow colour blindness

Precautions

- The Easy Cap™ II may provide a false reassurance of correct placement despite the ETT being situated in the right main bronchus or above the vocal cords.
- Easy Cap™ II accuracy will be affected when subjected to excessive humidity.
- On removal from the packaging the Easy Cap™ II will only remain accurate for a period of 2 hours.
Procedure

• Immediately inspect the Easy Cap™ II after removal from the sealed pouch, matching the initial colour of the indicator to the purple colour stripe labelled CHECK (located around the detector window). Permanent yellow in the indicator window identifies a damaged indicator.

• Attach the Easy Cap™ II to the breathing circuit, ensuring that a bacterial/viral filter is connected on the ‘patient’ side.

• Confirm CO₂ sensing by performing 6 ventilations of moderate tidal volume. When CO₂ is detected, the indicator colour window will change from purple (on inspiration) to tan or yellow (on expiration) on each respiratory cycle.

• The Easy Cap™ II is single-patient, one-time use only and must be disposed of appropriately after use.
Additional information

- Although colourmetric EtCO₂ offers an alternative to waveform capnography, it is not considered as reliable for confirmation of tracheal placement. Therefore, confirmation of tracheal intubation when using the Easy Cap™ II should be made in conjunction with the following:
  - Direct visualisation of ETT passing between the vocal cords.
  - Fogging within the ETT on expiration.
  - No sounds of air entry via auscultation of the epigastrium.
  - Bilateral rise and fall of the chest.
  - Adequate and ongoing oxygenation as determined by skin colour.

- ETT placement is only deemed successful when the Easy Cap™ II registers a colour change in the ‘B’ and ‘C’ range, in conjunction with other confirmation checks.

- Interpreting results before performing 6 ventilations can yield false results.

- States of poor or no perfusion will influence the accuracy of the Easy Cap™ II.

- If there is a complete absence of EtCO₂ sensing or only registering in the ‘A’ range (or if the Easy Cap™ II is damaged) the ETT must be removed and the failed intubation algorithm is to be commenced.

- Due to varying humidity, lighting or distance from the device, the colour change on inspiration may not be as apparent as initially observed. The EtCO₂ can still be read at the end of expiration.

- QAS clinicians must be familiar with the operating instructions, with particular attention to precautions, limitations and troubleshooting. [3][4]
Full assembly of airway circuit with ETT

Easy Cap™ II CO₂ Detector

Connect breathing device here
Connect bacterial/viral filter here
Connect ET tube here
The Glasgow coma score (GCS) was first introduced in 1974 as a measure of conscious level – in the setting of traumatic brain injury. Its ease of application has seen its use progress to the assessment of conscious level in many other patient types.[1]

To obtain a total score, three categories are assessed:
- eye opening
- verbal response
- motor response

Ensure that the best response is recorded for each category.

If at all possible, have the same person assess the patient’s GCS each time.

**Indications**
- The assessment of a patient’s conscious state

**Contraindications**
- GCS is not applied to the newborn as the APGAR score is used in this patient group.

**Precautions**
- As GCS was developed for the assessment of traumatic brain injury, its adaptation to other patient groups can sometimes present limitations.[1] Paramedics must use their clinical judgement to provide an accurate assessment of conscious state.

**Additional information**
- Ensure accuracy in the assessment of each category.
- The clinical handover of a GCS should involve the finding of each category in addition to the total score.
- The categories in isolation also provide an indication of severity, with motor response of highest importance when correlated to patient outcome.[2]
- If there is a suspicion of spinal injury, painful stimuli above the injury site is recommended (e.g. Supra-orbital pressure).[3]
- In some circumstances, painful stimulus may be required for 15–30 seconds to elicit an accurate response.[4]
Procedure

Assess eye opening as:
- spontaneous
- to voice
- to pain
- nil

Assess verbal response through the patient’s speech as being:
- orientated
- confused
- the use of inappropriate words
- only incomprehensible sounds
- nil

Assess motor response through:
- an obeying of commands

or with the application of a painful stimulus the patient:
- localises to the painful site
- withdraws from the painful site
- displays a flexion response (decoricate posture)
- displays an extension response (decerebrate posture)
- shows no motor response.

Note: when applying painful stimuli, always use the least amount necessary to elicit a response. A central painful stimulus is recommended to elicit an appropriate reflex response.

Scores are placed as per the attached table with a total out of 15 obtained. Note that an infant assessment can also be attained.[5]

<table>
<thead>
<tr>
<th>GLASGOW COMA SCALE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Infant</strong></td>
</tr>
<tr>
<td><strong>Eye opening</strong></td>
</tr>
<tr>
<td>Spontaneously</td>
</tr>
<tr>
<td>Reacts to speech</td>
</tr>
<tr>
<td>Reacts to pain</td>
</tr>
<tr>
<td>No response</td>
</tr>
<tr>
<td><strong>Best verbal response</strong></td>
</tr>
<tr>
<td>Babbles, follows objects</td>
</tr>
<tr>
<td>Irritable, cries</td>
</tr>
<tr>
<td>Cries to pain</td>
</tr>
<tr>
<td>Moans and grunts</td>
</tr>
<tr>
<td>No response</td>
</tr>
<tr>
<td><strong>Best motor response</strong></td>
</tr>
<tr>
<td>Spontaneously</td>
</tr>
<tr>
<td>Localises to pain</td>
</tr>
<tr>
<td>Withdraws from pain</td>
</tr>
<tr>
<td>Flexion response</td>
</tr>
<tr>
<td>Extension response</td>
</tr>
<tr>
<td>No response</td>
</tr>
</tbody>
</table>
Authorisation to practice

Glucometry

Field blood glucose testing, using a glucometer, is a quick and convenient way of obtaining an indication of a patient's blood glucose level (BGL).

Common BGL for:
- hypoglycaemia < 4 mmol/L
- hyperglycaemia > 10 mmol/L

Note: chronic or poorly controlled diabetics may be hypoglycaemic despite a BGL > 4 mmol/L.

Indications

- Seizures
- Sick paediatric patients
- Impaired consciousness
- Post collapse
- Abnormal behaviour
- Any patient who is suspected of being hypoglycaemic

Note: A patient with impaired consciousness must have BGL checked whenever practical, even if the ALOC is suspected to be of other causes.

Contraindications

Although no actual contraindication exists to glucometry and the recording of BGL, it must be remembered that this procedure is invasive and so judgement must be used as to the appropriateness of performing the procedure.

Precautions

BGL readings should not be interpreted in isolation, but with consideration of the other clinical signs and available history.

Numerous variables may distort test results such as:
- blood volume on the sensor
- oxygen level of the blood
- glucose contaminants on the skin.
**Procedure**

- Ensure QAS infection control guidelines are applied.
- Clean area to be tested using an alcohol swab and allow to dry.
- Prepare lancing device, ensuring it is a fully disposable lancet.
- Without touching the ‘blood target area’, insert the sensor electrode into the test port of the glucometer, ensuring it turns on.
- Lance the side of the finger with the lancet and obtain a hanging drop of blood.
- Move the glucometer to the finger and apply a drop of blood to the target area of the sensor strip.
- The test will start automatically and the BGL reading will appear on the screen.
- Discard the lancet and sensor electrode appropriately.
- Cover the wound with the bandaid.
- Record the patient’s BGL on the eARF.

**Additional information**

- Blood may be drawn from a cannula while gaining IV access.
- Some machine configurations allow the sensor strip to touch the skin, while others specify that the sensor must not touch the skin.
- Ensure glucometer is calibrated as per manufacturer’s recommendation.[1]
- Alcohol can affect the BGL result; the use of a new bandaid represents a readily available near-sterile option for drying the site.
A mental status assessment is the process of conducting a systematic evaluation of the patient’s thought processes at a particular time. The intention of such an examination is to guide the paramedic in identifying pertinent behavioural manifestations, but not to diagnose a specific condition. The information gained, along with any pertinent history, is useful in completing an Emergency Examination Order (EEO), if required.

<table>
<thead>
<tr>
<th>Authorisation to practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mental status assessment</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Indications</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Behavioural abnormalities</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Contraindications</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Nil in this setting</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Complications</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Violent patients</td>
</tr>
<tr>
<td>- Refusal of assessment and/or treatment</td>
</tr>
</tbody>
</table>
### Procedure

- Assess the patient appropriately to try to ascertain the cause of the presenting signs and symptoms.
- Exclude and/or manage other causes of behaviour.
- Attempt to treat the patient only if safe to do so.
- Using the guide to mental status examination observe, question and note relevant information.

### Additional information

#### MENTAL STATUS ASSESSMENT GUIDE

<table>
<thead>
<tr>
<th>Appearance</th>
<th>Thought form</th>
</tr>
</thead>
<tbody>
<tr>
<td>grooming</td>
<td>amount</td>
</tr>
<tr>
<td>posture</td>
<td>rate</td>
</tr>
<tr>
<td>build</td>
<td>derailment</td>
</tr>
<tr>
<td>clothing</td>
<td>flight of ideas</td>
</tr>
<tr>
<td>cleanliness</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Behaviour</th>
<th>Thought content</th>
</tr>
</thead>
<tbody>
<tr>
<td>eye contact</td>
<td>disturbances</td>
</tr>
<tr>
<td>mannerisms</td>
<td>delusions</td>
</tr>
<tr>
<td>gait</td>
<td>suicidal</td>
</tr>
<tr>
<td>activity level</td>
<td>obsessions</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Speech</th>
<th>Perception</th>
</tr>
</thead>
<tbody>
<tr>
<td>rate</td>
<td>Illusions</td>
</tr>
<tr>
<td>volume</td>
<td>thought insertion</td>
</tr>
<tr>
<td>pitch</td>
<td>broadcasting</td>
</tr>
<tr>
<td>tone</td>
<td>hallucinations</td>
</tr>
<tr>
<td>flow</td>
<td>- auditory</td>
</tr>
<tr>
<td>pressure</td>
<td>- olfactory</td>
</tr>
<tr>
<td></td>
<td>- tactile</td>
</tr>
<tr>
<td></td>
<td>- visual</td>
</tr>
<tr>
<td></td>
<td>- gustatory</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mood</th>
<th>Insight &amp; judgement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emotion as described:</td>
<td>cognition</td>
</tr>
<tr>
<td>anxious</td>
<td>illness</td>
</tr>
<tr>
<td>depressed</td>
<td>- understanding</td>
</tr>
<tr>
<td>cheerful</td>
<td>- cause &amp; effect</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Affect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emotion as observed:</td>
</tr>
<tr>
<td>restrictive</td>
</tr>
<tr>
<td>blunted</td>
</tr>
<tr>
<td>labile</td>
</tr>
</tbody>
</table>
The neurological status assessment forms part of the overall patient assessment process.

Patients with an impaired level of consciousness or obvious impairment require as detailed a neurological assessment as is practicable to the circumstances.

**Indications**
- To assess the patient’s neurological status

**Contraindications**
- Nil in this setting

**Precautions**
- The normal neurological status of a patient must be taken into account during assessment
There are five critical areas to a neurological assessment:

**Level of consciousness**
- The AVPU scale represents a tool easily applied during the initial patient assessment. In the AVPU assessment, three questions are asked:

<table>
<thead>
<tr>
<th>Alert</th>
<th>Is the patient alert?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Verbal</td>
<td>Does the patient respond to a verbal command?</td>
</tr>
<tr>
<td>Pain</td>
<td>Does the patient respond to a painful stimulus?</td>
</tr>
<tr>
<td>Unconscious</td>
<td>With no response to any of the above, the patient is considered unconscious.</td>
</tr>
</tbody>
</table>

- A formal assessment of the GCS is subsequently performed as soon as possible and repeated throughout patient management.

**Pupils**
- Pupil size must be determined as:
  - pinpoint (< 2 mm)
  - normal (2 – 6 mm)
  - dilated (> 6 mm)
- Assess the pupillary reaction to light using a small bright light. Direct light reflex is assessed by covering one eye and shining the light directly into the open eye which should result in a rapid constriction.
- Assessment is repeated on the other eye. Both reactions should be equal.
- Document any unusual eye movement such as deviation from midline, dilated, or non reactive pupils on one side, indicating possible raised intracranial pressure (ICP) or nerve compression.
Motor function

- Muscle strength and tone, including any obvious facial weakness
- Abnormal movements such as seizures, tremors or decorticate/decerebrate posturing. The latter is an ominous sign and may occur spontaneously, or to painful stimuli.

Sensory function

- Hearing and ability to understand verbal communication.
- Superficial sensation (light touch or pain).

Vital signs

- Assess respirations for rate, rhythm and effort.
- Assess blood pressure and pulse to ensure adequate perfusion status. Note that a widening pulse pressure and slowing pulse rate may indicate a rising ICP.[2]
- Assess body temperature and maintain normothermia.
QAS clinical practice defines a paediatric patient as 12 years of age or less.

Children are not to be considered small adults due to marked anatomical and physiological differences. Further to this, their exceptional ability to compensate well for significant injury or illness means that the severity of their condition may be overlooked or underestimated.[1]

The assessment of a paediatric patient requires a high level of clinical knowledge and judgement, incorporating not only the patient’s age, development and social circumstances, but also their anatomical, physiological and psychological status.

This is pertinent to all paediatric age groups, but it is of particular relevance in patients under 2 years of age where signs and symptoms of serious injury or illness may be subtle and rapid deterioration is common.[1] It is therefore recommended that all paediatric patients be transported by QAS for further assessment.
The process of paediatric assessment includes the same elements as the assessment of an adult. However, assessment is performed with consideration of four key categories that encompass the primary differences:

- weight
- anatomical
- physiological
- psychological

**Weight**

Most paediatric drugs or therapies are administered on a per kilogram of weight basis. A new paediatric weight estimation method – the Luscombe formula – is more accurate than the Argall and Advanced paediatric life support formulas, as well as the ‘best guess’ method.[2]

Several studies have shown that it is the most accurate estimation formula for paediatrics in developed countries, and, as such, it has been adopted by the QAS to estimate paediatric weights:

\[(\text{Age} \times 3) + 7\]

**Anatomical**

**Airway**

There are significant differences between adult and paediatric airways, including:

- narrow nostrils
- large tongue
- loose teeth
- compressible mouth floor
- horseshoe-shaped epiglottis
- high anterior larynx.

**Breathing**

- A small amount of airway obstruction can have significant effects on airflow.
- Infants are considered diaphragmatic breathers, therefore rapid gastric decompression can improve respiratory function.[3]
- Muscles can fatigue quickly.
- A compliant chest wall means significant underlying injury can occur without rib fracture.
**Circulation**

- Small blood or fluid loss in the infant or small child is clinically significant due to a small total blood volume.\(^1\)
- Hypotension is a serious and late sign in the paediatric patient.\(^3\) The decision to resuscitate should be primarily based on other clinical signs such as:
  - heart rate
  - capillary refill
  - appearance.
Procedure (continued)

Physiological

The expected vital signs throughout paediatric age groups differ to that of the adult patient. These are summarised as follows:

<table>
<thead>
<tr>
<th>Age</th>
<th>Neonate</th>
<th>6 Months</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight (kg)</td>
<td>3.5</td>
<td>7</td>
<td>10</td>
<td>13</td>
<td>16</td>
<td>19</td>
<td>22</td>
<td>25</td>
<td>28</td>
<td>31</td>
<td>34</td>
<td>37</td>
<td>40</td>
<td>43</td>
</tr>
<tr>
<td>Heart rate</td>
<td>100 – 160</td>
<td>100 – 160</td>
<td>90 – 150</td>
<td>80 – 140</td>
<td>70 – 120</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Respiration</td>
<td>25 – 50</td>
<td>20 – 30</td>
<td>15 – 25</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Systolic BP</td>
<td>60 – 70</td>
<td>70 – 100</td>
<td>80 – 110</td>
<td>90 – 115</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Psychological

- Paramedics must consider stages of child development and behaviour when assessing paediatric patients.
- Specific challenges lie in communication and alleviation of a child’s fear.
- Parents and carers should be involved in the assessment process whenever practical.
Relieving pain is an important component of patient care. Appropriate assessment and adequate analgesia underpins all aspects of paramedic practice. The accurate assessment of pain is challenging as pain is a subjective sensation and unique to the individual. For this reason the paramedic must take care not to let personal experience or preconceptions affect their assessment and appropriate management.

<table>
<thead>
<tr>
<th>Authorisation to practice</th>
<th>Indications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pain assessment</td>
<td>• Any patient suspected of experiencing pain or discomfort</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Contraindications</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Nil in this setting</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Precautions</th>
</tr>
</thead>
<tbody>
<tr>
<td>• The absence of pain does not always indicate the absence of injury.</td>
</tr>
</tbody>
</table>
The assessment of pain is dependant on age, verbal and cognitive capacity of the patient.

A commonly accepted mnemonic used for the assessment of pain is:

- **O** Onset: What was the patient doing when the pain started (active, inactive, stressed), and was the onset sudden, gradual or part of an ongoing chronic problem.
- **P** Position/palliation: Where is the pain? Does anything make the pain better or worse?
- **Q** Quality: Describe the pain. For example is it dull, sharp or crushing.
- **R** Region/radiation: Does the pain radiate or move anywhere?
- **S** Severity: How severe is the pain? (See below).
- **T** Timing: When did the pain start and does it come and go?

Self reporting of pain is the recommended method to assess severity. Strategies have been developed dependant on age.

**Adult**

- The most common method for assessing pain severity in the adult is with a numerical rating scale of 0 to 10 (0 denoting no pain through to 10 denoting the worst pain imaginable).
  - 0 = nil pain,
  - 1–4 = mild pain,
  - 5–7 = moderate pain,
  - 8–10 = severe pain.

**Child**

- Should the patient be unable to comprehend the numerical scale, a verbal rating scale can be used with the patient describing severity as no pain, mild, moderate or severe.

**Wong-Baker FACES Pain Rating Scale**

- Point to each face using the words to describe the pain intensity. Ask the child to choose a face that best describes their own pain and record the appropriate number.


**Infant**

- Behavioural cues may become the primary means to assess pain in infants who are unable to speak, comprehend or use self-reporting tools due to their varying developmental stages of life.
This is achieved with the use of the FLACC behavioural assessment scale:

<table>
<thead>
<tr>
<th>Categories</th>
<th>SCORING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Face</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>No particular expression or smile</td>
</tr>
<tr>
<td>1</td>
<td>Occasional grimace or frown, withdrawn, disinterested</td>
</tr>
<tr>
<td>2</td>
<td>Frequent to constant quivering chin, clenched jaw</td>
</tr>
<tr>
<td>Legs</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>Normal position or relaxed</td>
</tr>
<tr>
<td>1</td>
<td>Uneasy, restless, tense</td>
</tr>
<tr>
<td>2</td>
<td>Kicking, or legs drawn up</td>
</tr>
<tr>
<td>Activity</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>Lying quietly, normal position, moves easily</td>
</tr>
<tr>
<td>1</td>
<td>Squirming, shifting back and forth, tense</td>
</tr>
<tr>
<td>2</td>
<td>Arched, rigid or jerking</td>
</tr>
<tr>
<td>Cry</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>No cry, (awake or asleep)</td>
</tr>
<tr>
<td>1</td>
<td>Moans or whimpers, occasional complaint</td>
</tr>
<tr>
<td>2</td>
<td>Crying steadily, screams or sobs, frequent complaints</td>
</tr>
<tr>
<td>Consolability</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>Content, relaxed</td>
</tr>
<tr>
<td>1</td>
<td>Reassured by occasional touching hugging or being talked to, distracted</td>
</tr>
<tr>
<td>2</td>
<td>Difficult to console or comfort</td>
</tr>
</tbody>
</table>
Additional information

- The paramedic is to perform regular pain assessments throughout their treatment. Of particular importance is severity, particularly after analgesic administration.
- Severe, uncontrolled pain may lead to irrational and unexpected behaviour in some individuals.
Perfusion is the ability of the cardiovascular system to supply the body tissues with an adequate blood supply to meet their functional demands.

With inadequate systemic perfusion there is usually an initial loss of blood flow and pressure to less crucial organs (e.g. skin and gastrointestinal system) in order to maintain the flow to more vital organs (i.e. brain and heart).

Early vital sign assessment is crucial within the systematic approach to patient care, which considers perfusion as a time critical determinant of management.

### Authorisation to practice

<table>
<thead>
<tr>
<th>Perfusion status assessment</th>
</tr>
</thead>
</table>

### Indications

- All patients who raise a suspicion of haemodynamic compromise, either clinically, in history, or by mechanism of injury

### Contraindications

- Nil in this setting

### Precautions

- Nil in this setting

### Additional information

- Other factors may affect the interpretation of perfusion, for example, the environment, medication, age and anxiety.
- It is important to remember that, despite normal vital signs, significant hypovolemia may be present.
## ADULT PERFUSION STATUS ASSESSMENT

<table>
<thead>
<tr>
<th>Skin</th>
<th>Pulse</th>
<th>BP</th>
<th>Consciousness</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Adequate perfusion</strong></td>
<td>Warm, pink, dry</td>
<td>60 – 100 bmp</td>
<td>&gt; 100 mmHg systolic</td>
</tr>
<tr>
<td><strong>Borderline perfusion</strong></td>
<td>Cool, pale, clammy</td>
<td>50 – 100 bpm</td>
<td>80 – 100 mmHg systolic</td>
</tr>
<tr>
<td><strong>Inadequate perfusion</strong></td>
<td>Cool, pale, clammy</td>
<td>&lt; 50 bpm or &gt; 100 bpm</td>
<td>60 – 80 mmHg systolic</td>
</tr>
<tr>
<td><strong>Grossly inadequate perfusion</strong></td>
<td>Cool pale, clammy</td>
<td>&lt; 50 bpm or &gt; 120 bpm</td>
<td>&lt; 60 mmHg systolic or unrecordable</td>
</tr>
<tr>
<td><strong>No perfusion</strong></td>
<td>Cool pale, clammy</td>
<td>Absence of palpable pulses</td>
<td>Unrecordable</td>
</tr>
</tbody>
</table>

## CHILD PERFUSION STATUS ASSESSMENT

<table>
<thead>
<tr>
<th>Skin</th>
<th>Pulse</th>
<th>BP</th>
<th>Consciousness</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Adequate perfusion</strong></td>
<td>Warm, pink, dry</td>
<td>80 – 160 bmp</td>
<td>&gt; 70 mmHg systolic</td>
</tr>
<tr>
<td><strong>Borderline perfusion</strong></td>
<td>Cool, pale, clammy</td>
<td>50 – 80 bpm</td>
<td>50 – 70 mmHg systolic</td>
</tr>
<tr>
<td><strong>Inadequate perfusion</strong></td>
<td>Cool, pale, clammy</td>
<td>&lt; 75 bpm or &gt; 130 bpm</td>
<td>40 – 50 mmHg systolic</td>
</tr>
<tr>
<td><strong>Grossly inadequate perfusion</strong></td>
<td>Cool pale, clammy</td>
<td>&lt; 50 bpm or &gt; 140 bpm</td>
<td>&lt; 40 mmHg systolic or unrecordable</td>
</tr>
<tr>
<td><strong>No perfusion</strong></td>
<td>Cool pale, clammy</td>
<td>Absence of palpable pulses</td>
<td>Unrecordable</td>
</tr>
</tbody>
</table>

**Note:** The lowest criterion determines the overall perfusion status.
Pre-hospital ultrasound is a growing field in the assessment of trauma and critically ill patients.[1] It includes focused assessment of sonography for trauma (FAST), lung ultrasound and focused echocardiography. The QAS currently utilises this modality in proof of concept trials.

### Indications
- FAST and lung scanning
  - blunt trauma
  - penetrating trauma
- Focused echo
  - cardiac arrest

### Contraindications
- Nil in this setting

### Precautions
- FAST is a dynamic investigation. Clinical judgment continues to guide patient therapy irrespective of ultrasound findings.

### Additional information

**FAST**
FAST is a portable ultrasound examination used for trauma patients to determine whether there is any fluid within the abdomen and/or pericardium.[2] In the trauma setting this fluid is assumed to represent blood and is visualised as anechoic (black) on the ultrasound.

Four views comprise a FAST scan:
- Morrison’s pouch – right upper quadrant (hepatorenal space)
- splenorenal space – left upper quadrant
- subxiphoid pericardial view
- pelvic view – longitudinal and transverse.
**Additional information (continued)**

Ideally, the total time to complete the examination should be within two minutes.\(^3\)

Visualising fluid in any of the above views constitutes a positive FAST scan. Morrison’s pouch is the view which is most likely to demonstrate significant fluid within the peritoneum, regardless of the actual injury.

Ultrasound can detect volumes of fluid greater than 100 mL.\(^2\)
A 0.5 and 1.0 centimetre rim of fluid in Morrison’s pouch represents 500 mL and 1000 mL centimetre of blood loss respectively.

A positive FAST scan communicated to a receiving emergency department facilitates timely definitive care of the patient’s injuries.\(^3\)

**Lung scanning**

*Pneumothorax*

Ultrasound can further be employed to determine the presence or absence of a pneumothorax.\(^4\)

A normal scan is visualised as a series of horizontal lines down to the bright pleura, beneath which is a speckled pattern representing the moving lung, which has been likened to waves on a seashore.

A scan positive for pneumothorax does not demonstrate the speckling beneath the pleura interface. Instead the horizontal lines continue below, indicating no lung movement beneath the pleural line.

*Haemothorax*

An extension of Morrison’s Pouch view and the splenorenal view can include scanning above the diaphragm to visualise the lung and determine whether or not fluid is present – representing haemothorax in the setting of trauma.

**Focused echo in cardiac arrest**

Ultrasound is also employed in the cardiac arrest setting to aid diagnosis and prognosis.

Cardiac echo can be used to diagnose or exclude potentially treatable causes of cardiac arrest, including tamponade, massive pulmonary embolism, severe ventricular dysfunction and hypovolaemia.\(^6\)

Furthermore in the PEA arrest scenario, focused echo can guide prognosis: the appearance of cardiac standstill implies further resuscitative measures are futile.\(^6\)
This assessment forms an essential component of patient management. It comprises many individual and often ‘stand-alone’ components all of which, when viewed together, provide a comprehensive clinical picture of the patient.

The paramedic should initiate a primary and secondary assessment as soon as possible in every case. The collecting of patient assessment information and administering care are carried out simultaneously.
The purpose of a primary survey is to identify and immediately treat life-threatening conditions. The sequencing of the primary survey has been changed to bring it in line with contemporary clinical practices.\[1\]

**Primary survey:**
- **Danger**
- **Response**
- **Circulation**
- **Airway**
- **Breathing**

The secondary survey is aimed at obtaining a detailed history, along with vital signs and then performing a focused physical examination based on the patient's symptoms.

**Secondary survey:**
- **History**
- **Vital signs survey**
- **Physical examination**

### PRIMARY SURVEY

<table>
<thead>
<tr>
<th>PRIMARY SURVEY</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DANGER</strong></td>
<td>Check for DANGER (yourself, partner, bystanders and patient)</td>
</tr>
<tr>
<td><strong>RESPONSE</strong></td>
<td>Check the patient's RESPONSE to stimulus to determine level of consciousness. Use the AVPU scale: Is the patient Alert? Is the patient responding to Verbal stimuli, responding only to Painful stimuli, or Unresponsive?</td>
</tr>
<tr>
<td><strong>CIRCULATION</strong></td>
<td>Check if the patient has a pulse (CIRCULATION) and, if so, determine if it is adequate. Assess capillary refill in paediatric patients. <strong>Consider:</strong> Defibrillation, haemorrhage control, leg elevation (except for spinal injury), IV/IO access and fluid therapy</td>
</tr>
<tr>
<td><strong>AIRWAY</strong></td>
<td>Check if the patient has a patent AIRWAY and ensure there is no danger of future airway obstruction (e.g. stridor). <strong>Consider:</strong> C-spine immobolisation, simple airway manoeuvres, suctioning, basic and advanced airway adjuncts – OP, NPA, LMA, ETT</td>
</tr>
<tr>
<td><strong>BREATHING</strong></td>
<td>Check if the patient is BREATHING and has adequate ventilations. <strong>Consider:</strong> Oxygen and IPPV</td>
</tr>
</tbody>
</table>
SECONDARY SURVEY

**HISTORY**

Obtain a comprehensive history:
- **Onset**
- **Provocation**
- **Quality**
- **Radiation**
- **Severity**
- **Timing**
- **Signs/symptoms**
- **Allergies**
- **Medications**
- **Past medical Hx**
- **Events prior**
- **Lacerations, deformity, facial muscle, or asymmetry**
- **Eyes**
- **Ears**
- **Nose**
- **Mouth**
- **Voice**
- **General**
- **Lacerations, deformity, facial muscle, or asymmetry**
- **Pupils or evidence of raccoon eyes** (bruising around orbits suggestive of basal skull fracture)
- **Blood in canal or evidence of battle's sign (significant bruising behind the ears (over mastoid process) suggestive of base of skull fracture)**
- **Deformity or epistaxis**
- **Loose teeth, bite malocclusion (suggestive of a mandibular fracture) or airway/tongue swelling**
- **Hoarseness**
- **Crepitus, bony tenderness, or subcutaneous emphysema**

**VITAL SIGN SURVEY**

Complete a more detailed assessment of all appropriate vital signs:
- Pulse
- Respiration rate
- Blood pressure
- Temperature
- SpO₂
- Blood glucose level
- Glasgow coma scale
- 12-Lead ECG

**PHYSICAL EXAMINATION (head-to-toe)**

Complete a comprehensive physical examination of the patient as appropriate. This is particularly applicable in trauma, but may not be relevant in many medical presentations.

**NECK**

**Inspect**
- Deformity, laceration or either raised JVP or JVD or jugular venous distension

**Palpate**
- Tracheal position, bony tenderness, carotid pulse, subcutaneous emphysema, or lymphadenopathy.
### Procedure (continued)

#### CHEST

<table>
<thead>
<tr>
<th>Inspect</th>
<th>Expansion, paradoxical movement, accessory muscle use, lacerations, or deformity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Palpate</td>
<td>Tenderness, subcutaneous emphysema, bony crepitus, or apex beat</td>
</tr>
<tr>
<td>Auscultate</td>
<td>Heart sounds, air entry and breath sounds, or additional sounds</td>
</tr>
</tbody>
</table>

#### ABDOMEN

<table>
<thead>
<tr>
<th>Inspect</th>
<th>Laceration, bruising, distension, or priapism (spinal trauma)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Palpate</td>
<td>Tenderness, guarding, rigidity, rebound tenderness, or masses</td>
</tr>
<tr>
<td>Auscultate</td>
<td>Bowel sounds</td>
</tr>
</tbody>
</table>

#### PELVIS

<table>
<thead>
<tr>
<th>Inspect</th>
<th>Laceration, bruising, or deformity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Palpate</td>
<td>Bony tenderness</td>
</tr>
</tbody>
</table>

#### UPPER AND LOWER LIMBS

<table>
<thead>
<tr>
<th>Inspect</th>
<th>Laceration, bruising, deformity, shortening, or rotation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Palpate</td>
<td>Neurovascular status, bony tenderness, or crepitus</td>
</tr>
</tbody>
</table>

#### BACK

<table>
<thead>
<tr>
<th>Inspect</th>
<th>Laceration, bruising, or deformity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Palpate</td>
<td>Bony tenderness, or evidence of a bony step</td>
</tr>
</tbody>
</table>
Pulse oximetry estimates the oxygen saturation in arterial blood (SaO₂), by directing both red and infrared light from two LEDs through a patient’s translucent fleshy body site (usually a finger or earlobe). The absorption of the two wavelengths differs significantly dependent on the level of haemoglobin oxygenation and the pulse oximeter translates this ratio into a percentage (SpO₂).[1]

It is important to consider the relationship between blood oxygenation and measurable haemoglobin saturation when interpreting pulse oximetry. A graphical interpretation is represented below.

A small change in saturations (e.g. a drop of 97% to 90%) represents a large change in blood oxygenation (PO₂ 100 to 60 mmHg).

**Indications**
- To determine patient oxygen saturation

**Contraindications**
- Nil in this setting

**Precautions**[1]
- The reliability of SpO₂ readings depends on the following factors:
  - correct sensor size and placement
  - adequate blood flow through the sensor site

Inaccurate pulse oximetry readings may occur when the following factors are present:
- excessive patient movement
- exposure to ambient light
- dirt or nail polish under the sensor site
- methaemoglobinemia
- carbon monoxide
- insufficient amplitude on the pulsing pleth wave
**Procedure**

- Ensure SpO₂ cable is connected and the sensor is placed on the patient.
- Observe the pulse bar/pleth wave for amplitude; this indicates relative signal strength,
- Note the SpO₂ reading and document accordingly.

**Additional information**

- The SpO₂ of arterial blood is usually 94–100%.
- QAS oxygen saturation monitors are unable to differentiate between carboxyhaemoglobin and oxyhaemoglobin\(^1\) therefore patients with carbon monoxide poisoning are to be administered the maximum oxygen dose irrespective of SpO₂.
- Pulse oximetry is not a complete measure of respiratory or circulatory sufficiency.
There are several components to a comprehensive respiratory assessment in the pre-hospital setting.

### Indications
- All chest and respiratory symptoms and complaints including chest pain or shortness of breath
- Impaired consciousness

### Contraindications
- Nil in this setting

### Precautions
- Nil in this setting

### Authorisation to practice

<table>
<thead>
<tr>
<th>Respiratory status assessment</th>
<th></th>
<th></th>
</tr>
</thead>
</table>
**Procedure**

**RESPIRATORY STATUS ASSESSMENT**

<table>
<thead>
<tr>
<th>Components</th>
<th>Normal</th>
<th>Respiratory distress</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conscious State</td>
<td>Alert</td>
<td>Altered</td>
</tr>
<tr>
<td>General appearance</td>
<td>Calm and quiet</td>
<td>Distressed, anxious, struggling to breathe, exhausted</td>
</tr>
<tr>
<td>Speech</td>
<td>Clear, fluent and steady</td>
<td>Difficult, short sentences or phrases, unable to verbalise</td>
</tr>
<tr>
<td>Ventilatory rate *</td>
<td>12 – 18 (adult)</td>
<td>&gt; 18 (adult)</td>
</tr>
<tr>
<td>Ventilatory rhythm</td>
<td>Regular or even cycles</td>
<td>No respiratory pause, prolonged expiratory phase</td>
</tr>
<tr>
<td>Ventilatory effort</td>
<td>Minimal with little chest or abdominal movement</td>
<td>Marked chest movement, use of accessory muscles</td>
</tr>
<tr>
<td>Skin</td>
<td>Pink</td>
<td>Pale and sweaty; cyanosis is a late and serious sign</td>
</tr>
<tr>
<td>Pulse rate *</td>
<td>60 – 80 (adult)</td>
<td>Tachycardia; bradycardia is a late and serious sign</td>
</tr>
<tr>
<td>Breath sounds</td>
<td>Usually quiet</td>
<td>Upper airway stridor</td>
</tr>
</tbody>
</table>

*Refer to paediatric assessment CPP for relevant physiological parameters for paediatric patients.

**Chest auscultation**

- Limit external noise where possible.
- Position patient upright where possible.
- Ask patient to breathe normally through their mouth.
- Ensure that the stethoscope is held still and that the conductive tubing is kept clear of contact with any surface to avoid extraneous noise.
- Listen to both sides of the chest in a methodical manner. It is important to listen to several respiratory cycles in each location, noting the quality and intensity of the lung sounds.

*Recommended auscultation locations on the anterior and posterior chest*
The SAT is a simple, rapid and useful measure of agitation and sedation in patients with acute behavioural disturbance (ABD).

It is determined by assessing two objective descriptors based on responsiveness and speech and allocating a score derived from a 7-point scale (+3 to -3).

The purpose of the SAT is to determine the patient’s level of agitation and response to medication administration with resultant level of sedation.

**Indications**
- A SAT is required for all patients with ABD prior to and at regular intervals following sedation medication and should complement the patient’s standard vital sign survey.

**Contraindications**
- Nil in this setting

**Complications**
- Nil in this setting
**Procedure**

- Using the patient's responsiveness and speech as described in the table below identify the SAT score.
- Allocate the appropriate SAT score (+3 to -3) by determining the highest ranking (for example a patient displaying very anxious and agitated behaviour but who speaks normally will receive a score of +2).
- Following the delivery of any sedative medication, the patient must be regularly assessed (every 5 mins) and have documentation of the SAT score as well as standard vital signs (GCS, HR, BP, SpO2, RR) on the eARF.
- Any airway adjuncts/maneuvers or requirement for supplemental oxygen must be documented on the treatment and free text section of the eARF.

<table>
<thead>
<tr>
<th>Score</th>
<th>Responsiveness</th>
<th>Speech</th>
</tr>
</thead>
<tbody>
<tr>
<td>+3</td>
<td>Combative, violent, out of control</td>
<td>Continual loud outbursts</td>
</tr>
<tr>
<td>+2</td>
<td>Very anxious and agitated</td>
<td>Loud outbursts</td>
</tr>
<tr>
<td>+1</td>
<td>Anxious/restless</td>
<td>Normal/talkative</td>
</tr>
<tr>
<td>0</td>
<td>Awake and calm/cooperative</td>
<td>Speaks normally</td>
</tr>
<tr>
<td>-1</td>
<td>Asleep but rouses if name is called</td>
<td>Slurring or prominent slowing</td>
</tr>
<tr>
<td>-2</td>
<td>Responds to physical stimulation</td>
<td>Few recognizable words</td>
</tr>
<tr>
<td>-3</td>
<td>No response to stimulation</td>
<td>Nil</td>
</tr>
</tbody>
</table>

**Additional information**

- A SAT score of +2 or +3 is a good predictor of the need to administer sedation and should prompt the ACP to consider requesting ICP backup for assessment and management. In areas with no ICP availability the attending paramedics should call the QAS 24/7 Consultation Line for patient management options.
Vital signs survey

Indications

- QAS paramedics are to obtain vital signs on all patients under their care.
- As a minimum requirement, two full sets of vital signs are to be documented for all patients.

Contraindications

- Nil in this setting

Precautions

- Vital signs may not be taken when doing so would place the paramedic at undue risk of harm.
- A blood pressure is not to be taken on the arm of a patient that has an AV fistula present or on the arm that corresponds to the side of a mastectomy.
- Machine measurements must be correlated with patient condition.
### Procedure

#### Respiration
- The patient should be assessed to note respiratory rate, rhythm, effort and symmetry of chest, which is often most accurately viewed from the foot end of a supine patient.
- Auscultation should then be performed.

#### Pulse
- Assess pulse at the radial, or carotid artery pulse points.
- Other pulse points can be assessed when there is a requirement to determine more specific perfusion. Examples include: distal perfusion to the lower extremities (pedal pulse) or the patient who is in extremis (femoral pulse).
- Note that the brachial artery also provides a pulse point and is commonly used in the paediatric patient.
- **Paramedics must palpate the presence of a pulse.**
  It is not sufficient to rely exclusively on a rate obtained from an ECG, or pulse oximeter.

#### Blood pressure
- Accepted methods to measure BP include auscultation, automated NIBP and, in appropriate circumstances, palpation.
- The operation of any automated NIBP monitor used within the QAS should be in accordance with QAS training and manufacturer’s instructions.\[1\]

### Procedure (continued)

#### Capillary refill
- Capillary refill can be used as an indicator of perfusion and is assessed by applying pressure to the skin for five seconds and then observing the return of colour to the area. The area should return to a pink colour (well perfused) within two seconds to be classed as normal. To assess distal perfusion, apply pressure to the nail bed of a finger or toe. Central perfusion may be assessed through pressure to the forehead, or sternal area.

#### Temperature
- The QAS recommends tympanic thermometers for the measurement of temperature.
- Paramedics should familiarise themselves with the specific tympanic thermometer available to them.\[2\]
- Ensure a disposable sleeve or cover is used over the thermometer probe.
- The probe is gently placed into the patient’s ear and held for an indicated time frame after the thermometer button is depressed.
Waveform capnography is the continuous measurement of exhaled carbon dioxide (CO₂). This is displayed graphically as a capnogram (waveform) representing CO₂ throughout the respiratory cycle. End tidal CO₂ (EtCO₂) is the peak value at the end of each exhalation, and this is displayed numerically in mmHg.\[^1^\][\[^2^\]]

Measurement of EtCO₂ in patients with an advanced airway is an effective, non-invasive indicator of cardiac output during CPR, and may be an early indicator of ROSC.\[^3^\][\[^4^\]]

Capnography will provide objective evidence of breathing patterns and pre-empt any reduction in oxygen saturations. It provides real-time monitoring and readily detects apnoea or respiratory depression.\[^5^\]

EtCO₂ monitoring is mandatory to confirm ETT placement and throughout subsequent ventilation.\[^4^\][\[^6^\]]

*Contraindications*

- Nil in this setting

*Precautions*

- When performing effective CPR during cardiac arrest, EtCO₂ values are **not** to be used to vary IPPV from the recommended rate.\[^3^\]
- LIFEPAK® 12 capnography is not designed to operate at a depth greater than 380 m (1250 ft) or at an unpressurised altitude greater than 4572 m (15,000 ft).\[^7^\]
- In specific underground mining operations alternative devices for monitoring EtCO₂ may be approved under Local Work Instructions.
- When capnography is not in use, failure to keep the EtCO₂ connection port door closed may cause water or contaminants to enter the EtCO₂ sensor and cause capnography to malfunction. Should the EtCO₂ connection port door become dislodged, the port is to be protected with tape, and a replacement or repair is to be arranged ASAP.
Procedure

Procedure for capnography monitoring

- Attach the EtCO₂ sample tube to the capnograph device.
- When using a BVM, LMA or ETT, attach the EtCO₂ sample tube airway adaptor to the breathing circuit, ensuring that a bacterial/viral filter is connected on the 'patient' side.
- It is mandatory that continuous waveform EtCO₂ is working and included in the circuit prior to ETI.
- Carefully route the EtCO₂ sample tube to avoid patient entanglement or strangulation.
- Confirm capnography values are displayed.
- If the EtCO₂ sample tube becomes contaminated or blocked, replace immediately.
- EtCO₂ sample tubes are single-patient, one-time use only, and must be disposed of appropriately after use. Do not clean or reuse sample tubes.

Additional information

- In cardiac arrest, tracheal placement of the ETT must be confirmed using capnography. If there is a complete absence of EtCO₂ (or if the capnography device becomes unserviceable) the ETT must be removed, and the failed intubation algorithm is to be commenced. [3][4]

- In non-cardiac arrest situations, tracheal placement of the ETT must be confirmed and monitored continually with capnography. If the capnogram indicates that tracheal placement cannot be confirmed, the ETT must be removed and the failed intubation drill is to be commenced. [4][6]

- In situations where IPPV is provided without an ETT, (ie when using a BVM or LMA), capnography is highly desirable and it should be connected as soon as other urgent priorities allow. [4]

- QAS clinicians must be familiar with the operating instructions, with particular attention to warnings, alarms and troubleshooting.
**Normal capnogram**

A normal capnogram is present when the patient:
- is spontaneously breathing or adequately ventilated
- has normal cardiac output
- has normal metabolic function

**Endotracheal tube in the oesophagus**

Oesophageal intubation may be confirmed by:
- an absence of waveform and EtCO₂
- small transient diminishing waveforms

**Reduced EtCO₂ levels**

Possible causes:
- shock
- pulmonary embolus
- effective CPR being performed during cardiac arrest

**Sudden significant increase in EtCO₂ levels**

Possible cause:
- return of spontaneous circulation

**Absent EtCO₂ levels and waveform**

Possible causes:
- no metabolic activity
- no CPR in cardiac arrest
- exsanguination/profound shock
- equipment failure
- apnoea
- airway obstruction
- oesophageal placement

**Inadequate seal around endotracheal tube**

Possible causes:
- a leaky or deflated endotracheal or tracheostomy cuff
- an artificial airway that is too small for the patient
### Increasing EtCO₂ levels from normal

**Possible causes:**
- respiratory depression/failure
- inadequate respiratory rate and or tidal volume
- increased CO₂ production through increased metabolic rate or temperature or reperfusion of ischaemic tissue

### Decreasing EtCO₂ levels from normal

**Possible causes:**
- increased respiratory rate and or tidal volume
- diminished CO₂ production through decreased metabolic rate
- falling cardiac output

### Obstruction in breathing circuit or airway

**Possible causes:**
- obstruction in the expiratory limb of the breathing circuit
- presence of a foreign body in upper airway
- partially kinked or occluded artificial airway
- bronchospasm

### Increasing EtCO₂ values towards normal

**Possible causes:**
- restoration of normal respiratory rate and or tidal volume
- cardiac output improved
- improved integrity of airway seal (BVM/LMA/ETT)

### Curare cleft

**Possible cause:**
- inadequate or ‘lightening’ of paralysis

### Decreasing EtCO₂ levels towards normal

**Possible causes:**
- restoration of normal metabolism/CO₂ production
- normalised respiratory rate and or tidal volume