

Pre-Hospital Emergency Anaesthesia

Position Responsible: Medical Director

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Related Documents:

1.0 Aims

- 1.1 To ensure a common, basic, evidence-based approach and the safe and efficient delivery of care to patients receiving pre-hospital anaesthesia. Individual organisations may supplement this Standard Operating Procedure (SOP).
- 1.2 To ensure that the standards of care delivered in the prehospital environment is equal to those delivered in a hospital environment and that they meet or exceed those set out by the AAGBI.

2.0 Background

- 2.1 Pre-hospital emergency anaesthesia (PHEA) may dramatically improve airway management, oxygenation, ventilation, pain relief and outcome. PHEA may speed up the resuscitation-investigation-definitive care process and more than compensate for the additional time on scene.
- 2.2 PHEA is a potentially high-risk undertaking; specific skills, knowledge and experience are required. The risks of anaesthesia (including increased scene time) must be balanced against the risks of no anaesthesia.
- 2.3 All pre-hospital anaesthetics should be performed based on a rapid sequence technique. The purpose of rapid sequence induction and intubation (RSI) is to render the patient unconscious and paralysed in order to intubate the trachea in as short a time as possible whilst limiting the risk of gastric distension and pulmonary aspiration.
- 2.4 Only those doctors or paramedics that have completed the appropriate training and are current within their system are permitted to undertake PHEA, this includes BASICS doctors with appropriate support.

2.5 The indications for pre-hospital emergency anaesthesia are:

- Actual or impending airway compromise (including protection and maintenance)
- Respiratory failure (oxygenation +/- ventilation)
- Head injured patients who are agitated and unmanageable.
- Anticipated clinical course (where the patient is expected to deteriorate rapidly or when intubation and ventilation will have a major impact on expediting life-saving intervention at hospital).
- Humanitarian – to ease suffering and extreme pain in a multiply injured patient.

3.0 Procedure

3.1 Rapid Assessment

3.1.1 Pre-anaesthetic assessment

If time and the clinical situation allows, take a focused “anaesthetic history” from the patient (including past anaesthetics, airway difficulties, past medical history).

3.1.2 Assess the likely difficulties that will be encountered as a result of anaesthesia, including the relative cardiovascular stability / frailty of the patient and whether anaesthetic drug dosage adjustments may be necessary

3.1.3 Examine for the presence of signs indicating a difficult airway and the likelihood of both successful intubation and successful bag-valve-mask ventilation in the event of intubation failure (see 3.2).

3.1.4 Examine for features that suggest the patient will desaturate from the moment of apnoea despite pre-oxygenation (e.g. obesity, pregnancy, children, chest injury)

3.1.5 A small group of patients will remain hypoxic in spite of optimum pre-oxygenation techniques and efforts should be made to address any suspected causes. A potentially easily reversible cause is that of significant pneumothoracies, which can be decompressed (needle decompression – not open thoracostomy if breathing spontaneously) prior to induction of anaesthesia and commencement of positive pressure ventilation.

3.2 Difficult Airway Assessment

3.2.1 Every patient should undergo a rapid pre-anaesthetic airway assessment. It is recognised that the majority of patients attended by the team will have cervical spine immobilisation which in itself does not necessarily predict a difficult airway

3.2.2 Those patients identified as having a potentially difficult airway should have the need for pre-hospital anaesthesia re-assessed. Surgical airway equipment should be available for immediate use before every induction. The most experienced operator

within the team should have the first attempt at laryngoscopy if a difficult airway is anticipated.

3.3.3 Decisions regarding drug doses, laryngoscope blade type, endotracheal tube size etc., should be made prior to commencing the pre-anaesthetic checklist.

3.3 Difficult Airway Management

3.3.1 A difficult airway is one in which direct laryngoscopy or bag-valve-mask ventilation is difficult or impossible. While all pre-hospital airway management should be considered difficult, some features may suggest higher than normal difficulty.

3.3.2 Identify those patients that are at increased risk of having a “difficult airway” (see “Difficult Airway Assessment” above)

3.3.3 If a “Difficult Airway” is identified –

- Reconsider the need for pre-hospital anaesthesia.
- Consider whether a primary surgical airway is indicated.
- The most experienced laryngoscopist should be involved with at least one of the attempts at intubation

3.4 Vascular access

3.4.1 If possible, two intravenous lines should be established prior to induction. Patency of access should be checked. Intraosseous (IO) access can be used if no intravenous access is available.

3.4.2 At least one of the intravenous access sites should have intravenous fluids attached, serving as visual confirmation of cannula patency and allowing immediate access to a fluid bolus if required.

3.5 Monitoring

3.5.1 Every patient undergoing anaesthesia must have monitoring applied as per AAGBI guideline. This includes –

- Continuous pulse oximetry SpO₂
- Non-Invasive Blood Pressure (with a cycling interval set to at least every 3 minutes)
- Continuous ECG cardiac monitoring
- Continuous end-tidal CO₂ monitoring

3.6 Positioning

3.6.1 Every effort should be made to establish adequate (ideally 360°) access before induction of anaesthesia and efforts can be made to place the patient with a head-up tilt on an ambulance trolley where practical to improve view. This may involve

moving the patient to another part of the scene in order to achieve it. Occasionally, clinical urgency or environmental factors may dictate that anaesthesia is performed inside an ambulance.

- 3.6.2 Optimise the first attempt at intubation. Only under exceptional circumstances should a patient be anaesthetised at ground level or in unusual positions or postures.
- 3.6.3 The patient should be in a supine position with manual inline immobilisation of the cervical spine if necessary (i.e. collar and blocks removed). There should be no restriction in the movement of the mandible.
- 3.6.4 Attention should also be given to the position of the sun or other bright light sources (blue lights at night) as this may result in a poor view under laryngoscopy. The impact of other environmental considerations (water, wind) should also be considered.
- 3.6.5 Complex extrication and patient movements (e.g. across ditches / fences) after anaesthesia should be avoided.

3.7 Task allocation

- 3.7.1 One person should be responsible for each of the following:
 - 1. Laryngoscopy (“Operator”)
 - 2. Drugs & Equipment (“Assistant”)
 - 3. Cricoid pressure, if required
 - 4. Cervical spine control, if required
- 3.7.2 The operator and assistant roles should always be undertaken by the enhanced care team members. Team members should be able to swap roles as required and agreed within their organisation.

3.8 Oxygenation

- 3.8.1 Pre-oxygenation should be employed prior to induction of anaesthesia and requires at least two oxygen cylinders.
- 3.8.2 Nasal oxygen is intended to assist with pre-oxygenation and to provide apnoeic oxygenation and should be used to reduce induction-related hypoxia in high-risk groups (those with brain injuries, difficult airways or otherwise at particular risk of hypoxia). Nasal cannula should be placed under the patient’s nose connected to high-flow oxygen. Alert patients will find 15L/min uncomfortable – start with 2L/min and turn to 15L/min on induction. NB –contraindicated with maxillo-facial injuries.
- 3.8.3 Over the nasal oxygen, apply a Bag Valve Mask (BVM) +/- PEEP valve, or a well fitting face-mask with reservoir bag connected to a second cylinder of oxygen running at 15L/min
- 3.8.4 Agitated patients require sedation in order to facilitate pre-oxygenation prior to safe induction of anaesthesia. It is important to remember that the desired level of

sedation is that of being able to tolerate pre oxygenation whilst spontaneously breathing and maintaining intact airway reflexes, avoiding apnoea.

3.8.5 In a spontaneously breathing patient at least three minutes of pre-oxygenation is required to denitrogenate the lungs. In alert co-operative patients, eight “deep” vital capacity breaths may provide equivalent pre-oxygenation.

3.9 Pre-treatment

3.9.1 In hypotensive/shocked/cardiographically unstable patients, reduce external haemorrhage (e.g. application of splints) and consider giving a 250-500ml fluid bolus and reducing induction drug dose regime.

3.10 Anaesthetic Drugs

3.10.1 The primary anaesthetic agents used are –

- Ketamine 10mg/ml
- Fentanyl 50mcg/ml
- Rocuronium 10mg/ml

3.10.2 Clinical judgment must be used when determining the appropriate medications and doses that are needed to provide anaesthesia. Patients that are already deeply unconscious, shocked or that are post-cardiac arrest (with a return of spontaneous circulation) are at little risk of anaesthetic awareness and should have a significant dose reduction of hypnotic agents. Advice should be sought in cases of uncertainty.

3.10.3 The following is a guide for the induction of anaesthesia -

Haemodynamically normal patient - “3 : 2 : 1”

Fentanyl 3 mcg/kg + ketamine 2mg/kg + rocuronium 1 mg/kg

The above doses may be altered according to clinical presentation and following teammate discussion.

Doses should be rounded to easy to remember, safe, doses. Do not round down rocuronium, only round up, as a 1.2mg/kg dose of rocuronium is optimal.

Patient with significant compromise - “1:1”

Ketamine 1 mg/kg + rocuronium 1 mg/kg

3.10.4 Elderly patients are likely to require reduced doses despite apparent cardiovascular stability, as will shocked patients.

3.10.5 In moribund patients, rocuronium only may be required as part of a “crash intubation”.

3.10.6 Rocuronium when used at a dose of 1.2mg/kg will provide good intubating conditions within 60 seconds. For safe calculations 1mg/kg is used, but all rocuronium dose calculations should be rounded up to give doses closer to 1.2mg/kg.

3.11 Induction of Anaesthesia

3.11.1 A challenge-and-response checklist should be used for every planned pre-hospital anaesthetic. It is not intended to be used as part of “crash” emergency airway management for which an abridged emergency checklist is used.

- Ensure pre-anaesthetic checklist is complete
- Mark time of induction
- Give IV induction agents and saline flush
- Wait 45 seconds
- It may be necessary to gently ventilate throughout the period of apnoea. This will become easier as the muscle relaxation takes effect but will be made easier still with the use of an oropharyngeal airway.
- It may not be possible to achieve oxygen saturations >95% in the presence of severe chest injuries, cardiac shunts or profound hypotension. Clinical judgment must be applied and intubation should only be attempted if the team feel oxygenation has been optimised. Periods of apnoea should not be allowed in these patient groups.
- The oxygen facemask and nasal oxygen should be left applied and the airway maintained open until immediately before the moment that laryngoscopy is attempted.
- Muscle tone (e.g. jaw opening) should be assessed after 45 seconds. If mouth opening remains poor, oxygenate and wait a further 15 seconds.
- Once muscle relaxation has occurred, proceed to Plan A of the Emergency Anaesthesia Airway Management Algorithm.

3.11.2 Plan A – Initial RSI Intubation Plan

- Laryngoscopy – direct or videolaryngoscopy. Use a Macintosh / videolaryngoscope size 4 blade for an adult, and a proportionally smaller blade for children. A straight/Miller blade may be considered for children under 1-year-old. A size 8.0 ETT for adult males and a size 7.0 ETT for adult females is appropriate in most cases.
- If the glottic inlet is not visualised, rapidly – within 20 seconds - progress through –
 - o Release cricoid pressure (If applied)
 - o A BURP manoeuvre (Backwards, Upwards, Rightwards Pressure) of the thyroid cartilage (not cricoid cartilage)
 - o External laryngeal manipulation (ELM) by the laryngoscopist’s right hand.
 - o Confirm appropriate patient and operator positioning

- o Insert blade to maximum and slowly withdraw under vision
- o Suction as required
- The glottic aperture should be visualised and the tip of a gum elastic bougie placed a few cm into the trachea.
- While maintaining the view and keeping the laryngoscope in place, an assistant should then pass a tracheal tube over the bougie. A bougie or stylet should be used for all intubations.
- Blind attempts at passing a bougie into the glottis aperture are discouraged and should be a last resort.
- The endotracheal tube is then progressed into the trachea while the assistant holds the bougie. The entire process should take place under direct vision. Once the tube is in place and the cuff is inflated the laryngoscope should be removed.
- Correct tube placement should be confirmed immediately by the use of waveform capnography. Absent carbon dioxide should prompt the removal of the endotracheal tube and a reversion to attempts at oxygenation.
- If the first attempt at laryngoscopy fails, then –
 - o Maintain oxygenation using BVM ventilation and airway adjuncts
 - o A further good attempt at laryngoscopy may be undertaken provided deliberate steps have been taken to identify and rectify the problem causing the failure and that oxygenation can be maintained between attempts.
 - o Change at least one feature that was used during the first attempt such that the second attempt is likely to be successful. If not already doing so, the most experienced laryngoscopist should perform the second direct laryngoscopy.
 - o Consider using a hyperangulated (“difficult”) videolaryngoscope blade (if available) or a McCoy blade if the glottis inlet was not initially well visualised (C&L grade III or IV view)
 - o Use external laryngeal manipulation (ELM) and/or the BURP manoeuvre if laryngeal inlet not clear visualised.
- If after two good attempts at laryngoscopy intubation is not achieved, proceed to Plan B. Further attempts at laryngoscopy should not be made unless a significant change in circumstances occurs or some other exceptional circumstance arises.
- Those trained and current in the use of videolaryngoscopy may use this in place of direct laryngoscopy. Attempts at intubation using videolaryngoscopy should not exceed two attempts, nor should they be attempted in the face of an inability to maintain high oxygen saturations.

3.11.3 Plan B – Rescue Ventilation Plan

- Insert supraglottic airway device (SAD)
- If this allows adequate oxygenation (SpO₂>92%) then extend anaesthesia.
- If the SAD does not provide adequate oxygenation, proceed to Plan C.

3.11.4 Plan C – Rescue Oxygenation Plan

- Insert oropharyngeal airway
- Attempt oxygenation with facemask and bag-valve-mask
- Use two-handed technique, two-person technique
- Use jaw-thrust
- Use chin-lift if no cervical spine injury suspected
- Insert nasopharyngeal airway(s) if required
- If unable to oxygenate proceed to Plan D

3.11.5 Plan D – Surgical Airway as per local Surgical Airway SOP/Supplement.

NOTE – The Essex & Herts Air Ambulance use an alternative technique for the surgical airway

- Perform a “laryngeal handshake” to identify the cricothyroid membrane
- **Palpable cricothyroid membrane?**
 - o Transverse stab incision through cricothyroid membrane
 - o Turn blade through 90° (sharp edge caudally)
 - o Slide bougie tip along blade into trachea
 - o Railroad lubricated 6.0mm cuffed tracheal tube into trachea and inflate cuff
 - o Connect to breathing circuit and capnography
 - o Confirm endotracheal position (endobronchial intubation is common) and secure the endotracheal tube
- **Impalpable cricothyroid membrane?**
 - o Make a 10cm vertical skin incision caudad to cephalad
 - o Use blunt dissection with fingers of both hands to separate tissues
 - o Identify and stabilize the larynx
 - o Proceed with technique for palpable cricothyroid membrane as above
- Tracheal dilators or insertion of a finger may be used to assist with opening the access to allow passage of the bougie.
- Pass suction catheter through endotracheal tube to aspirate blood / secretions
- Once airway secure, reassess physiology and consider extending anaesthesia.

3.12 Proof of Endotracheal Tube Placement

3.12.1 Determination of correct tube placement involves the following -

- End Tidal waveform CO₂ monitoring (without capnography tube placement cannot reliably be confirmed)
- See the tube passing through the vocal cords
- See the chest expand equally with each ventilation
- Auscultation of breath sounds in both axillae

- Absence of epigastric sounds with ventilation
- See vapour condense in the tube with each ventilation

3.12.2 Clinical signs alone are not sufficiently reliable in the pre-hospital environment and tube placement MUST always be confirmed by end tidal CO₂ detection. Breath sounds and chest movements can be replicated by oesophageal ventilation

3.12.3 If there is any doubt about the correct placement of the tube it should be removed

3.12.4 The length of the tube at the teeth should be noted and recorded. For adults this should rarely be more than 23cm.

3.12.5 Once tracheal tube placement is confirmed it should be secured in place.

3.13 “Crash Intubation”

3.13.1 The term “crash intubation” is used to describe a peri-arrest patient who requires immediate airway management.

3.13.2 Crash intubation procedure -

3.13.3 The team must focus on preparing the minimum equipment required to secure the airway safely.

3.13.4 One team member should focus on the assertive use of a facemask, self-inflating bag and airway adjuncts to provide oxygenation.

3.13.5 The other teammate should prepare the equipment for intubation (laryngoscope, bougie, endotracheal tube, capnograph, suction). If ventilation and oxygenation is possible then a full equipment dump may be assembled.

3.13.6 Use of the pre-anaesthetic ‘immediate’ checklist applies to a “crash intubation”.

3.13.7 When the necessary equipment is ready the airway should be secured following Plans A – D above

3.13.8 Cricoid pressure should be omitted under “crash” conditions.

3.13.9 Use a muscle-relaxant if a near-death patient demonstrates increased muscle tone / trismus such that airway management is difficult. Give rocuronium 1mg/kg if IV or IO access is available

3.13.10 Consider a primary surgical airway in near-death patients in whom a difficult intubation is predicted (for example massive maxillofacial injuries) or for trapped patients in whom good access is restricted or intubation is felt to be impossible (burns, anaphylaxis)

3.14 Maintenance of Anaesthesia

- 3.14.1 Minimum monitoring must remain in place (SpO₂, NIBP, ECG, E_tCO₂) and a repeat set of observations made as soon as the airway is secured.
- 3.14.2 Following induction, sedative can be maintained as an infusion or as intermittent boluses.

Infusion-based sedation

Ketamine – Initially 1mg/kg/hr (=0.1ml/kg/hr). For example, a 70kg person = 7ml/hr
Propofol 1% - Initially 2-5mg/kg/hr (=0.2-0.5ml/kg/hr), eg 70kg person = 14-35ml/hr

The infusion rate will need to be altered according to the patient's physiology, typically adjusted by 20% increments. Changes to the infusion rate will take up to 30 minutes before it will be reflected in the patient's physiology. Bolus medication is required for immediate effects.

Bolus-based sedation

Ketamine up to 0.25mg/kg (eg 10-20mg for an adult)

Midazolam up to 0.025mg/kg (eg 1-2mg for an adult)

Boluses should be given at intervals according to the patient's physiology.

- 3.14.3 Rocuronium given at induction can be expected to last approximately an hour. For pre-hospital times that extend beyond this a further 0.25-0.5mg/kg dose of rocuronium should be given at 30-minute intervals. Consider giving rocuronium just prior to patient movements (eg Emergency Department arrival) to avoid coughing / secondary brain injury.
- 3.14.4 If analgesia is required, further 0.5mcg/kg boluses of fentanyl should be given at intervals according to the patient's physiology. Patients receiving ongoing ketamine sedation are unlikely to require additional opioid analgesia.
- 3.14.5 Morphine and/or midazolam or propofol can be used at the clinician's discretion and experience if indicated.

3.15 Post-Intubation Ventilation

3.15.1 Establish mechanical ventilation.

- Set frequency to approximately twelve breaths per minute for an adult (use aide memoire for children)
- Set tidal volumes to approximately 6-8ml/kg (ideal body weight)
- If using a pressure mode of ventilation, commence with pressure that provide approximately 7ml/kg tidal volumes and set alarm limits.
- After several minutes of ventilation, adjust the frequency of ventilation according to the trending end-tidal carbon dioxide concentration, aiming for normocapnia. Blood gas analysis, if available, can be used to guide ventilation

3.15.2 If a patient desaturates following intubation and ventilation, return to hand ventilation with oxygen and capnography whilst searching for a cause of desaturation. Common causes include lack of an oxygen supply (not turned on or not connected), inappropriate ventilator settings and leaks within the breathing circuit.

3.15.3 High airway pressures (>30cmH₂O) or reduced compliance (low tidal volumes) should be troubleshooted by searching for (DOPE acronym) –

- Displacement of the tracheal tube
- Obstruction somewhere in the breathing circuit
- Pneumothorax or muscle relaxation wearing off.
- Equipment failures, e.g. malassembly or malfunction should be sought.

3.15.4 All patients must have a tension pneumothorax excluded at any sign of deterioration following the initiation of positive pressure ventilation, regardless of whether oxygenation is maintained.

3.15.5 Gastric decompression with an orogastric (or nasogastric in the absence of head trauma) tube should be considered, particularly in children and in patients who have had a period of bag-valve-mask ventilation.

4.0 Documentation and audit

4.1 All doctors and paramedics will have completed the necessary training and have passed their Initial Assessment of Competence, or “sign off” if not under direct supervision.

4.2 Adverse incidents, near misses or concerns should be submitted as adverse incidents through the incident reporting system.

4.3 Learning points from these discussions should be disseminated to the wider organisation

4.4 Providers will maintain constant vigilance over its failed intubation and surgical airway rates to ensure it is operating at the highest standard

4.5 All team members are able to request further training from their senior clinical team on any of the topics discussed in this policy at any time.