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CSOP 013 - PRE-HOSPITAL EMERGENCY ANAESTHESIA

Version No: 3.3 Effective Date 18/09/2023

APPROVALS

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Next Review Date:	Sept 2025		

HISTORY

Effective Date	Version No.	Summary of Amendment
09/12	v1.0	Creation of Document
11/02/2014	v2.0	Update of CSOP to include paediatric references and RSI Observation Chart – see Annex 4.
June 2017	V3.0	Review and change of name from Rapid Sequence Induction
October 2017	V3.1	Improved checklist following crew survey
January 2020	V3.2	Review and revision of PHEA indications, removal of unused observations chart, change to taasBase.
September 2023	V3.3	Addition of: VL, ketamine infusion, optimisation of dosing strategies, Annex 5 complications, "consideration" of apnoeic ventilation, raised threshold for PHEA for soft indications alone, discussion of Paeds ventilation, rocuronium dosing now 1.2-1.5mg/kg

KEY DOCUMENT

AAGBI: Safer pre-hospital anaesthesia 2017. *Anaesthesia* 2017, **72**, 379–390.

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ANNEXES

No.	Title
1	Checklist for PHEA
2	Thirty Second Drills
3	Failed Intubation Drills
4	Capnography set-up
5	Post PHEA Complications

1. PURPOSE

From the key document (AAGBI Safer Pre-Hospital Anaesthesia 2017):

"Pre-hospital emergency anaesthesia with oral tracheal intubation is the technique of choice for trauma patients who cannot maintain their airway or achieve adequate ventilation. It should be carried out as soon as safely possible, and performed to the same standards as in-hospital emergency anaesthesia. It should only be conducted within organisations with comprehensive clinical governance arrangements. Techniques should be straightforward, reproducible, as simple as possible and supported by the use of checklists. Monitoring and equipment should meet in-hospital anaesthesia standards. Practitioners need to be competent in the provision of in-hospital emergency anaesthesia and have supervised pre-hospital experience before carrying out pre-hospital emergency anaesthesia."

2. SCOPE

TAAS recognises that some staff have considerable anaesthetic experience. However, when delivering PHEA within TAAS the expectation is that this SOP is followed. In exceptional circumstances where deviation from the SOP is warranted this should be discussed if possible with the on call clinical supervisor.

3. TRAINING & MANDATE

PHEA must only be undertaken by a doctor and paramedic who have both been trained and approved to do so by TAAS – see below. In the circumstance of a patient already intubated as part of ALS who regains spontaneous circulation, a dual CCP crew can administer muscle relaxant and sedation as required, under relevant PGDs.

3.1 Doctors

PHEA must only be undertaken by doctors who have been assessed and approved by the Clinical Lead.

3.2 Paramedics

Paramedics must be specifically trained by TAAS to assist in PHEA.

4. INDICATIONS FOR PHEA

Patients with the following clinical indications should be considered for PHEA:

- Airway obstruction (actual or impending)
- Ventilatory failure or severe hypoxia
- Unconscious
- Agitated or combative patients

The following are soft indications for PHEA and as such the threshold to intervene and the margin of safety needs to be higher than for more time critical PHEA.

- *Humanitarian indications*
- *Anticipated clinical course.*

If the risk to the patient (or rescuer) outweighs the benefit of PHEA it should not be attempted and basic medical care appropriate to the environment should be provided.

The TAAS crew should consider the risk versus benefit of PHEA on a case by case basis and make an appropriate judgement and subsequent decision. In difficult cases the clinical supervisor can be contacted for advice.

Care should be exercised when considering the use of anticipated clinical course as an indication for PHEA. There should be a clear and unequivocal reason for PHEA to avoid

unnecessary anaesthesia and consequent delay on scene. Humanitarian reasons need to be balanced with other factors such as the patients potential subsequent lack of ability if anaesthetised to discuss their potential future options with an in hospital multi disciplinary team.

Recent data demonstrates an association between PHEA and mortality in hypotensive trauma patients. This association is strengthened when haemodynamic instability is due to significant hypovolaemia. The prehospital team must be fully conversant with the risks of the procedure and see clear potential benefits in performing PHEA distant from hospital resuscitative and surgical interventions. In these patients it may be appropriate to delay anaesthesia until arrival in hospital **even in the context of a reduced level of consciousness.**

5. PAEDIATRIC PHEA

AAGBI: Safer Pre-Hospital Anaesthesia 2017 guidance for pre-hospital anaesthesia in children states the following:

"It is increasingly recognised that anaesthesia for children aged 8 years or under is a sub-specialist area of in-hospital anaesthesia. Young children with severe injuries are uncommon, but can present pre-hospital practitioners with significant challenges.
In general terms, the threshold for anaesthesia and tracheal intubation in young children is high. The majority can be adequately managed with simple airway techniques. Pre-hospital emergency anaesthesia is considered only after careful risk–benefit analysis. This will usually mean that a skilled anaesthetic practitioner with appropriate equipment is present, and that simple airway manoeuvres combined with oxygen therapy have failed to provide a patent airway or adequate oxygenation. In difficult circumstances, rapid transfer to the nearest hospital to enable advanced airway management may be appropriate, even if definitive care needs to be undertaken at a different hospital."

Within TAAS PHEA for children under the age of 8 should not be undertaken unless the doctor is an NHS anaesthetist with paediatric expertise or the clinical condition of the child is such that paediatric PHEA is the only option (airway obstruction or significant hypoxia not corrected by simple measures for example). Note that whilst TAAS equipment is regularly re-assessed to be

the best available for its purpose, a TAAS transport ventilator cannot perform as well as an hospital intensive care unit ventilator, and this is likely to be accentuated in the care of a paediatric patient. Higher tidal volumes than we would usually expect may well be required to achieve acceptable ventilation in young children.

The on call clinical supervisor should be contacted in all cases of proposed paediatric PHEA under the age of 8 before proceeding except in exceptional circumstances. Do not delay PHEA if the clinical condition of the child warrants immediate intervention.

Consider transfer to the nearest hospital with a paediatric emergency department for children who require emergency anaesthesia (where this cannot be provided on scene within the guidance above) prior to onward transfer to a paediatric MTC.

6. PREPARATION

6.1 Access

- Confirm scene safety
- Move the patient to ensure 360° access if practical and this will not expose the patient unnecessarily or create unacceptable delay.
- The optimum position of the patient is on an ambulance trolley at kneeling height
- Ensure adequate lighting and/or shield the patient from direct sunlight
- Trapped patients can usually be extricated rapidly if their airway is compromised.
- Genuine entrapment is relatively uncommon. In these circumstances a supraglottic airway or surgical airway will probably be safer alternatives than PHEA in situ. This may be facilitated with the use of sedation and appropriate monitoring prior to extrication.
- The scene should be as quiet as possible.
- Do not anaesthetise a patient in a confined space unless there is no alternative.

6.2 Airway Assessment

All patients should have an airway assessment to help predict the possibility of a difficult airway including difficult mask ventilation and difficult intubation. This may influence the conduct of PHEA or change the risk benefit balance of PHEA.

6.3 Pre Oxygenation and Apnoeic Oxygenation

Pre oxygenation should be done using a bag valve mask with a two handed mask seal and nasal cannula in situ at 5-15lpm. The reservoir should be seen to move thus demonstrating a good mask seal.

A non rebreathing mask with nasal cannula at 15lpm can be used if it is not possible to use a bag valve mask but evidence has shown that this is less effective.

Apnoeic oxygenation can be considered via nasal cannula, continued during laryngoscopy if possible. If used, ensure that this does not adversely affect the seal of the face mask.

Oxygenation and ventilation should be optimised prior to PHEA where possible: open chest wounds should be sealed; consider treatment for tension pneumothoraces or plan for immediate post PHEA thoracostomy; ensure adequate tidal volume with assisted ventilation taking care to avoid gastric insufflation.

6.4 Circulatory Access

In ideal circumstances prior to commencing PHEA the patient should have two IV cannula. Both should be flushed to ensure patency. Take particular care with cannula in the antecubital fossa that have not been placed by the TAAS crew (risk of inadvertent arterial placement or misplaced in soft tissues). If in doubt insert your own cannula(s).

If it is not possible to site an intravenous cannula use intraosseous access. The preferred site is the humeral head. One IO cannula is sufficient for PHEA if no other options are available.

6.5 Sedation

It may be necessary to sedate a patient prior to PHEA to facilitate management, including monitoring, pre-oxygenation and general safety. This can be done using IV or IO boluses of:

- Midazolam in divided doses up to 0.1 mg / kg

- Ketamine in divided doses up to 0.5 mg / kg (commonly 10mg bolus's)

6.6 Clinical Observations and Measurements

Prior to PHEA, the following should be recorded:

- Heart rate & pulse volume
- Respiratory rate and tidal volume assessment
- Level of consciousness (you must record GCS prior to PHEA)
- Focal neurology and spinal cord function
- Pupil size and reactivity
- Blood glucose

6.7 Monitoring

Establish monitoring with TAAS equipment as soon as possible and before commencing PHEA. TAAS audit shows that our monitors are consistently more reliable than ambulance service monitors: if for any reason a TAAS monitor is not used this must be clearly explained in the narrative.

The following must be monitored:

- 3 lead ECG
- Oxygen saturations
- Non-invasive blood pressure
- End tidal CO2

ECG, pulse oximetry and end tidal CO2 are recorded continuously. NIBP should be cycled every three minutes or more frequently if possible. Temperature should be recorded as per CSOP 12. In future, invasive blood pressure monitoring may be considered.

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Equipment Preparation

Oxygen	One for BVM or NRM, one for nasal cannula
Suction	Checked with a yankauer catheter connected and spare suction unit available
Bag Valve Mask Reservoir	Checked, bag inflated and connected to oxygen
Nasal cannula	In place on patient at 5-15lpm oxygen
Two Laryngoscopes	A choice of two blades, checked and working. The McCoy laryngoscope has now been removed and introduction of a trial period of video laryngoscope (VL) to use as first line. VL has numerous advantages, including facilitating team situational awareness as the procedure progresses.
Simple airway adjuncts	A range of OP and NP airways appropriate to patient
Rescue Airway 1	Correct size Supra-glottic Airway Device (igel) and lubricant
Rescue Airway 2	Surgical airway equipment
Endotracheal Tubes	One of the appropriate size with the cuff checked and lubricated and one size smaller
20 ml syringe	To inflate the cuff
Bougie	To be available for all PHEA
Catheter Mount and Filter	Use during pre-oxygenation
End Tidal CO_2 adapter	Use during pre-oxygenation
Thomas tube holder or tape	The Thomas tube holder is the preferred device. Tape is to be used in small children. Avoid tube ties to mitigate the risk of worsening ICP
Check List	Final check before induction

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6.8 Drugs

- Only drugs provided by TAAS should be used
- Two TAAS clinicians should verify dose, concentration, volume, expiry date and drug when drawing up medications
- Syringes should be labelled and capped until delivery as per CSOP 007 Critical Care Medicines

Drug	Dose	Notes
Induction Agents		
Ketamine	1-2mg / kg IV or IO	Induction agent of choice for PHEA
Thiopentone	Up to 5mg / kg	Consider for isolated hypertensive head injury and status epilepticus if within current scope of practice of the Doctor.
Analgesia and Sedation / Maintenance		
Fentanyl	1-3 µg/kg	Analgesia and as co induction to mitigate hypertensive response to laryngoscopy. Although part of the 3:2:1 ratio of Fentany:Ketamine:Rocuronium, in practice, frequently used regime is 2:2:1 unless specific indication for 3:2:1.

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Ketamine	1mg/kg/hr	Infusion for maintenance of anaesthesia
Morphine	Up to 0.1 mg / kg	Maintenance of anaesthesia Small boluses (< 0.1 mg / kg) titrated to effect to avoid hypotension
Midazolam	Up to 0.1 mg / kg	Maintenance of anaesthesia Small boluses (< 0.1 mg / kg) titrated to effect to avoid hypotension
Paralysis		
Rocuronium	1.2 to 1.5 mg/kg	Relaxant of choice for PHEA
Rocuronium	0.6 mg / kg	Ongoing paralysis if required
Vasoactive Agents		
Ephedrine	30mg in 10mls saline 3-6mg boluses	Titrated to response
Metaraminol	10mg in 20mls saline 0.5mg (1ml) increments	Titrated to response Preferred choice to maintain cerebral perfusion pressure

- The following dose regimes are suggested guidelines only – use clinical judgement to determine the correct drug(s) and to calculate the appropriate drug dose(s) for PHEA.

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Standard PHEA

1. Fentanyl up to 2 micrograms / kg*
2. Ketamine 2 mg / kg
3. Rocuronium 1.5 mg / kg

Adjusted doses for patients who are felt to be at risk of significant post induction hypotension

1. Fentanyl 1 microgram / kg
2. Ketamine 1 mg / kg
3. Rocuronium 1.5 mg / kg

*Previously, a ratio of 3:2:1 ratio of Fentany:Ketamine:Rocuronium was commonly advocated, although in practice, 2:2:1.5 is more appropriate unless specifically indicated.

Consider rocuronium only in the peri-arrest / agonal patient whose airway reflexes or muscle tone prevents direct laryngoscopy but who in your judgement do not require an induction agent, a “Crash Intubation”. This should be a very rare event as high rates of PTSD have been reported in survivors.

If a patient is peri-arrest, or arrested, airway management may require immediate intervention, as such the time pressure may mitigate against the full brief and set up as required, assessed as a team on a individual case basis, and is technically not PHEA, but airway management.

Consider the following for post ROSC PHEA

1. Fentanyl 2 micrograms / kg
2. Midazolam 0.05 – 0.1 mg / kg
3. Rocuronium 1.5 mg / kg

Under the appropriate PGD for TAAS CCPs midazolam and / or rocuronium may be used in selected patients for the provision of sedation and in the already intubated patient requiring subsequent paralysis.

6.10 Personnel

Ideally there should be four clinicians in the team of people performing the PHEA. Where numbers are inadequate, non-clinicians (pilots, fire fighters) may be helpful however their role must be one of support.

The following roles are crucial:

Intubator	Must be either the TAAS Doctor or TAAS Paramedic
Drug Giver	Must be either the TAAS Doctor or TAAS Paramedic
MILS (if appropriate)	MILS should be used unless to do so adversely affects airway management
Kit Passer	Must be either the TAAS Doctor or TAAS Paramedic
Monitoring	The monitor must be placed where the TAAS Doctor and Paramedic can see it. The person not doing the intubation must continually monitor the screen, calling out any significant change in heart rate, NIBP or oxygen saturation
(Cricoid Pressure)	Often not used in PHEA. If used must be carried out by someone who has been trained to perform it. Cricoid pressure should be removed if it makes the view of the cords difficult on the instruction of the intubator.

6.11 The PHEA Checklist and the PHEA Brief

A TAAS clinician should lead the team brief to ensure all staff present understand the process and that roles are clearly identified.

Following the team brief one of the TAAS crew should lead and complete the PHEA checklist (annex 1).

Once the brief and checklist is complete there should be no interruptions other than to identify an emergency or to confirm successful intubation.

7. PROCEDURE

The first intubation attempt should be optimised to maximise the first pass success rate.

Intubation should take less than thirty seconds from commencing laryngoscopy. If it is not achievable within this time: stop, ventilate the patient and commence the Thirty Second Drills. If after two attempts intubation has not been achieved move to the Failed Intubation Drill**.**

A key to minimising scene time is to ensure simultaneous activity throughout the process. Involve on scene crews – this might be their only serious trauma case over a longer period and will help maintain good working relationships with crews. Think several steps ahead and utilise scene personnel accordingly.

1. Complete the team brief and PHEA checklist including pre procedure observations at time of PHEA

2. Apply manual in-line stabilisation, remove or undo the front of any collar and remove the head blocks

3. Confirm anatomy and landmarks for surgical airway and to position cricoid pressure correctly

4. Apply cricoid pressure if appropriate

5. On the instruction of the lead TAAS clinician administer the induction agent(s) as a rapid bolus followed by the neuromuscular blocking agent. Use a 10-20 ml saline flush following drug administration

6. Allow one minute for full muscle relaxation after administering the drugs and prior to laryngoscopy. Gentle ventilation (avoiding gastric insufflation) may be achievable and appropriate in some patients during this period. Obtain an appropriate laryngoscopic view

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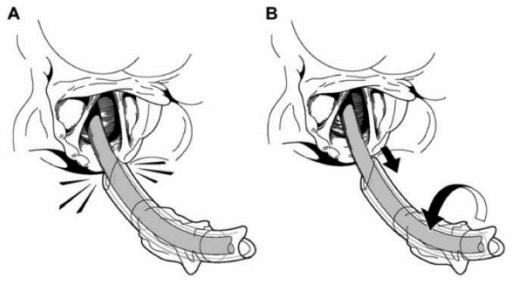
to facilitate endotracheal intubation. Aim for a grade 2 view rather than a grade 1 view. Attempts to achieve a better than necessary view may worsen the hypertensive response to laryngoscopy, raise intracranial pressure and risk inadvertent movement of the cervical spine

7. A bougie is recommended for all intubations. At the discretion of the intubator with a good view the endotracheal tube may be inserted without a bougie. Pass the ET tube through the vocal cords, note the position of the black line above the cords and note the length of the tube at the teeth.

   The Bougie may cause the ET tube end bevel to catch on the right arytenoid, therefore, if difficulty is experienced advancing the ET tube, facilitate the "flip flop" technique of 90 degree rotation to move the ET bevel off the arytenoid and into the tracheal lumen to facilitate tube advancement



   "Flip-Flop" technique for advancing ET Tube off and past the arytenoid.

8. Remove the bougie and connect the self-inflating bag with catheter mount, angle piece, filter and CO2 adapter

9. Inflate the cuff gently obliterating any air leak but taking care to avoid over inflation

10. Confirm intubation by:

- Watching the tube go through the cords.
- Watching for equal chest rise and fall.
- Check presence of CO2 on monitor.

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- Listen to confirm that there is no gastric insufflation and that there is equal air entry across both lung fields.

11. Remove cricoid pressure (if used)

12. Attach to Oxylog 3000 at the earliest opportunity. Initial settings: Vt 6-8 ml /kg, FIO2 1.0, no PEEP, CMV, adjust rate for a target ETCO2 of 4.5 kPa, commonly initially a rate of 16. As soon as practical start to titrate the FiO2 down to avoid hyperoxia. Aim for oxygen saturation of at least 96%.
    The Oxylog 3000 is configured to commence with a PEEP of zero, this may need increasing to 5, considering body habitus & physiology, or possibly greater if experienced to do so on clinical evaluation. Aim for PAP <30cmH2O, CO2 4.5-5
    The use of the ambulance service minute volume divider type ventilator, such as the Smiths pneumpac VR1 can be considered, when, due to the small and lightweight design, there may be advantage, for example complicated extrications.

13. Consider the need for thoracostomies - positive pressure ventilation can rapidly convert a simple pneumothorax to a tension pneumothorax

14. Consider the insertion of an orogastric tube prior to securing the ET tube

15. The intubator will secure the ET tube in place, noting the depth of insertion at the teeth or upper gum. This is done with either a Thomas Tube Holder or tape, avoiding excessive circumferential pressure around the neck.

16. Repeat observations and be vigilant for post PHEA complications (annex 5)

17. Based on the clinical condition, vital signs and presence or absence of lacrimation administer titrated boluses of maintenance analgesia and sedation

18. Immobilise the patient as indicated and provide hearing protection

19. Monitor and maintain core body temperature. PHEA (in particular use of muscle paralysis) increases hypothermia and heat loss, hence requirement for proactive management. (CSOP012)

8. Post PHEA / RSI Sedation

In anaesthetised patients, a continuous infusion of sedative is desirable to maintain a stable consistent conscious level.

This will aim to prevent swings in physiological parameters in the post-anaesthetic period, especially in relation to ongoing critical care interventions.

Ketamine is widely used in pre-hospital PHEA due to its cardiovascular stability, and thus lends itself to on-going infusion and maintenance. The receiving hospital should be familiar with its use for continuation in ED post handover.

This will increase clinician situational awareness or "bandwidth" as it will eliminate the need to remember bolus doses of sedation. An infusion is not mandated, and bolus sedation is an accepted alternative.

Method

Ketamine 10mg/ml (20ml) syringe loaded into a Braun Perfusor Space

Rate - 0.1ml/kg/hour eg 1mg/kg/hr (70 kg = 7mls/hr)

Titrated up or down 25% as clinical state dictates, an infusion rate of 1-3mg/kg/hr is common.

If signs present to indicate an increased amount of sedation required, consider the use of midazolam, fentanyl or morphine depending on clinical judgement.

Signs of awareness;

- Tachycardia
- Hypertension
- Lacrimation
- Sweating

- Symmetrical pupil dilation
- Limb movement (if not completely paralysed)

9. Loading and Transport

- Secure all lines and tubes
- Ensure hospital is pre alerted using a conference call via EOC
- Check that the following is immediately available throughout the transfer to hospital
  - Bag valve mask
  - Laryngoscope, cuff syringe, bougie and replacement ET tube
  - Suction - flexible catheters and yankauer catheter
  - Supraglottic airway (iGel)
  - Spare capnograph in case of primary $ETCO_2$ failure
  - Drugs for maintenance: analgesia and sedation
  - Resuscitation drugs

10. Post PHEA Emergencies

See Annex 5 for common complications

11. Documentation

The following information must be documented to allow reference by hospital staff after hand over:

- Indication for PHEA
- Pre-induction vital signs and clinical condition including neurology
- Drugs used, timings and doses
- View at laryngoscopy and ease of mask ventilation where relevant
- Number of attempts at laryngoscopy
- Endotracheal tube size and length at lips
- Vital signs summary (print trends)
- Clinical course post induction
- Name(s) of the TAAS crew members

- Contact details for TAAS
- Any other relevant detail from the PHEA process including adverse events

12. AUDIT

All cases involving PHEA (or CCP administered rocuronium under the relevant PGD) must be recorded via taasBase which will automatically trigger the peer review process (OSOP12.) This must include a monitor trend summary.

END OF DOCUMENT