Guideline

Rapid sequence induction in the Emergency Department

1. Reason for development

To standardise/improve patient care.

2. Scope

Patients presenting to the emergency department requiring rapid sequence induction

3. Aim

This guideline is to help the clinician managing a patient requiring rapid sequence induction

4. Background

Anaesthesia may dramatically improve airway management, oxygenation, ventilation, pain relief and outcome, particularly for those with head and chest injuries.

Emergency anaesthesia is a potentially dangerous undertaking; specific skills, knowledge and experience are required. The risks of anaesthesia must be balanced against the risks of no anaesthesia. All anaesthetics in the ED should be performed with a rapid sequence technique. The purpose of rapid sequence intubation (RSI) is to render the patient unconscious with muscle relaxation in order to intubate the trachea in as short a time as possible and without the use of bag-valve-mask ventilation (which may cause gastric distension and increase the risk of aspiration).

5. Emergency Anaesthesia Policy

Competent staff
Emergency anaesthesia in the department should only be undertaken by :-

- An ED Specialist Registrar or Consultant competent in rapid sequence induction of anaesthesia and associated emergency airway rescue techniques described in this document
- An Anaesthetic Registrar or Consultant

When performing an RSI, there should be a minimum number of competent medical staff present:

- 2 ED SpR or Consultants, one of whom must be competent as described
- an Anaesthetic SpR or Consultant plus one ED SpR or Consultant

Competency to proceed with RSI depends on the following criteria:

- A minimum of six month's training in Anaesthesia or Intensive Care or an Emergency Medicine post in which rapid sequence induction was regularly performed.

- The maintenance of an up-to-date log book quantifying RSI cases.

- Tested and certified as proficient in RSI, failed intubation drill, bag mask ventilation, surgical airway, and RSI drug familiarity.

Documentation

It is important that all anaesthetics are adequately recorded (including complications) for future anaesthetic reference and as an aid to audit.

Equipment

Those performing RSI should be familiar with the standard intubating equipment, the difficult airway trolley equipment, the ventilators and monitors. These should be checked prior to use by the operator.

Indications

Indications for emergency anaesthesia are based on assessment of clinical need rather than a predetermined list. In each case, clinical need must be balanced against risk to the patient. The indications for emergency anaesthesia are:

5.1 Failure of airway maintenance

5.2 Failure of airway protection

5.3 Failure of ventilation or oxygenation

5.4 Anticipated clinical course/other reasons to anaesthetise

5.1 Failure of airway maintenance. Although simple manoeuvres and adjuncts such as oropharyngeal and nasopharyngeal airways help maintain the airway, these should be regarded as temporary measures. These patients will all require intubation at some point and this should be considered.

5.2 *Failure of airway protection*. An unconscious patient with an easily maintained airway and adequate ventilation is still at major risk of passive regurgitation and aspiration. The best way to assess airway protection is to look for absence of spontaneous swallowing and/or failure to clear blood, saliva or mucous from the oropharynx. Lack of a gag reflex cannot be relied upon as an indicator of need for intubation.

5.3 *Failure of ventilation or oxygenation*. Patients with acute ventilatory failure or failure to maintain oxygen saturations despite supplemental oxygen should be considered for emergency anaesthesia and intubation. The response to simple measures such as supplemental O_2, careful analgesia and positioning should be taken into account in making the decision to anaesthetise such patients.

5.4 *Anticipated clinical course*. This indication refers to the patient who can be predicted to deteriorate (e.g. inhalational burns, stab wound to neck or spinal injuries) or for

whom the work of breathing will be overwhelming in the face of multiple major injuries. In the case of major trauma patients whose management is certain to include prolonged diagnostic evaluation or an emergency operation, or who are combative from head injury and/or intoxication, early anaesthesia and intubation should be considered.

6. Procedure

Emergency anaesthesia procedures follow four algorithms. These are: 'Standard RSI', 'Crash' Intubation, 'Difficult' Intubation and 'Failed' Intubation. All those undertaking emergency anaesthesia must be familiar with these algorithms. (Also see "Difficult and failed intubation" flowchart.)

The decision regarding which algorithm to commence with is based on assessment of the patient and is illustrated in figure 1.

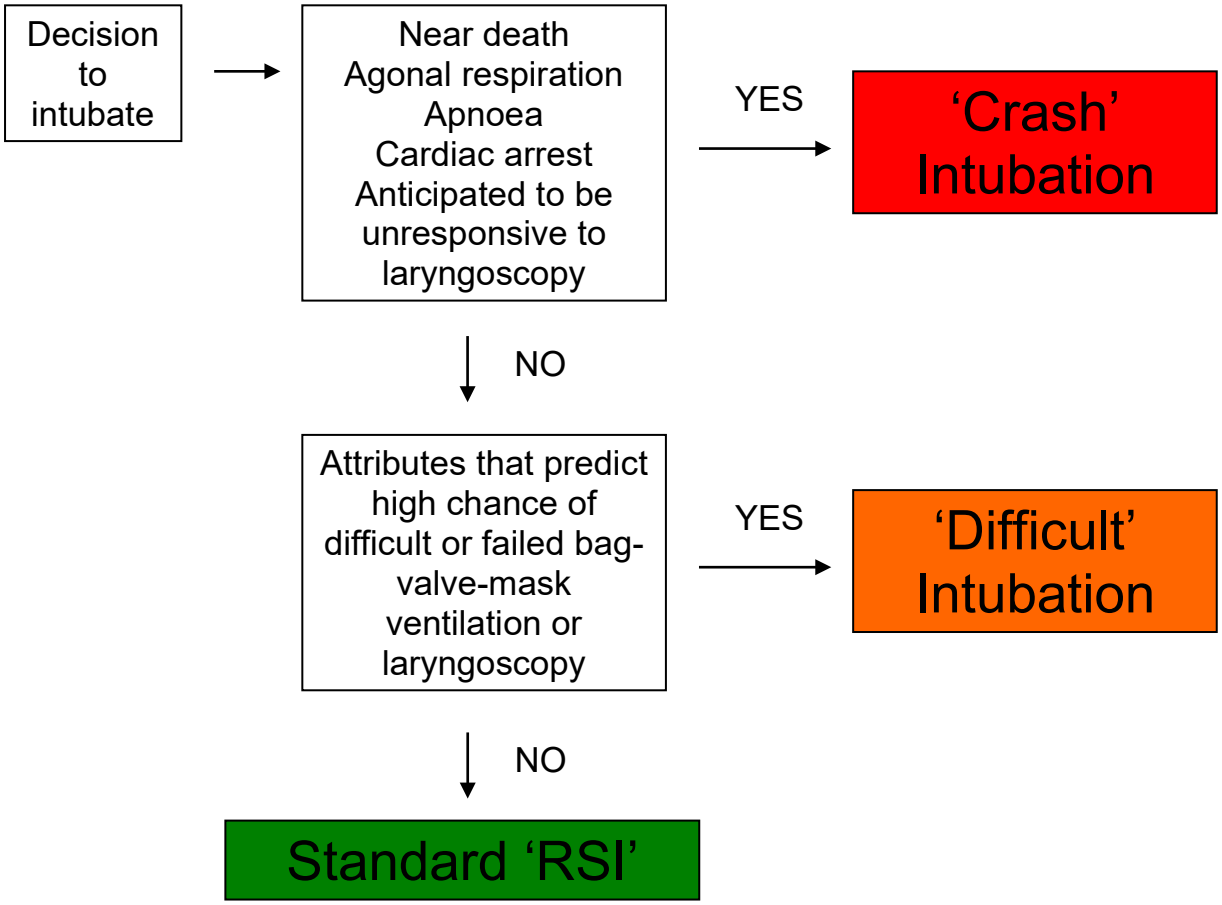

Figure 1. Entry point to emergency anaesthesia algorithms

Standard 'RSI'

Standard intubation or RSI is the central component of pre-hospital emergency anaesthesia. It is divided into ten conceptual and practical stages

6.1 Preparation

6.2 Patient positioning

6.3 Pre-oxygenation

6.4 Pre-treatment

6.5 Paralysis with induction

6.6 Protection and positioning

6.7 Placement with proof

6.8 Plan for failed intubation

6.9 Post-intubation management

6.10 Packaging and transfer

6.1 Preparation

- Pre anaesthetic assessment. Focus on 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 failure (see below).

- Setting up
    i) Intubation equipment - Must be checked
    ii) Ventilation equipment
    iii) Suction
    iv) Drugs – drawn up and labelled (see below)
- Intravenous access (two secure iv lines, connected to fluids). Alternative strategies for airway control and analgesia should be employed if there is no intravenous access unless it is absolutely necessary to anaesthetise the patient. If this is the case consider intramuscular Ketamine.
- Pre anaesthetic monitoring: SpO_2, NIBP (set cycling interval to 3min), 3 lead ECG.

6.2 Patient Positioning

- Ensure adequate access to the patient. Where possible:
- Allocate tasks: 3 or 4 person technique depending on need for cervical spine immobilisation.
    i) Cervical spine control
    ii) Drugs and cricoid pressure
    iii) Equipment
    iv) Operator

6.3. Pre-oxygenation

- Pre-oxygenation is essential for safe anaesthesia and RSI. It should proceed throughout the preparation phase above. Pre-oxygenation establishes an oxygen reservoir in the lungs, blood and tissues and, if effective, will allow several minutes of apnoea without O_2 desaturation. Please note, however, an obese adult can desaturate to 90% in under 3minutes. Two nasopharyngeal airways and an oropharyngeal airway should be used whenever possible ('Silo' technique) to optimise pre-oxygenation.
- If possible preoxygenate by 3-5 minutes of spontaneous ventilation ("no bagging") with a bag-valve-mask (100% O_2) using a two handed technique. If not tolerated, use high flow O_2 via a non-rebreathing mask with reservoir (70 –80% O_2). In circumstances where 3 to 5 minutes of pre-oxygenation is not possible, eight vital capacity breaths through a bag-valve-mask system will provide roughly equivalent pre-oxygenation.
- If saturations are below 90% during preoxygenation then assisted ventilation, using a BVM, is required. If assisted ventilation is required, cricoid pressure should be applied to minimise gastric insufflation and prevent passive regurgitation.

6.4 Pre-treatment

- In children under ten, Atropine should be given 3 minutes prior to RSI to counter reflex bradycardia.
- In patients with an isolated head injury who are haemodynamically normal consider Fentanyl 3 minutes prior to RSI to blunt the sympathetic reflexes to laryngoscopy.

6.5 Paralysis with induction

- Planned and controlled
- IV induction agent (Etomidate, Propofol, Thiopentone or Ketamine)
- IV Suxamethonium (immediately after induction agent)
- Fluid bolus (immediately after Suxamethonium)
- Gentle assisted ventilation if SpO_2 drops below 93-95%

6.6 Protection and positioning

- Cricoid pressure should be initiated as soon as the patient begins to loose consciousness and should be maintained throughout RSI until the position of the tube has been confirmed, the cuff inflated and the intubator gives the instruction. The task of cricoid pressure should be given to an experienced provider who has a clear understanding of the procedure as incorrect application can make laryngoscopy more difficult.
- The patient should be in a supine position with manual inline immobilisation of the cervical spine is necessary (i.e. collar and blocks removed). There should be no restriction in the movement of the mandible.

6.7 Placement with proof

- Approximately 45 seconds after Suxamethonium administration, the jaw should be tested for flaccidity and laryngoscopy attempted. **There is always time to perform laryngoscopy gently and carefully.**

- 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. The 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 inflated, correct tube placement should be confirmed immediately.

- Determination of correct tube placement
  i) See the tube passing through the cords
  ii) Palpation of tube movement within the larynx and trachea
  iii) See the chest expand equally with each ventilation
  iv) Auscultation of breath sounds
  v) Absence of epigastric sounds with respiration
  vi) See vapour condense in the tube with each ventilation
  vii) End Tidal CO_2 monitoring (colorimetric or quantitative)
- Clinical signs alone are not sufficiently reliable and **tube placement MUST always be confirmed by end tidal CO_2 detection**.
- If there is any doubt about the correct placement of the tube it should be removed.
- Disposable qualitative $ETCO_2$ detectors undergo a colour change when expired CO_2 passes across their surface. The colour change is from purple (room air) to yellow (4% CO_2). At least 6 tidal volumes should be given before these detectors are used to confirm tracheal tube position.

- The Emergency Department monitors allow main stream qualitative $ETCO_2$. This should be attached as soon after intubation as is practically possible; as well as confirming tube placement it also serves to record the approximate time of intubation on the monitor and provides a disconnection alarm.
- Once tube placement is confirmed it should be secured in place. Particular care must be taken in the paediatric patient.

6.8 Plan for failed intubation

- Actions on first failed intubation during standard RSI:
  i) Return to bag-valve-mask with adjuncts to maintain oxygenation
  ii) A further good attempt 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.
    - Change operator position
    - Use aids to intubation (stylet)
    - Use suction
    - Consider BURP manoeuvre
    - Consider alternative laryngoscope blade / McCoy laryngoscope/ Glidescope
    - Consider cricoid release
    - Consider changing operator
- The key to the management of failed intubation is early recognition of the problem and not persevering in the face of a desaturating patient (see below).

6.9 Post Intubation Management

- Post RSI complications such as bradycardia (hypoxia, suxamethonium) and hypotension (over sedation) should be sought and managed. Full monitoring should be in place (SpO_2, NIPB, ECG, $ETCO_2$)
- Commence maintenance of anaesthesia with:
    i) 2% Propofol infusion for sedation. A&E cupboard may contain 1%; Beware.
    ii) Atracurium (0.5mg/kg initial dose, subsequent doses 1/3 of initial) for long acting muscle relaxation
- Overzealous positive pressure ventilation may increase intrathoracic pressure and reduce venous return, so reducing cardiac output. 8 to 10 breaths per minute at tidal volumes of approximately 10ml/kg may be adequate to maintain oxygenation without impairing cardiac output.
- If a patient desaturates following intubation and ventilation, displacement of the tube, obstruction somewhere in the breathing circuit, pneumothorax and equipment failures, malassembly or malfunction should be sought.
- Beware pneumothoraces either caused or exacerbated by positive pressure ventilation. All patients must have a tension pneumothorax excluded at any sign of deterioration following ventilation.
- Gastric decompression with an orogastric tube should also be considered particularly in children and in casualties who have had a period of bag-valve-mask ventilation.

6.10 *Packaging and Transfer out of the department*

- All tubes and lines must be absolutely secure.
- All intubated and ventilated patients must be accompanied by a competent doctor.
- Careful observation of chest movement, pattern of respiration, absence or presence of sweating or lacrimation and reaction of pupils is required throughout transfer.
- Full monitoring should be maintained throughout transfer (the minimum standard is continuous SpO_2, intermittent NIPB, continuous ECG and continuous $ETCO_2$ level and waveform).
- Full documentation should always be maintained.

7. 'Crash' Intubation

If on initial assessment the patient is considered to be near death (with agonal respiration, apnoea or cardio-respiratory arrest) then laryngoscopy and tracheal intubation without drugs should be attempted immediately (figure 2).

- If successful, proceed with post-intubation management as per standard RSI.
- If unsuccessful, assess whether SpO2 ≥ 90% with bag-valve-mask ventilation.
- If not able to intubate or oxygenate – manage as 'failed' intubation.
- If SpO2 ≥ 90% – assess whether patient completely relaxed / jaw flaccid. Attempt laryngoscopy a second time if relaxed.
- If not relaxed, give a single dose of suxamethonium before second laryngoscopy attempt.
- Manage as failed airway if second laryngoscopy attempt unsuccessful.

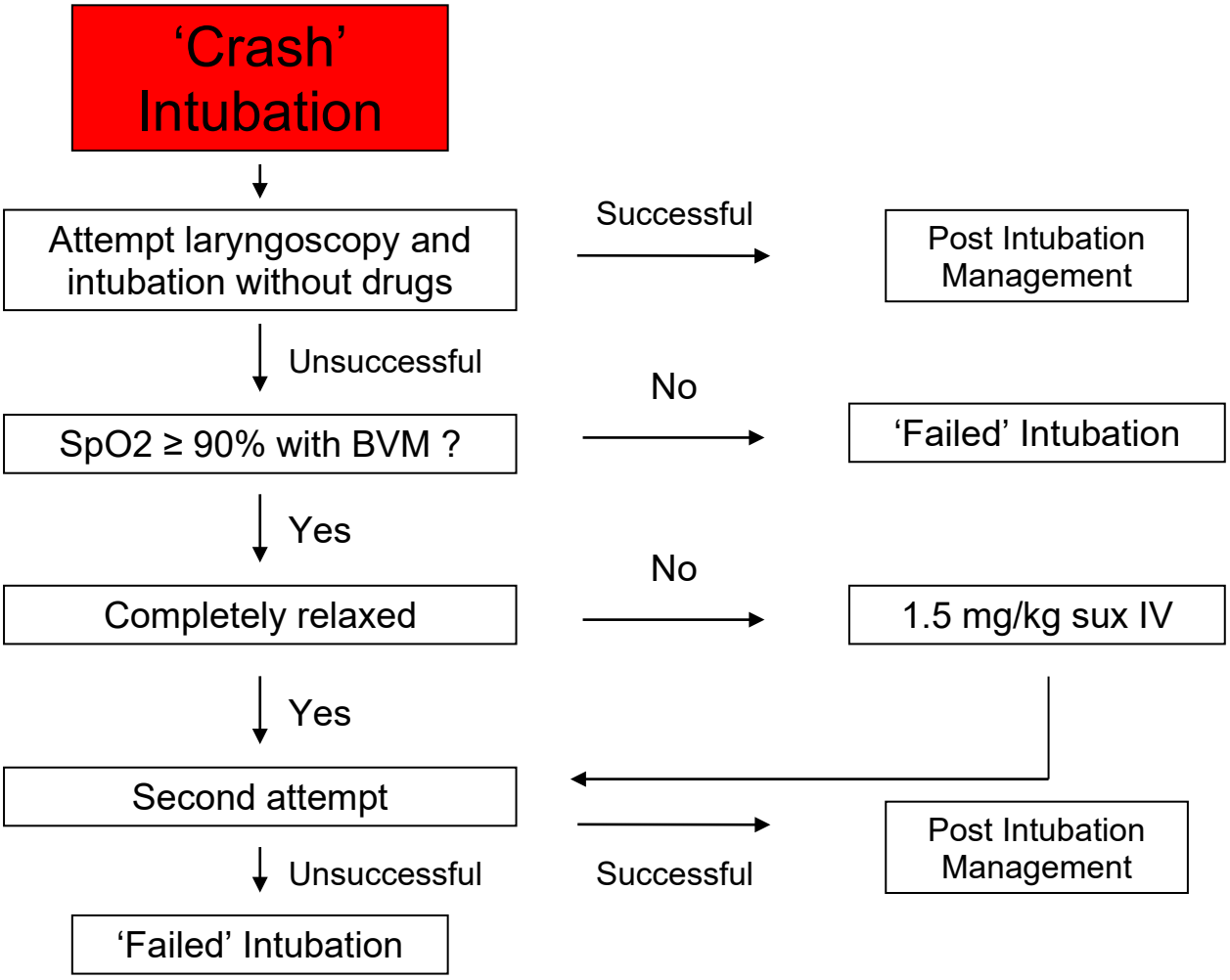

Figure 2. 'Crash' Intubation algorithm

8. 'Difficult' Intubation

All emergency intubations are, by definition, potentially difficult. There are, however, some patients who may exhibit clear features that predict a high chance of failure of bag-valve-mask ventilation and/or laryngoscopy. These features should be actively sought following the L-E-M-O-N mnemonic:

Look externally:

- Morbid obesity
- Abnormalities of the face, mouth and neck (e.g. short immobile neck, high arched palate, inability to sublux the jaw).
- Facial or neck trauma
- Large teeth / no teeth
- Protruding tongue
- Receding mandible
- Presence of facial hair

Evaluate 3-3-2 rule

- Mouth opening - 3 finger breadths
- Size of mandible - 3 finger breadths between tip of chin (mentum) and hyoid bone
- Position of larynx – 2 finger breadths between top of thyroid cartilage and floor of mouth

Mallampati score (if able to assess)

Grade 3 and 4 views are associated with increasingly poor laryngeal visualisation and higher intubation failure rates.

Obstruction

- Tonsils
- Airway trauma
- Haematoma
- Foreign body
- Epiglottitis
- Oedema

Neck mobility / immobility

- Trauma
- Non trauma
- Age
- Pre-existing disease

If a patient has features suggesting a high chance of failure of bag-valve-mask ventilation or laryngoscopy, then the urgency of emergency anaesthesia should be reviewed and, if considered imperative, specific measures taken to prepare for the difficult airway (figure 3). These include use of the McCoy laryngoscope, Glidescope or considering primary laryngeal mask insertion and primary surgical cricothyroidotomy.

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Note that RSI should not be attempted without an Anaesthetist present if it is clear that the patient will not be effectively ventilated using a bag-valve-mask apparatus.

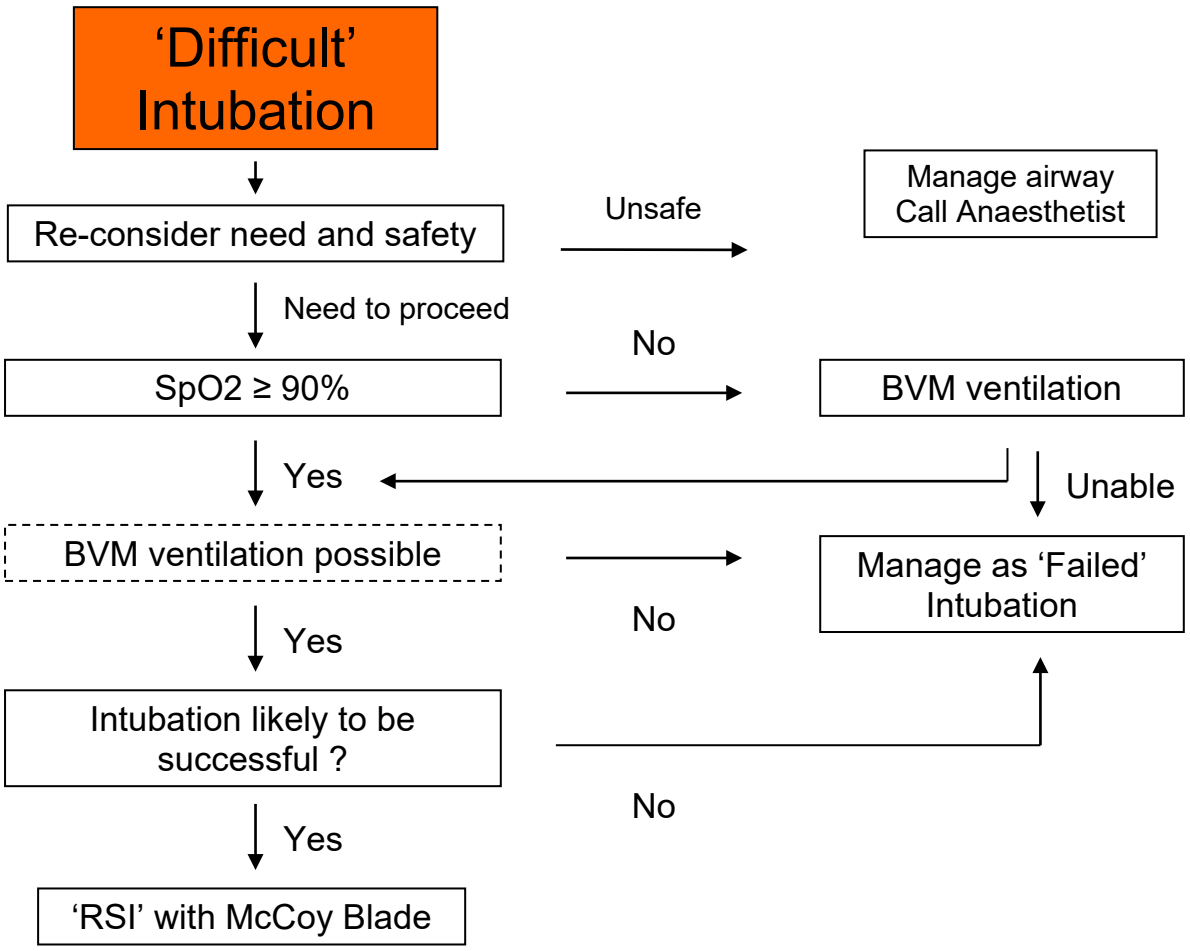


Figure 3. 'Difficult' Intubation algorithm

9. 'Failed' Intubation

(See also "Failed intubation protocol"). The failed intubation algorithm is the final common pathway in emergency anaesthesia (figure 4). It should be followed in the following circumstances:

- Two failed attempts at laryngoscopy by experienced operator
- Single failed attempt at laryngoscopy with inability to maintain SpO2 ≥ 92% with bag-valve-mask apparatus
- 'Difficult' intubation identified where bag-valve-mask ventilation unable to maintain SpO2 ≥ 92%
- 'Difficult' intubation identified where bag-valve-mask ventilation impossible and/or intubation not considered likely to be successful

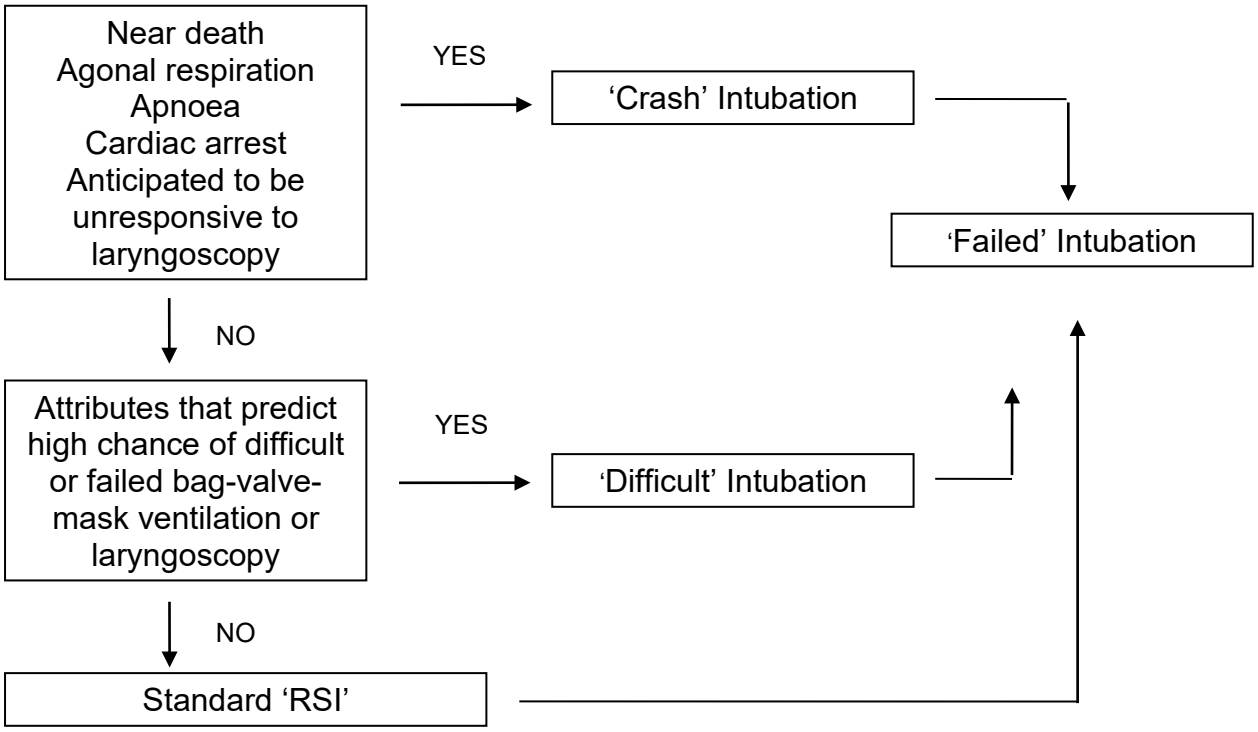


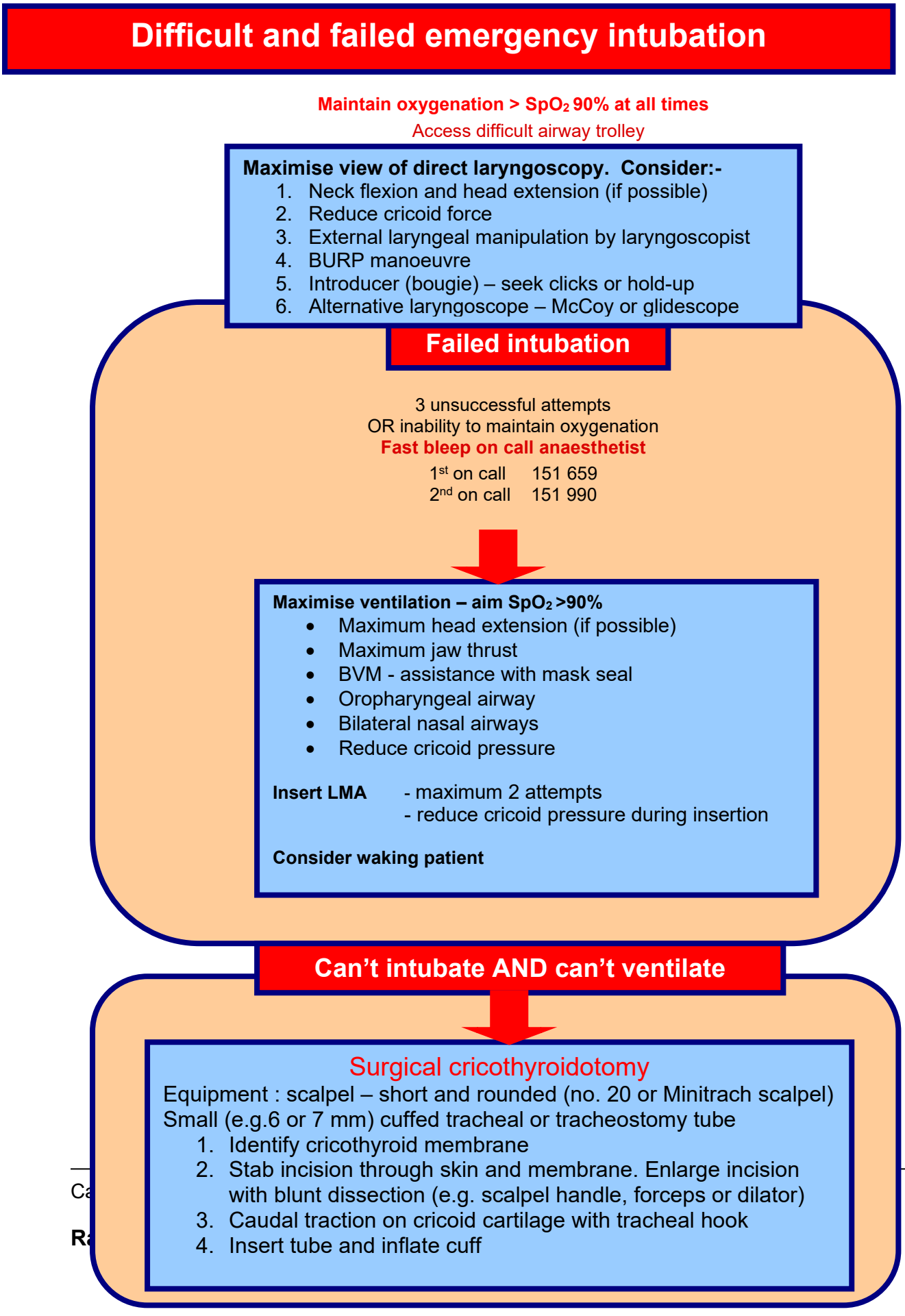
Figure 4. Route to 'Failed' Intubation algorithm

After true failed intubation the aim to maximise ventilation by:

- Airway manoeuvres / adjuncts together with bag-valve-mask ventilation.
- Insertion of a laryngeal mask airway (LMA) and waking patient.

If unable to intubate AND unable to ventilate despite the above then perform a surgical cricothyroidotomy in the adult or needle cricothyroidotomy in children.

Figure 5. Failed intubation Protocol:



10. ANAESTHETIC DRUGS

Emergency Department anaesthesia using rapid sequence induction requires a very limited range of drugs. However familiarity with the effects, correct dosages and side effects of these agents is of prime importance. This guidance provides only basic information regarding the drugs used in the department. When drawing up and using these drugs, consistency with regard to correct concentrations, syringe size and labelling is paramount.

10.1 Induction agents

Etomidate

- Is an intravenous induction agent associated with a rapid recovery.
- Stocked in 10ml ampoules of 2mg/ml Etomidate-Lipuro (white liquid – do not confuse with diazepam or propofol) or Hypnomidate (clear liquid)
- Should be drawn up undiluted into a 10ml syringe (20mg total) and labelled accordingly.
- Dosage for induction of anaesthesia is 0.3mg/kg (NOTE dosage should be reduced by ½ to $^{2}/_{3}$ in patients with significant hypotension).
- Onset of action is within 5-15 seconds (this will be delayed if there is a reduction in cardiac output).
- Duration of action 5-14 minutes.
- It is relatively cardio stable and causes less hypotension than other induction agents and lowers intracranial pressure.

10.2 Ketamine

- Ketamine is an anaesthetic agent, with analgesic properties in sub-anaesthetic doses.
- Ketamine increases pulse rate, cardiac output, blood pressure and muscle tone by direct cardiovascular system stimulation.
- Ketamine has a bronchodilator effect and is the agent of choice for asthmatics.
- Stocked in 10ml vials of 50mg/ml. Note other preparations exist!!
- Should be drawn up into a 10 ml syringe, diluted if required and labelled accordingly.
- Dosage intravenously is 2 mg/kg administered over at least 60 seconds. This gives good anaesthesia in 30-60 seconds and lasts for 5-10 minutes.
- Dosage intramuscularly is 4-6 mg/kg. This gives surgical anaesthesia in 3-4 minutes lasting 15-25 minutes (absorption unreliable, especially in the hypovolaemic patient).
- Ketamine is generally contraindicated in casualties in whom an elevation of blood pressure would cause harm (e.g. hypotensive patients with penetrating thoracic injuries, isolated head injury with normal blood pressure).

10.3 Propofol

- Propofol is an alkylphenol derivative, very lipid solube anaesthetic agent
- Rarely used for induction in ED (depresses myocardium, reduces cerebral perfusion pressure)
- Very good sedation for maintaining anaesthesia
- Induction dose 0.5 to 1.2 mg/kg iv

Muscle Relaxants

10.4 Suxamethonium

A short acting depolarising muscle relaxant with a rapid onset of action

- Stocked in 2ml ampoules of 50mg/ml AND pre-filled syringes.
- Should be drawn up into a 2ml syringe (100mg total) and labelled accordingly (if pre-filled syringe not being used).
- Dosage intravenously is 1.5-2 mg/kg.
- If second dose required – consider atropine pre-treatment.
- Onset of action 45-60 seconds usually preceded by fasciculation within 15 seconds.
- Initial return of muscle activity occurs within 3-5 minutes and adequate spontaneous ventilation within 8-10 minutes.
- May cause hypotension and bradycardia (especially after second dose, in younger children (atropine pre-treatment), in the presence of hypoxia).

10.5 Atracurium

- A long acting non-depolarising muscle relaxant
- Stocked in 5ml ampoules of 10mg/ml solution
- Is drawn up undiluted
- Dosage intravenously is 0.5-1mg/kg
- Onset of action is within 2-4 minutes and lasts for between 20 and 40 minutes

Drugs used in maintenance of Anaesthesia

10.6 Morphine

- A potent and effective opioid analgesic.
- Stocked in 1ml ampoules of 10mg/ml AND pre-filled 10mg/1ml syringes.
- Should be drawn up into a 10ml syringe with 9mls of N/Saline (10mg in total) and labelled accordingly – beware using pre-filled syringe alone.
- Dosage intravenously is initially 0.1–0.2 mg/kg (usually 5mg initially). Repeat doses should be given at regular intervals during transfer at approx $^1/_3$ the initial dose.
- Onset of action 2-3 minutes, peak effect in 10-20 minutes.
- May cause hypotension.
- May be reversed with Naloxone (caution).

10.7 Midazolam

- A short acting water soluble benzodiazepine which at higher doses causes intense sedation (anaesthesia) and retrograde amnesia.
- Stocked in 5ml ampoules of 2mg/ml or 2ml ampoules of 5mg/ml.
- Should be drawn up into a 10ml syringe with 5mls of normal saline (10mg in total) and labelled accordingly.
- Dosage intravenously is initially 0.1 mg/kg (usually 5mg initially). Repeat doses should be given at regular intervals during transfer at approx $^1/_3$ the initial dose.
- Onset of action 30-60 seconds with peak action at 12min.
- Half life of Midazolam is approx 2hrs.
- May cause hypotension.
- May be reversed with Flumazenil (caution).

10.8 Propofol

- See previous section.
- 2% Propofol infusion starting 7-12 mls/hour. Adjust rate to sedation level and blood pressure
- If using other concentrations adjust rate

Adjuncts to anaesthesia (Pre treatment phase)

10.9 Fentanyl

- A potent synthetic opiate with a rapid onset of action and short half life.
- Used to blunt sympathetic reflexes to laryngoscopy and the rise in ICP associated with intubation.
- Stocked in 2ml ampoules of 50µg/ml.
- Should be drawn up into a 2ml syringe (100µg in total) and labelled accordingly.
- Dosage intravenously of 1.5µg/kg over 30 – 60 seconds approx 3min before laryngoscopy.
- May cause significant respiratory depression and hypotension.

10.10 Atropine

- A competitive muscarinic antagonist, which causes vagal inhibition at the SA and AV nodes resulting in increased heart rate.
- Used to counter reflex bradycardia in children under 10 yrs or after repeat dose suxamethonium
- Stocked in 1ml ampoules of 600micrograms/ml.
- Should be drawn up in a 10ml syringe with 5mls N/Saline (600 microgram's in total)

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and labelled accordingly.

- Dosage intravenously of 0.02mg/kg three minutes before administration of Suxamethonium.

Equality and Diversity Statement

This document complies with the Cambridge University Hospitals NHS Foundation Trust service Equality and Diversity statement.

Disclaimer

It is **your** responsibility to check against the electronic library that this printed out copy is the most recent issue of this document.

References

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