

Emergency Intubation Outside of Theatre

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Key Amendments

Date	Amendment	Approved by
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INTRODUCTION

Airway maintenance and ventilation form a vital part of resuscitation of critically unwell patients. Whilst on occasion it is possible to intubate the patient without the use of drugs – such as during cardiac arrest or in severely obtunded patients – the majority will require administration of medication in order for these to be achieved safely. In these circumstances a rapid sequence induction (RSI) should be performed.

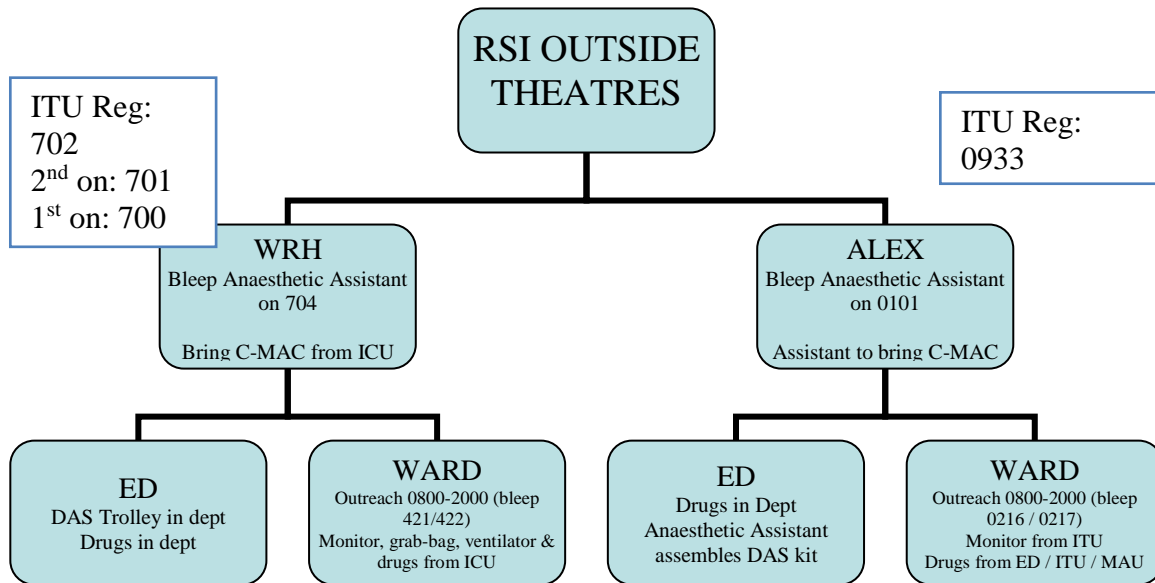
Whilst RSI for emergency surgery is frequently performed in theatres with the assistance of an Anaesthetic Assistant, in the critically ill patient it is often necessary to expedite intubation in an unfamiliar environment with assistance of varying experience. RSI in the critically ill patient is fraught with difficulty hence specific experience and skills are required.

The 4th National Audit Project of the Royal College of Anaesthetists and the Difficult Airway Society (NAP4) demonstrated the highest proportion of serious complications from airway management occurred in intensive care and the emergency department.¹ The biggest contributing factors were:

- Inadequate planning and preparation
- Lack of skilled staff and equipment
- Failure to use or interpret capnography
- Failure to follow emergency drills.

This document aims to offer clear guidance for medical and nursing staff as to how RSI should be performed outside theatres. For RSI performed in the emergency department, please also read the “Emergency Intubation undertaken in the Emergency Department” guideline.

Please note that the key documents are not designed to be printed, but to be used on-line. This is to ensure that the correct and most up-to-date version is being used. If, in exceptional circumstances, you need to print a copy, please note that the information will only be valid for 24 hours and should be read in conjunction with the key document supporting information and/or Key Document intranet page, which will provide approval and review information.



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DETAILS OF GUIDELINE

It is anticipated that RSI will be performed by the anaesthetic registrar covering intensive care (WRH bleep 702 / ALX bleep 0933) or the consultant on-call for intensive care (WRH bleep 602 or 603). Out of hours, the first on-call anaesthetist (WRH bleep 700 / ALX bleep 0907) or another suitably experienced intubator may be required to perform the procedure if the intensive care registrar is unavailable. In this event, the intensive care consultant on-call should be informed.

The appropriateness of RSI and ventilation must be considered prior to it being undertaken. The urgency of the situation may dictate that this can only be performed briefly.

Intubation and ventilation is indicated in the following circumstances:

- Failure of airway maintenance
- Failure to adequately protect airway
- Inadequate ventilation or hypoxaemia
- Anticipated clinical course eg severe shock, need for inter-hospital transfer, reduced GCS following head injury.

General Preparation

An airway assessment must be undertaken. This should be as thorough as practical given the circumstances and will largely be determined by the clinical state of the patient. Predictors of difficult intubation should prompt consideration for obtaining senior help.

The difficult airway trolley (where available) must be brought into the bed-space. Where it is not available, it must be requested immediately and if possible induction delayed until it is present.

Routine use of video-laryngoscopy is recommended. The Storz equipment should be brought from ITU (WRH) or theatres (ALX). The C-MAC blade will easily permit both direct and indirect laryngoscopy, easily facilitating its use in the event of an unanticipated difficult airway.

Prior to performance of RSI, appropriate assistance should be sought. This is likely to be an emergency department or intensive care nurse who is appropriately trained to assist with RSI, an Anaesthetic Assistant or a second anaesthetist. The on call Anaesthetic Assistant at the Alex can be contacted on bleep 0101 and the on-call Anaesthetic Assistant at Worcester can be contacted on 704.

There are multiple tasks to undertake and several people are required.

Check appropriate equipment

- Two working laryngoscopes (MAC 3 and 4 blades) if Storz C-MAC not immediately available
- A 20ml syringe
- Check integrity of the endotracheal tube cuff and availability of alternative size tubes
- Lubricate the endotracheal tube
- Availability of a bougie
- Functioning suction – on maximal flow, Yankeur sucker placed under pillow.
- A self-inflating bag or Mapleson C (“Waters”) circuit connected to high flow oxygen (15L/min)
- Catheter mount and HME filter
- Capnography
- Difficult intubation equipment: oropharyngeal airway, nasopharyngeal airway, supra-glottic airway device, alternate laryngoscopes, cricothyroidotomy sets.
- Video-laryngoscopes (Storz C-MAC)
- Availability of portable ventilator

- Drugs (induction, maintenance, emergency)

Task allocation

- Team Leader
- Intubator Intubator
- Application of cricoid pressure and monitoring
- Intubator assistant
- Drug administration (if not intubating anaesthetist)
- 2nd Intubator (if required)
- Rescue airway provider (if required)
- Cervical Spine stabilisation (if appropriate)

Instigation of monitoring – as determined by the Association of Anaesthetists of Great Britain and Ireland (AAGBI)

- Capnography
- ECG
- Blood pressure measurement – non-invasive blood pressure should be set to cycle at a minimum interval of 3 minutes
- Pulse oximeter – consider ear probe and use SpO₂ tone modulation

For critically ill patients on the ward, liaise with critical care outreach and request the portable monitor from intensive care. If possible, consideration should be made to transferring the patient to a more appropriate location for intubation. A senior clinician, or a more junior clinician in discussion with the intensive care consultant, should weigh up the risks and benefits of transferring a critically unwell patient prior to intubation.

Patient preparation

Establish adequate IV access. Ideally two large bore cannulae should be sited and a free-flowing bag of fluid should be connected to the cannula through which the anaesthetic drugs will be given. Alternatively, intra-osseous access should be inserted and drugs flushed thoroughly.

Position the patient to optimise the view at laryngoscopy. Typically this will involve one pillow under the head and shoulders and a degree of head up tilt on the trolley. Where cervical spine injury is anticipated, the collar and blocks must be removed prior to induction of anaesthesia and manual in-line stabilisation instigated.

Drugs

The drawing up of drugs is the responsibility of the anaesthetist. On occasion this may not be possible. Appendix 1 forms a reference guide of what will be required. With the exception of Ketamine and Rocuronium the drugs listed are available in the emergency anaesthetic drug boxes kept in the fridges in ED and other locations in the hospital. Where the anaesthetist has not drawn up the drugs they must check all drugs prior to their administration.

Performance of Rapid Sequence Induction

Three minutes of pre-oxygenation, ideally via a Mapleson C (“Waters”) circuit, should be undertaken. It is recognised that in some circumstances assistance with ventilation may be required during this period if the patient is severely hypoxic or hypercapnic.

The Emergency Intubation Checklist, found within the emergency drug boxes, should be completed during the pre-oxygenation period to ensure the appropriateness of the procedure and the understanding of task allocation and procedure.

The following forms a brief summary of what should be covered:

- Is the Patient Prepared?
 - Is the clinical state optimised? Has airway assessment been undertaken?
Is position optimised? Is patient preoxygenated?
- Is Monitoring Applied?
 - Usually: SpO₂, SpO₂ tone, ECG, BP (Cycle 3 mins), Capnography
- Is Equipment ready?
 - Video-laryngoscopy, suction, alternative scope, alternative endotracheal tube, Bougie, Supraglottic airway, Self-inflating bag, tipping trolley
- Are all necessary drugs ready?
 - Consider induction agent, muscle relaxant, post-intubation sedation, vasopressor/fluids
- Have roles been allocated?
 - Team leader, intubator, cricoid pressure, drug giver, 2nd intubator, rescue airway provider, C-spine stabilisation
- Is assistance from a theatre Anaesthetic Assistant required?
- Has there been preparation for unforeseen problems?
 - Who can be called for help? Can patient be woken up? Where is difficult airway equipment located? Discuss plan for difficult intubation.

The person responsible for performing cricoid pressure should locate and apply light pressure over the cricoid cartilage prior to induction. The correct position should be confirmed with the lead anaesthetist. On instruction of the lead anaesthetist, the induction agent and muscle relaxant should be administered. Cricoid pressure is applied fully as the patient loses consciousness.

Bag-mask ventilation may be performed at the discretion of the team-leader and this decision is made on a case by case basis. Once adequate muscle relaxation has occurred laryngoscopy should be attempted and the laryngoscopy grade clearly communicated to the team. The trachea should be intubated with minimal delay and the cuff inflated until there is no audible leak. Correct endotracheal tube placement must be confirmed by observing bilateral chest movement, bilateral chest auscultation in the axillae and the presence of a non-decaying capnograph trace. Only once the anaesthetist has confirmed the position of the endotracheal tube, and at their explicit instruction, should cricoid pressure be removed.

The endotracheal tube should then be secured, specifically noting the length at which it is tied. The ventilator may then be attached and anaesthesia should be maintained. A chest x-ray is required to confirm endotracheal tube position, but this is not urgent.

The difficult intubation

Failure to intubate within 30 seconds of commencing the attempt should prompt re-evaluation of the situation and identification of the likely problem. The intubator should declare a difficult intubation. Ensure the patient remains well oxygenated and request additional help.

The following should be considered:

- Optimise patient position
- Optimise operator position

- The use of a gum-elastic bougie
- An alternative laryngoscope blade eg McCoy, video-laryngoscope
- Partial release of cricoid pressure
- External manipulation of the larynx eg BURP.

A maximum of three attempts at laryngoscopy is permitted.

Failed intubation

If laryngoscopy is difficult the intubator should immediately inform the team. If following three attempts it has not been possible to intubate the intubator must declare "Failed Intubation". No further attempts at laryngoscopy should be made: maintaining oxygenation is the priority. Senior assistance should be sought immediately. This may be another anaesthetist resident in the hospital or contacting the on-call intensive care consultant via switchboard. The details of what to do in this event should be discussed as part of the pre-intubation checklist.

As a first line, simple airway adjuncts such as naso- or oro-pharyngeal airways should be inserted and bag-valve-mask ventilation commenced. This may be performed as either a one or two person technique. If ventilation can be achieved, cricoid pressure should be maintained.

In the event that bag-valve-mask ventilation is not possible following the removal of cricoid pressure, the next action is to insert a supraglottic airway device. A classic laryngeal mask airway (LMA) or i-Gel are both appropriate options. The latter is available on the difficult airway trolley.

If ventilation is successful anaesthesia could be maintained depending on the circumstances. Intubation may be possible using an airway exchange device or an intubating fiberoptic scope once further assistance is available. Alternatively, if the patient can be woken up, oxygenation should be maintained until sedative and muscle relaxant drugs have worn off and the patient can be woken up. This may not always be appropriate in a critically unwell patient and this decision will be taken on a case by case basis.

Can't intubate, can't ventilate

Failure to intubate and failure to ventilate via a supraglottic device necessitates the performance of emergency cricothyroidotomy. Surgical cricothyroidotomy is recommended as 1st line by the Difficult Airway Society. Ensure anaesthesia is maintained, muscle relaxation is adequate and neck access is optimal (may require a pillow under the shoulder blades to facilitate extension of the neck). Cannula cricothyroidotomy has a higher incidence of failure.

The difficult/failed intubation drill can be found in Appendix 3.

Post intubation management

Reassess oxygenation and ventilation. Endotracheal tube position should be reconfirmed once it has been secured and capnography must be present continuously.

Maintain anaesthesia and muscle relaxation as required: a Propofol infusion is usually appropriate with aliquots of muscle relaxant such as Atracurium or Rocuronium. Maintain AAGBI minimum standards of monitoring and consider the need for invasive monitoring.

Vigilance for complications following RSI such as bradycardia and hypotension is essential and their prompt management is crucial. Overzealous positive pressure ventilation may increase intrathoracic pressure, consequently reducing venous return and therefore cardiac output. Lung-protective ventilatory

strategies should be employed: this will assist in maintaining acceptable intrathoracic pressures.

Desaturation following intubation and ventilation necessitates a rapid and systematic approach to identifying the underlying problem. Check all equipment starting from the patient working back to the ventilator. Re-check the appropriateness of ventilator settings. Examine the patient for tube malposition and potential intra-thoracic problems such as pneumothorax or mucous plugging. Remember a pneumothorax may be either caused or exacerbated by positive pressure ventilation. Tension pneumothorax must be excluded.

Gastric decompression with an orogastric tube should be considered particularly in children and patients who have received a period of bag-valve-mask ventilation.

Packaging and transfer

Liaise with the receiving unit. Usually this will be theatre, intensive care, radiology or another hospital.

Ensure the following:

- All airways and lines must be secured
- All intubated and ventilated patients must be accompanied by an RSI 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
- Maintain AAGBI minimum standards of monitoring throughout transfer
- Full documentation should always be maintained.

Once the patient has been appropriately managed please complete an “Out of Theatre Intubation” audit form.

The paediatric patient

Sick children present to emergency departments and present unique challenges.

The general principles of induction and rapid sequence induction should still be applied.

However, it is recognised that experience with this population will be lower than in adults and thus preparation should be meticulous and appropriate equipment available.

The team should consider whether transfer to the operating theatre for intubation is more appropriate than undertaking the procedure in an external setting

Non-technical skills are vital and assistance may be considered from other departments including anaesthesia, intensive care, paediatrics and surgery.

Trained assistance is vital and an Operating Department Practitioner may be required from theatre.

The incidence of difficult airway in this population is probably under-reported but is generally lower than in adults. Simple manoeuvres tend to be beneficial, unless the child has congenital development abnormalities which will require expert assistance.

However, hypoxia is the main concern as it leads to bradycardia and cardiac arrest. Thus maintenance of oxygenation must be a priority.

Guidelines for the management of the paediatric failed laryngoscopy are reproduced in appendix 4. It should be noted that these guidelines are initially intended for use in the operating theatre environment but provide useful guidance in an external setting. Also note that the use of the cricothyroidotomy cannula is still part of the guideline for Can't Intubate, Can't Oxygenate/ Ventilate scenario in children.

Paediatric Resuscitation Trolleys

At Worcester Royal Hospital Paediatric Resuscitation Trolleys are available on Riverbank ward, WRH Theatre Recovery and the WRH A+E Resus department.

The A+E Paediatric trolley contains Miller blades (size 00,0,1 and 2), Mackintosh blades (size 2 and 3) and uncuffed endotracheal tubes from size 2-6. LMAs are available in size 2 / 2.5 / 3 and 4. There are stylets available (from size 2mm).

The Riverbank and Main Theatre Paediatric Resuscitation trolleys are standardised and contain Miller blades (sizes 00,0,1 and 2), Mackintosh blades (sizes 1,2 and 3) and uncuffed endotracheal tubes from size 2-6mm. Riverbank and Theatres also stock cuffed endotracheal tubes from size 3mm. Cuffed 3mm tubes are suitable for infants over 3kgs. There are also stylets available (smallest size is 2mm). LMAs are available in size 1/1.5/2/2.5/3 and 4. Specific size guidance is provided on the manufacturers packaging but as an approximate weight related guide:

LMA Size	Weight	LMA Cuff Volume (mls)
1	<5kg	Up to 4
1.5	5-10kg	Up to 7
2	10-20kg	Up to 10
2.5	20-30kg	Up to 14
3	30-40kg	Up to 20

At the Alexandra Hospital a Paediatric Resuscitation trolley is available in the Emergency Department (Resus room). This should be maintained with the same equipment that is found within the Riverbank resuscitation trolley.

Videolaryngoscopy should be considered and Miller blades (in size 0 and size 1) are available from main theatres, and the neonatal unit.

Consider the use of a supraglottic airway device as a rescue device early.

Emergency airway access is challenging due to the size of the trachea relative to the scalpel blade and consideration should be given to head and neck surgery support.

Paediatric Drug Calculator

Use of a drug calculator should reduce errors in medication. A commonly used regional guide is that from Birmingham Childrens Hospital, Kids Intensive Care Decision And Support.

<http://kids.bch.nhs.uk/healthcare-professionals-2/drug-calculator/>

The team are also available for advice and transfer.

Cuffed and Uncuffed Endotracheal Tubes for Paediatric Intubation

The decision about whether to use an uncuffed or cuffed tube will be made on a case by case basis by the health care professionals involved.

Traditionally cuffed tubes have not been used on children under 8 years old as it has been thought that the cricoid is circular which enables a snug circumferential fit. However recent evidence has suggested that the paediatric cricoid is more elliptical with a cylindrical shape and a narrowest point at the glottic/subglottic region.

The advent of high volume low pressure (HVLP) microcuff tubes has meant children under 8 may be considered for a cuffed tube. Microcuff ETTs have shorter cuffs with no murphys eye meaning that the cuff can be placed more distally reducing risk of endobronchial intubation and a cuff in the sub-glottic zone.

Potential advantages of a cuffed endotracheal tube include decreased reintubation rates, possibly reduced risk of aspiration and ventilator associated pneumonia and, in theory, reduced airway damage as a smaller tube is selected (usually 0.5mm less than uncuffed ETT) which does not wedge within the delicate cricoid.

If using a cuffed tube then cuff pressures should be checked. Cuff pressures should be maintained at below 20 cm H₂O. Generally the cuff is inflated until the leak just disappears at peak inspiratory pressure of 20-25 cmH₂O.

However, potential disadvantages include smaller diameter tubes which have increased resistance and potential for ETT blockage. Also there is concern about airway damage due to overinflated cuffs causing circular necrosis leading to subglottic stenosis.

MONITORING TOOL

Following the introduction of this guideline, an audit will be carried out within one year by the anaesthetic department to monitor compliance.

STANDARDS	%	CLINICAL EXCEPTIONS
All patients undergoing emergency intubation outside theatres have AAGBI minimum monitoring attached	100	
The checklist is used for all emergency intubations outside theatre	100	

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REFERENCES

1. Cook TM, Woodall, Harper J, Benger J on behalf of the fourth national audit project. Major complications of airway management in the UK: results of the Fourth National Audit Project of the Royal College of Anaesthetists and the Difficult Airway Society. Part 2: intensive care and emergency departments. *Br J Anaesth* (2011) 106 (5) 632-42
2. Frerk C, Mitchell VS, McNarry AF et al. Difficult Airway Society 2015 guidelines for management of unanticipated difficult intubation in adults. *British Journal of Anaesthesia* (2015) 115 (6) 827-848
3. Royal College of Anaesthetists. "4th National Audit Project of The Royal College of Anaesthetists and The Difficult Airway Society. Major airway complications of airway management in the United Kingdom, Report and Findings." Royal College of Anaesthetists. London 2011

CONTRIBUTION LIST

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Appendix 1 – Drugs

Induction agents

- Thiopentone 500mg made up to 20ml in water for injection
- Alternatively: Etomidate 0.2% 20mls neat / Ketamine 10mg/ml 20mls neat / 1% Propofol 20mls

Muscle relaxants

- Suxamethonium 100mg in 2mls (neat)
- Alternatively Rocuronium 10mg/ml 10mls (neat)
- For follow up relaxation: Atracurium 10mg/ml 5mls (neat), Vecuronium 50mg made up to 5mls in water for injection, Rocuronium 10mg/ml 5mls (neat)



Maintenance of anaesthesia

- 1% Propofol 50mls neat as infusion
- Alternatively Midazolam 10mg made up to 10mls in 0.9% saline and Morphine 10mg made up to 10mls in 0.9% saline in aliquots

Emergency drugs

- Metaraminol 10mg made up to 20mls in 0.9% saline
- Ephedrine 30mg made up to 10mls in 0.9% saline
- Atropine 600micrograms 1ml (neat) or Glycopyrrolate 600micrograms 3mls (neat)

Appendix 2 – RSI Checklist

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<p>IS THE TEAM READY?</p> <table style="width: 100%; border-collapse: collapse;"> <tr><td>Team leader</td><td><input type="checkbox"/></td></tr> <tr><td>Intubator</td><td><input type="checkbox"/></td></tr> <tr><td>Cricoid Pressure</td><td><input type="checkbox"/></td></tr> <tr><td>Intubator assistant</td><td><input type="checkbox"/></td></tr> <tr><td>Drug giver</td><td><input type="checkbox"/></td></tr> <tr><td>2nd intubator</td><td><input type="checkbox"/></td></tr> <tr><td>Rescue airway provider</td><td><input type="checkbox"/></td></tr> <tr><td>C-spine stabilisation</td><td><input type="checkbox"/></td></tr> <tr><td>Is ODP required (bleep 704)</td><td><input type="checkbox"/></td></tr> </table>		Team leader	<input type="checkbox"/>	Intubator	<input type="checkbox"/>	Cricoid Pressure	<input type="checkbox"/>	Intubator assistant	<input type="checkbox"/>	Drug giver	<input type="checkbox"/>	2nd intubator	<input type="checkbox"/>	Rescue airway provider	<input type="checkbox"/>	C-spine stabilisation	<input type="checkbox"/>	Is ODP required (bleep 704)	<input type="checkbox"/>																		
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<p>PREPARE FOR PROBLEMS</p> <p>Who can be called for help?</p> <p>Can patient be woken up?</p> <p>Where is the difficult airway equipment?</p> <p>Discuss plan for difficult intubation:</p> <p>Plan A i.e bougie/BURP/cricoid release/position change/laryngoscope change</p> <p>Plan B i.e oxygenate, i-Gel, Fibre-optic intubation</p> <p>Plan C i.e surgical or needle cricothyrotomy</p>																																					
<p>Signature to proceed:.....</p> <p>Designation:</p>		<p>Print Name:</p> <p>Date:</p>																																			
	PF WR4960 Emergency Intubation Checklist Version 2 Page 1 of 2																																				

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Appendix 3 – Difficult Intubation Strategy

Direct laryngoscopy → Any difficulties → Get help

PLAN A – INITIAL TRACHEAL INTUBATION PLAN

- Head position
- External laryngeal manipulation
- Laryngoscope change (McCoy / C-MAC / Airtraq)
- Reduce cricoid force?

MAXIMUM 3 ATTEMPTS

Maintain:

- Oxygenation
- Cricoid pressure
- Anaesthesia

INTUBATED

Check position:

- Visual
- Capnograph
- Auscultate

Succeed

Failed Intubation

Maintain cricoid

PLAN B – MAINTENANCE OF OXYGENATION AND VENTILATION

Use face mask, oxygenate and ventilate
1 or 2 person mask technique (with oral ± nasal airway)
Consider reducing cricoid force if ventilation difficult

Succeed

Failed oxygenation (SpO2 < 90%)

Supraglottic airway device (eg i-Gel)
Reduce cricoid force during insertion
Oxygenate and ventilate

Succeed

Consider continuing with supraglottic device

Consider airway exchange device / fiberoptic (with senior assistance)

Can patient be woken?

Failed oxygenation and ventilation

PLAN C – RESCUE TECHNIQUES FOR "CAN'T INTUBATE CAN'T VENTILATE"

Emergency cricothyroidotomy

- Maximal neck extension
- Ensure anaesthesia and muscle relaxation
- Surgical Cricothyroidotomy recommended

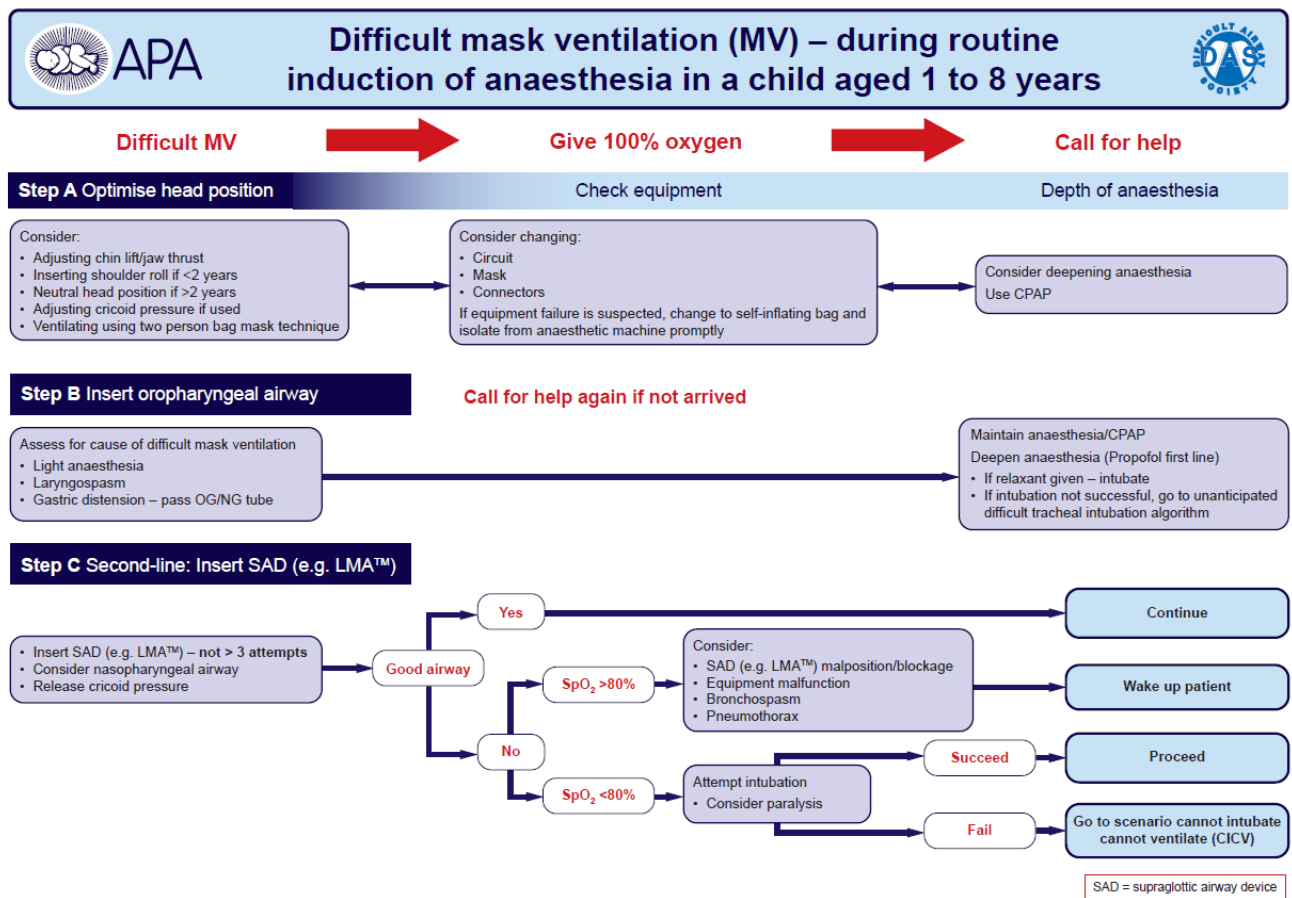
Appendix 4 – Guidelines for difficult and failed laryngoscopy in children

Reproduced from -
Difficult Airway Society 2015 guidelines for management of unanticipated difficult intubation in adults

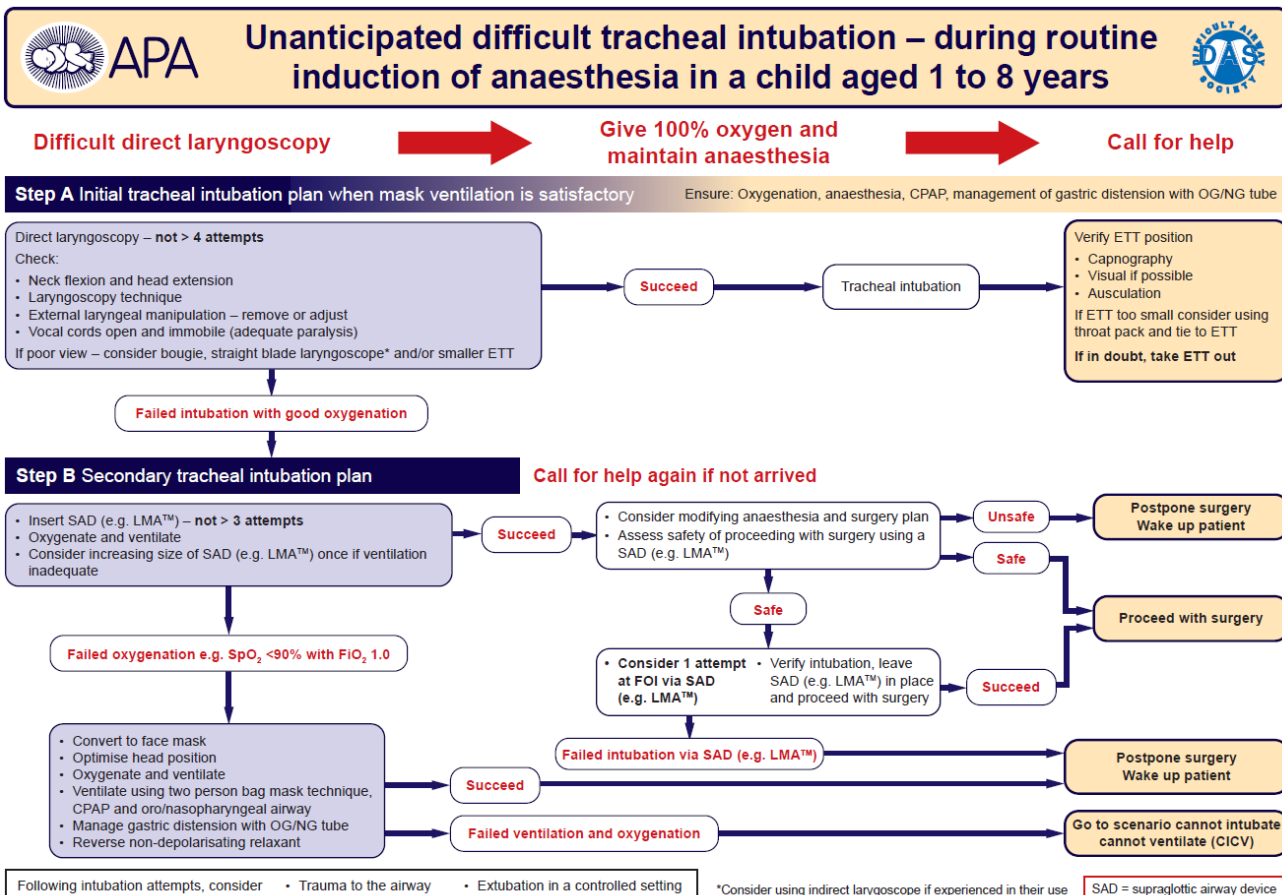
C. Frerk, V. S. Mitchell, A. F. McNarry, C. Mendonca, R. Bhagrath, A. Patel, E. P. O’Sullivan, N. M. Woodall and I. Ahmad, Difficult Airway Society

Intubation guidelines working group

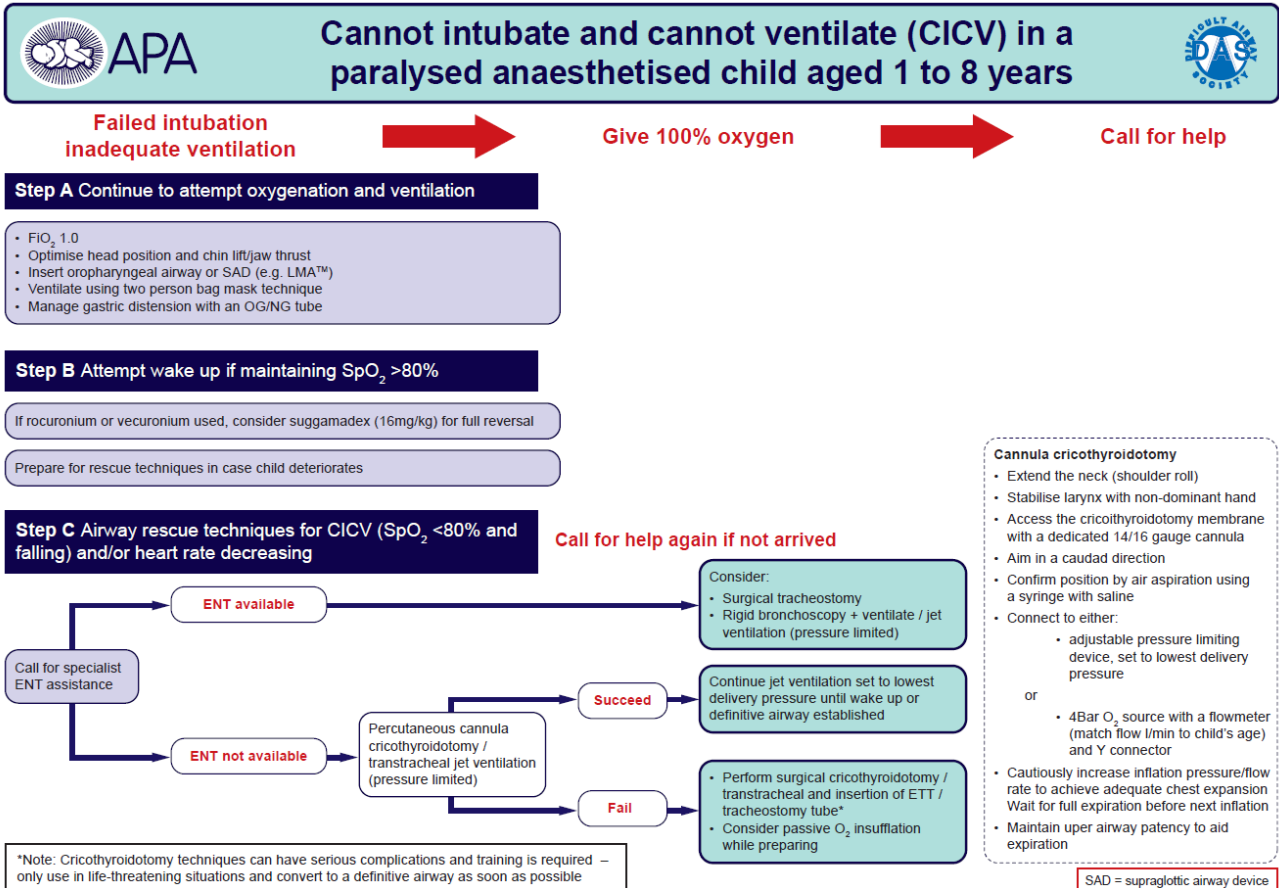
British Journal of Anaesthesia, 115 (6): 827–848 (2015) doi:10.1093/bja/aev371



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