

Emergency Airway Management in Children

Key Points

- Emergency airway management in children, particularly infants and neonates, is often challenging and is a rare but high stakes clinical scenario.
- Pre procedure assessment and planning is critical to inform a multi-disciplinary approach.
- The current difficult airway guidelines should be followed, and video laryngoscopy is recommended as first-line laryngoscopy for this age group.
- Surgical tracheostomy is the recommended front of neck access in this age group but other techniques can be appropriate depending upon the clinical scenario
- Staff required to perform emergency airway management for this group of patients should receive appropriate training in the equipment and skills required.

Version: 1.0
Date Issued: 25 June 2025
Review Date: December 2027
Key words: Paediatric, airway, emergency

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Abbreviations

ENT	Ear Nose Throat
ETT	Endotracheal Tube
PICU	Paediatric Intensive Care Unit
SORT	Southampton and Oxford Retrieval Team

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1.0 Introduction

Emergency airway management in children is always a challenging clinical scenario. This is particularly pertinent to airway management in neonates (28 days or less gestational age) and infants (less than 1 year of age) and are associated with a high incidence of critical events. As non-tertiary paediatric sites, the staff at Frimley Health NHS Trust have a relative unfamiliarity with airway management in this age group and is more often performed out of hours as an emergency. This guideline is written to assist those performing this procedure, primarily in emergencies, and provide some elements of standardisation of an approach to airway management in this patient cohort to enhance safety and performance.

2.0 The Scope of the Guideline

This guideline refers to the following subset of patients:

- Unplanned airway management
- Patients under the age of 18
- Patients discharged from the neonatal services

3.0 The Guideline

3.1 Pre-Procedure Decision-Making and Assessment

For emergency airway management:

- A multidisciplinary approach (paediatrics, anaesthesia, intensive care, ENT) should be utilised to discuss the indication, timing, and optimisation for airway management.
- A full medical history of the child should be taken including past medical history, fasting status, allergies, family history of difficulties with anaesthesia. Any previous anaesthesia notes should be reviewed.
- A core requirement of the preoperative assessment is to identify any predictors for difficult airway management. Difficulties generally fall into three categories:
 - Difficult anatomy – Airway examination should be tailored to this population and in particularly examining for facial, mandibular and neck deformities.
 - Difficult haemodynamics – any critically unwell child will be challenging to intubate without some haemodynamic compromise.
 - Difficult scenario – emergency scenarios are more challenging with little time for preparation with compromises in timing, location and optimisation of the patient.
- The admitting team are required to have a discussion with the regional Paediatric Intensive Care Retrieval Service that serves the local Paediatric Intensive Care Units (PICUs) for retrieval and acceptance for transfer of the patient. The referral should be made by a consultant responsible for the child's admission or a suitable senior clinician if they are unavailable.
- An appropriate location for airway management should be identified. The decision of location should be based upon the clinical urgency and the personnel and equipment resources available.

3.2 Equipment

The minimum requirement for equipment for airway management in this patient cohort (appropriately sized with availability of the full range of sizes) includes:

- Intravenous access
- Intraosseous access
- Face masks
- Nasogastric tubes and syringes
- Endotracheal tubes – micro-cuffed and uncuffed (sized as per *Appendix A*)
- Tube lubrication
- Oropharyngeal airways
- Nasopharyngeal airways
- Supraglottic airway devices – first and second generations
- Laryngoscopes – Macintosh and Miller
- Video laryngoscope – stocked with Miller and hyper-angulated blades (all paediatric blades available)
- Mapleson F Circuit with Jackson Rees Modification
- Self-inflating bag
- Paediatric Yankauer suction catheter
- Flexible suction catheters (sized as per *Appendix B*)
- Paediatric bougie (5Fr and 10Fr)
- Paediatric stylet (2mm)
- Magill forceps
- Endotracheal tube tape
- Cuff manometer
- Appropriate monitoring (Oxygen saturations, blood pressure, waveform capnography and ECG).
- HME filters and neonatal HMEs
- Drugs
- Stethoscope
- Difficult airway trolley – this should ensure contains everything above plus:
 - Fiberoptic bronchoscope – paediatric sized
 - Scalpel/bougie “Surgical Airway” kit – 10 scalpel blade, 3.0ETT with 5 Fr Bougie for neonates and infants (<1 year), 4.0 ETT with 8 Fr Frova introducer for (1 – 12 years) and 5.0 ETT and 11 Fr airway exchange catheter for (12 years to adult sized)
 - Cannula Cricothyroidotomy Kit – 16G In Site cannula, Rapid O2 oxygen insufflator™ or equivalent device, 5ml syringe, 10ml saline ampoule.
- Availability of a “Make the Airway Safe Trolley” – stocked as per the “Make Airway Safe” guidelines and must contain the full range of sizes of paediatric tracheostomies.

3.3 Preparation for Intubation

- Team – the team should conduct a briefing. The pertinent case history should be shared with an airway strategy verbalised (Plan A/B/C/D). Potential problems and failures should be discussed and actions pre-determined.
- Personnel - the correct personnel should be present with a minimum of two anaesthesia or intensive care consultants and a skilled airway assistant (e.g. operating department practitioner). Other personnel that should be considered include an ENT consultant and paediatrician/neonatal consultant. The admitting team must be immediately available for assistance with ongoing patient care.
- Roles – a team leader should be identified and stated to the team. Roles during the intubation should be assigned and at least include first intubator, second intubator, airway assistant and drug administrator.
- Checklists - a specific paediatric intubation checklist should be utilised to assist with optimisation of human factors.
- Patient positioning – generally a neutral supine position is optimal for this cohort of patients. A shoulder roll should be considered for younger patients.
- Gastric aspiration – if a nasogastric tube is in situ, then it should be aspirated. If one is not present consideration should be made for inserting one prior to intubation on a case-by-case basis to decide whether the benefits (reduced aspiration risk, more effective face mask ventilation) outweigh the risks (regurgitation, time delay and agitation)
- Medications for intubation (*Appendix C*) – drugs for intubation as per the decision of the lead clinician for intubation. The SORT recommended medications for intubation for critically unwell children are:
 - Ketamine = 2mg/kg, or reduced to 0.5 to 1mg/kg if haemodynamically unstable
 - Rocuronium = 1mg/kg
- Rescue medications and resuscitation drugs should also be prepared. This should include dilute adrenaline, atropine, fluid boluses,
- Optimisation of haemodynamics prior to intubation with consideration of the following:
 - Fluid resuscitation
 - Peripheral adrenaline infusion
 - Checking and correcting ionised Calcium > 1.0 to 1.2 (replace with 0.5mL/kg of 10% Calcium **Gluconate**, see SORT calculator)
- Reliable intravenous/intraosseous access – at least one reliable access is required prior to intubation. Two intravenous lines are preferable but avoid delays in proceeding with intubation to obtain a second intravenous line. An intraosseous device should be immediately available if proceeding with intubation with one intravenous line.

3.4 Airway Management in General

Some key points for the general management include:

- Pre oxygenation should be attempted with either a face mask or nasal prongs.
- Apnoeic oxygenation (low or high flow oxygen) should be utilised for neonatal intubations and considered for infants dependent on an individual risk/benefit analysis.
- Videolaryngoscopy with age adapted standard blades should be used as first line for intubation. In our centre, this would mean utilising the Glidescope™ videoscope with a Miller blade for neonatal intubations.

- Oral intubation is preferred for critically unwell neonatal intubations. Nasal intubation could also be considered and topical nasal vasoconstrictor (Lidocaine 5%/Phenylephrine 0.5%) should be applied in this instance (unlicensed use).
- Intubation success should be verified by clinical assessment and a continued end-tidal CO₂ waveform.
- Cuffed ETT tubes that are age and weight appropriately sized as per manufacturer should be used for children above 3kg (*Appendix A*). Uncuffed tubes can also be safely used.
- Cuff pressures should be measured and should not exceed 20-30 cmH₂O.

3.5 Management of an Anticipated Difficult Airway Management

Airway management should follow the difficult airway algorithm (*Appendix D*) and utilise the difficult airway cognitive aid (*Appendix E*).

Some key points:

- In addition to a video laryngoscope with an age adapted blade either an appropriately sized flexible or rigid/semi-rigid bronchoscope should be prepared and incorporated into the airway strategy.
- Presence of an ENT surgeon is recommended for intubation and performed in theatre.
- Attempts at intubation should be limited to one trainee and three consultant attempts and following that awakening the patient should be considered (but is unlikely to be feasible).
- In cases where intubation proves difficult, consideration should be made for advanced techniques. These include:
 - Hyper-angulated blades with endotracheal tube and stylet
 - Flexible bronchoscope intubation (including with concurrent use of video laryngoscope)
 - Rigid bronchoscope intubation
 - Flexible bronchoscope intubation via a supraglottic device

3.6 Management of Unanticipated Difficult Intubation (2 failed intubation attempts)

Airway management should follow the difficult airway algorithm (*Appendix D*) and utilise the difficult airway cognitive aid (*Appendix E*).

Some key points:

- Supraglottic airway device should be used as a rescue device when an intubation has failed, and face-mask ventilation is difficult.
- In a scenario of cannot intubate and cannot oxygenate, a surgical tracheostomy should be used as first line front of neck access.
- Surgical cricothyroidotomy and percutaneous needle thyroidotomy are not recommended in this cohort of patients but may be deemed necessary in some clinical scenarios

3.7 Post Airway Management

- On going sedation will be required and SORT recommend morphine and midazolam infusions ([Drug calculator \(sort.nhs.uk\)](https://www.sort.nhs.uk/Drug-calculator.aspx), <https://www.sort.nhs.uk/Guidelines/Drug-calculator.aspx>)
- Endotracheal tube insertion depth should be checked with a chest x-ray. Ultrasound assessment is also feasible and should be clinically correlated.

- Endotracheal tube should be secured as per *Appendix F*.
- Further procedures that are beneficial prior to retrieval include nasogastric tube insertion (if not done so already), a reliable second intravenous access obtained, urinary catheter inserted, initial blood tests taken and a chest x-ray to confirm endotracheal tube position.
- A responsible clinician is required to continue sedation and monitoring of the patient until handover occurs to the retrieval team.
- Extubation of child who requires airway management as an emergency is unlikely to occur locally as they would be transferred to the nearest PICU for further care. However, there may be some clinical scenarios where SORT would encourage extubation and this should be conducted in a controlled environment (i.e., intensive care or theatre) with personnel and equipment prepared for reintubation.
- Clear documentation is required to ensure continuity of care, facilitate communication among healthcare providers, and provide a record for future reference.

4.0 Training and Competency

- It is recommended that all emergency airway management occurrences are recorded in a Trust paediatric emergency airway registry. A full record should be collected as part of an airway registry and any complications recorded.
- Cases of difficult intubation should be reviewed specifically to identify if any systemic factors can be optimised.
- Simulation training for the relevant personnel provides an opportunity to obtain some familiarity with this rare but high stakes clinical scenario and to optimise performance and safety.

References

Airway management in neonates and infants: European Society of Anaesthesiology and Intensive Care and British Journal of Anaesthesia joint guidelines (2024). Disma N, Asai T, Cronin A et al. *British Journal of Anaesthesia*, 132 (1): 124 – 144 Available at: <https://doi.org/10.1016/j.bja.2023.08.040>. (Accessed 19 April 2025)

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Southampton and Oxford Retrieval Team (2024) *Anaesthesia for emergencies*. Available at: <https://www.sort.nhs.uk/Guidelines/Guidelines-systems.aspx> (Accessed: 19 April 2025)

Flannigan, C. (no date) *Intubation Preparation and Equipment*. Available at: <https://www.paediatricemergencies.com/intubationcourse/course-manual/intubation-preparation-and-equipment/> (Accessed: 19 April 2025)

Appendix A: SORT Intubation Checklist (with paediatric equipment size guide)

<https://www.sort.nhs.uk/Media/Guidelines/Intubation-checklist-2024.pdf>

SORT: Paediatric Intubation Checklist

Preparation

Planning and Team

- ☐ Are SORT aware?
- ☐ Members of the team introduce themselves
- ☐ Indication for intubation?
- ☐ Are spinal precautions required?
- ☐ Any anticipated airway difficulty? If so is ENT presence needed? Use MAST guideline
- ☐ Is the patient haemodynamically optimised for intubation?

Patient and Monitoring

- ☐ IV access (ideally 2 working sites)
- ☐ 3-minute pre-oxygenation 100% O₂
- ☐ Insert NG tube & aspirate continuously when bag-mask ventilating (especially in neonates)
- ☐ ETCO₂ attached to the bagging circuit and working
- ☐ Optimise patient position (consider shoulder roll)
- ☐ SpO₂ "beeps" on
- ☐ BP on automatic 1-minute cycles

Equipment

- ☐ Correct size facemask and Ayres T-piece (<20 Kg) or waters circuit (>20kg)
- ☐ Guedel airway
- ☐ Yankauer suction and soft suction catheters (use twice the internal diameter of ETT for size)
- ☐ 1 Video laryngoscope (gold-standard) + 1 other (bulbs/battery checked) and 2x blade sizes
- ☐ Correct size Bougie and Stylet available (ETT loaded with stylet for neonates and infants)
- ☐ Correct sized ETT + one size up/down
- ☐ ETT cuff checked
- ☐ 2-5ml syringe for inflating cuff
- ☐ Magills
- ☐ Stethoscope
- ☐ ETT tape
- ☐ Ventilator ready with appropriate settings (*see initiation of ventilation guideline*)

Drugs (*see SORT drug calculator for doses*)

Any allergies?

- ☐ Ketamine
- ☐ Rocuronium
- ☐ Diluted adrenaline
- ☐ IV fluid bolus 5-20ml/kg Hartmann's or Plasmalyte
- ☐ Morphine + Midazolam or Propofol infusions for ongoing sedation

Time out

- ☐ Assign roles: Team leader (overviews and treats physiology), Intubator, Airway Assistant, Drug-giver, Pulse-checker, C-spine immobilisation (if required)
- ☐ Any concerns about the procedure?
- ☐ Is senior/extra help needed?
- ☐ Anticipated difficult airway?
- ☐ Airway plan discussed?

Paediatric equipment size guide

Do NOT use APLS formula to size microcuff ETT.

Neonate <3kg	consider uncuffed
>3kg up to 8 months:	3.0mm* microcuff
8 months -2 years:	3.5mm microcuff
2-4 years:	4.0mm microcuff
4-6 years:	4.5mm microcuff
6-8 years:	5.0mm microcuff

*If microcuff unavailable use cuffed 3.0mm up to 1 year, and otherwise size as above

Length: Thick black depth mark at level of the vocal cords
 ORAL = Age/2 + 12, NASAL = Age/2 + 15

Supraglottic Device (LMA or iGel):

Size 1	<5 kg
Size 1.5	5-10 kg
Size 2	10-20 kg
Size 2.5	20-30 kg
Size 3	30-60 kg

Stylet:

2.0 Fr Stylet ETT up to 5.0mm
 4.0 Fr Stylet ETT >5.0mm

Bougie:

Size 5 ETT sizes <3.5
 Size 10 ETT Sizes 4.0-5.5

Suction Catheter:

Twice internal diameter of ETT (e.g. 8Fr for a 4.0mm ETT)

Post-intubation checklist

- ☐ Sustained ETCO₂ capnography waveform x7
- ☐ Tube depth checked? (*bilateral air entry*)
- ☐ ETT taped and secured (*see guideline*)
- ☐ Appropriate ventilator settings (*see ventilation guideline*)
- ☐ Sedation started
- ☐ Wean FiO₂ to target appropriate SpO₂
 - >92% respiratory
 - 75-85% in cyanotic congenital heart disease
 - >94% neuroprotection
- ☐ CXR

Documentation

Procedure Date and time:

Name and Grade of:

- Intubator

- Assistant

No. of intubation attempts:

Grade of intubation:

Bougie/Stylet used? Y/N

ETT Size:

ETT initially secured at: cm

ETT adequate position on CXR? Y/N

ETT adjusted after CXR? Y/N

Final ETT depth cm

Patient Details/Sticker

Name:

DOB:

Hospital Number:

SORT Sept 2024 Review 2027
www.sort.nhs.uk

Appendix B: Flexible Suction Catheters Sizing Table

Source: [Intubation Preparation and Equipment | Paediatric Emergencies](#)

Endotracheal Tube Internal Diameter (mm)	Suction Catheter Size (CH)
2.5 - 3.0	6
3.5 - 4.5	8
5.0 - 5.5	10
6.0 - 6.5	12
≥ 7.0	14

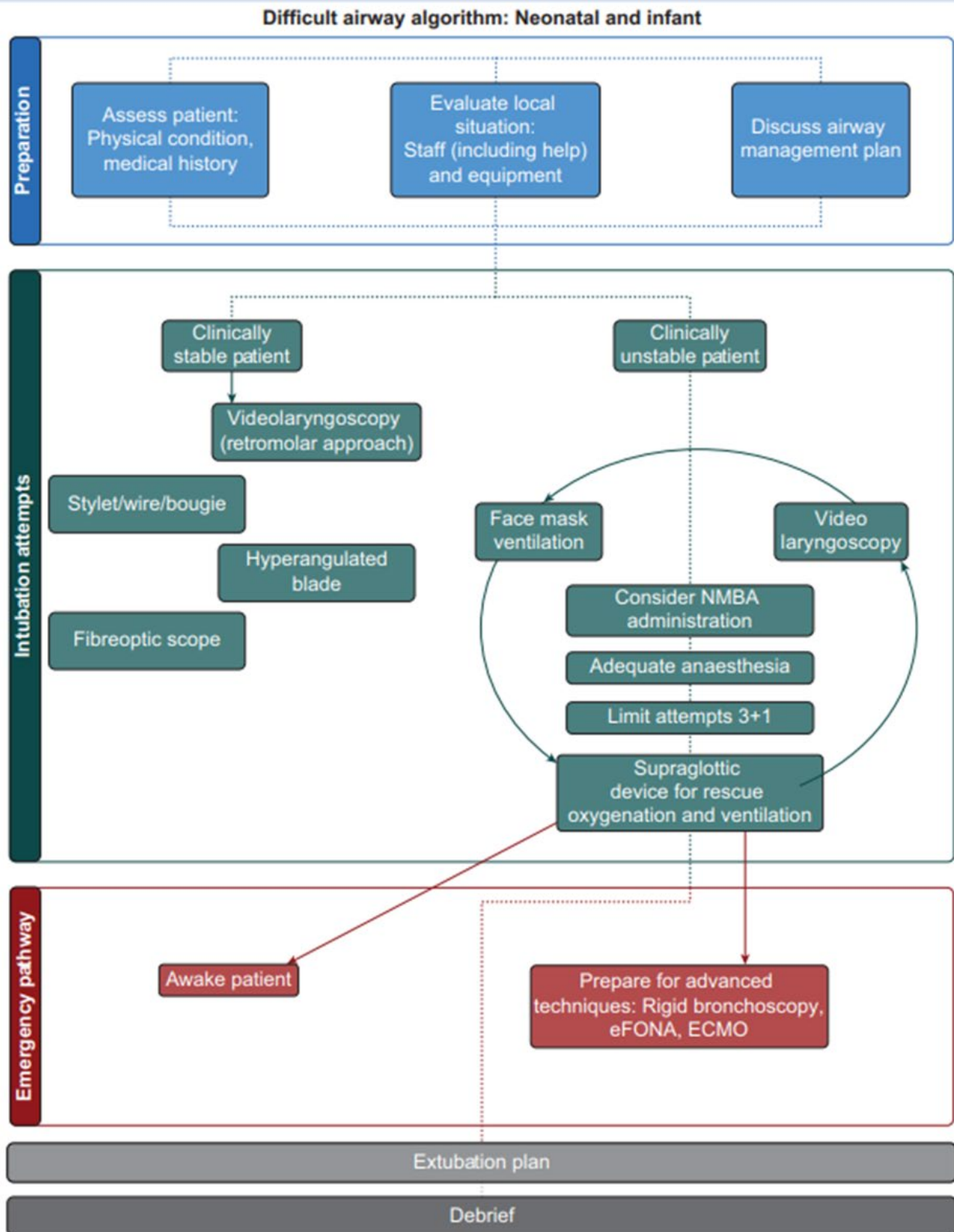
Appendix C: Emergency Induction of Anaesthesia Advice by SORT

Source: Southampton and Oxford Retrieval Team – Anaesthesia for Emergencies Guideline (2024). Available at [Anaesthesia for emergencies \(sort.nhs.uk\)](https://www.sort.nhs.uk/anaesthesia-for-emergencies).

Emergency Induction of Anaesthesia in a Critically ill Neonate or Child
If red flags for imminent cardiorespiratory arrest or brainstem herniation are present DO NOT DELAY Place a 2222 paediatric emergency call to gather the MDT with skills for advanced resuscitation A: Severe stridor or upper airway obstruction not relieved by CPAP/High-flow nasal cannula O₂ or simple airway manoeuvres B: SpO₂ <92% in maximum oxygen therapy, severe work of breathing, unable to talk, 'silent chest' C: Fluid refractory shock/hypotension, no saturations trace due to poor perfusion, lactate >4 D: Hypertension & bradycardia, abnormal pupil responses, suspected raised ICP (regardless of GCS), status epilepticus
CALL SORT EARLY FOR SUPPORT: 02380 775502
Apply PEEP via Ayres T-piece or Waters circuit with 15L/min oxygen flow (or increase FiO₂ to 1.0 if on non-invasive ventilation/High-flow nasal cannula O₂) Ensure full monitoring is attached: ECG, BP on 1min cycles, finger on pulse, SpO₂, End-Tidal CO₂
Ensure at least one working intravenous (IV) or intraosseous (IO) line
Ensure circulation is adequately supported if signs of shock Adequate fluid resuscitation as indicated (up to 40ml/kg isotonic fluid) Peripheral adrenaline infusion running at 0.1microg/kg/min (see SORT drug calculator) Consider calcium gluconate after discussion with SORT
Prepare airway equipment See 'SORT Intubation Checklist' & consider 'Difficult Airway Algorithms: MAST' as indicated Ensure cuffed tubes used (appropriate size for age of child) NG tube insertion in neonates/infants prior to induction to allow NG aspiration during mask ventilation
Prepare anaesthetic induction agents Ketamine 2mg/kg IV (reduced to 0.5 to 1mg/kg if haemodynamically unstable) Rocuronium 1mg/kg Drug onset will be slow in a low cardiac output state: be patient DO NOT USE PROPOFOL/THIOPENTONE/VOLATILE ANAESTHETICS
INDUCTION MAY REDUCE SYMPATHETIC TONE AND REDUCE CARDIAC OUTPUT PREPARE FOR CARDIOVASCULAR COMPROMISE BY PREPARING ISOTONIC CRYSTALLOID BOLUS & RESCUE DILUTED ADRENALINE (see SORT drug calculator)
Maintain ongoing sedation following intubation Morphine & Midazolam infusions (see SORT drug calculator) Propofol infusion may be used if not shocked, in time critical head injuries, or in situations where extubation is expected within 6 hours (e.g. status epilepticus)
Other actions needed post intubation NG tube (if not inserted), Chest X-Ray, 2nd IV/IO access, urinary catheter, bloods & gas, notes photocopied
Points to consider on deterioration during induction of anaesthesia Hypoxia: is ET tube in correct position? Adequate pressure? Secretion clearance? Hypotension: administer rescue diluted adrenaline +/- fluid bolus as indicated Consider reversible pathologies: e.g. pneumothorax, pleural effusions, air trapping

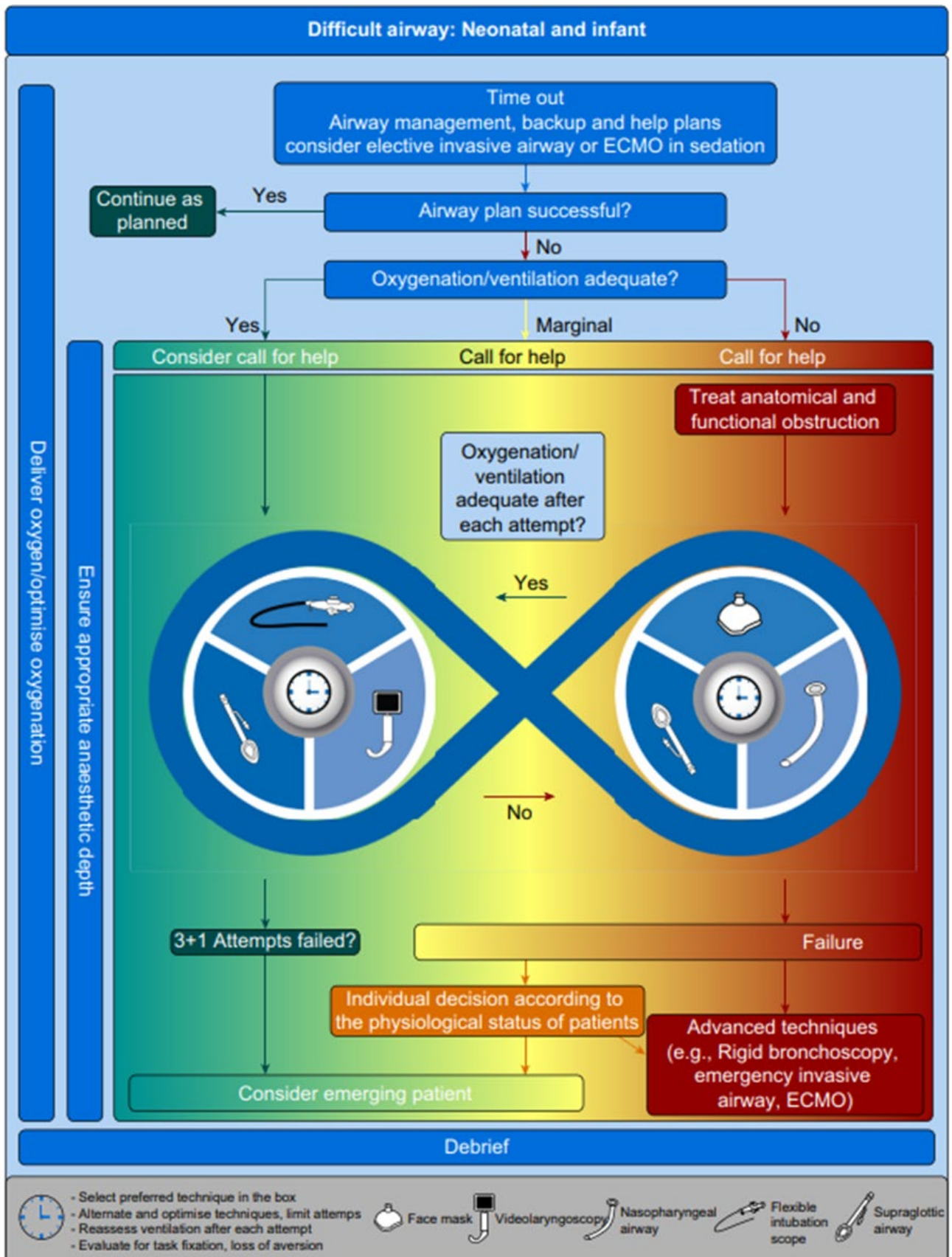
Appendix D: Difficult Airway Algorithm

Source: Difficult Airway Algorithm: Neonatal and Infant. Airway management in neonates and infants: European Society of Anaesthesiology and Intensive Care and British Journal of Anaesthesia joint guidelines (2024). Disma N, Asai T, Cronin A et al. British Journal of Anaesthesia, 132 (1): 124 – 144



Appendix E: Difficult Airway Cognitive Aid for Neonates and Infants

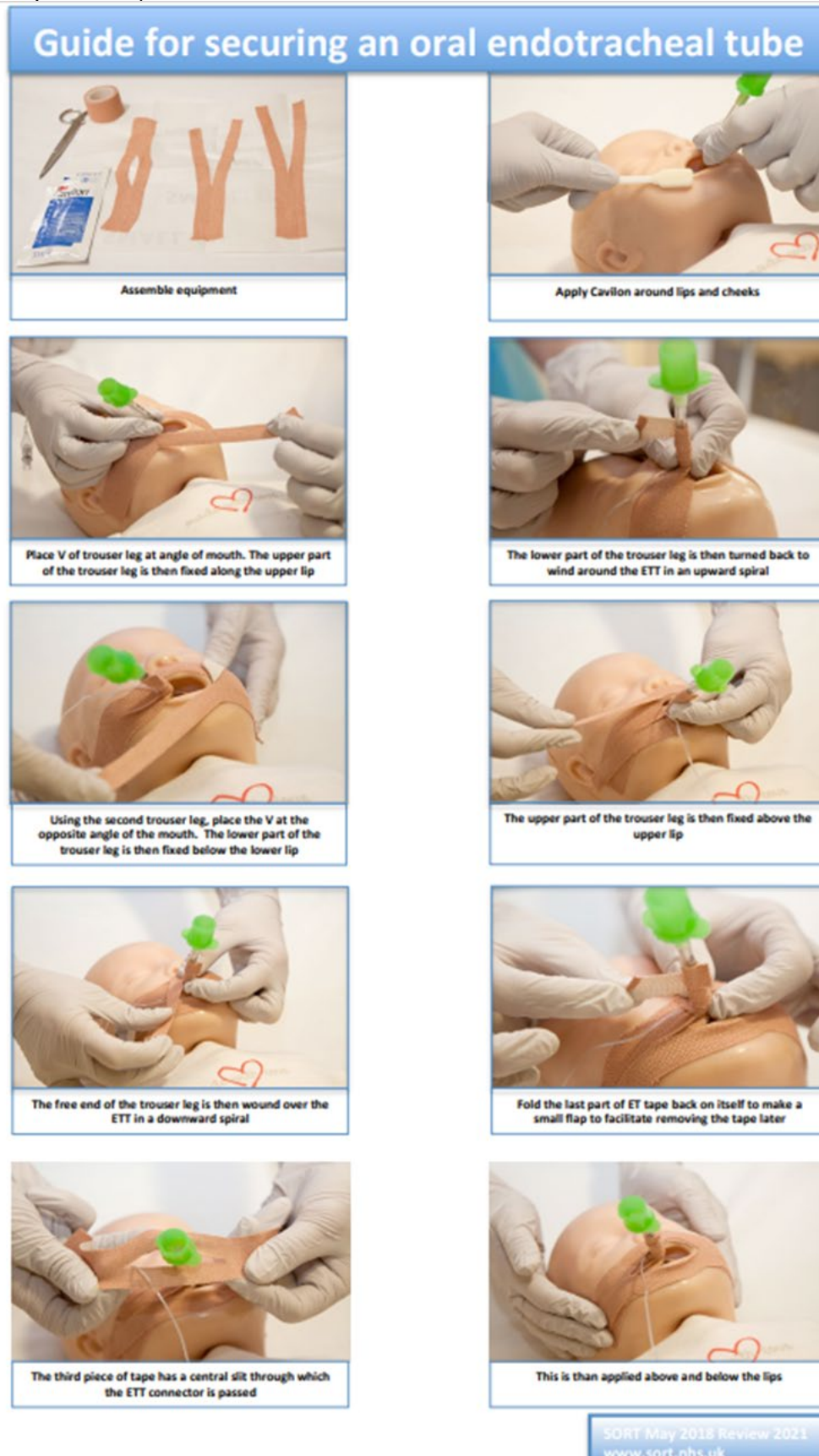
Source: Airway management in neonates and infants: European Society of Anaesthesiology and Intensive Care and British Journal of Anaesthesia joint guidelines (2024). Disma N, Asai T, Cronin A et al. British Journal of Anaesthesia, 132 (1): 124 – 144



Appendix F: Securing and Oral ET Tube by SORT

Source: Southampton and Oxford Retrieval Team (2024) *Securing Oral and Nasal Endotracheal Tubes*. Available at:

<https://www.sort.nhs.uk/Media/Guidelines/Endotracheal-tube-Securing-oral-and-nasal-ETT.pdf>
(Accessed 22 April 2025)



Full version control record

Version:	1.0
Guidelines Lead(s):	Dr Gihan Ganesh, Consultant Anaesthetist
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Lead Director / Chief of Service:	Dr Subodh Tote, CoS for Theatres, Anaesthetics and Critical Care
Library check completed:	19 January 2025
Ratified at:	Anaesthesia Clinical Governance Committee 22/1/2025 DTC June 2025
Date Issued:	25 June 2025
Review Date:	December 2027
Pharmaceutical dosing advice and formulary compliance checked by:	Ruhena Ahmad, January 2025
Key words:	Paediatric, airway, emergency

This guideline has been registered with the Trust. However, clinical guidelines are guidelines only. The interpretation and application of clinical guidelines will remain the responsibility of the individual clinician. If in doubt, contact a senior colleague or expert. Caution is advised when using guidelines after the review date.

This guideline is for use in Frimley Health NHS Foundation Trust hospitals only. Any use outside this location will not be supported by the Trust and will be at the risk of the individual using it.

Version History

Version	Date	Guideline Lead(s)	Status	Comment
1.0	April 2025	Dr Gihan Ganesh	Final	

Related Documents

None