

NHS CATS
Children's Acute Transport Service



Clinical Guidelines

Intubation of the Critically Ill Child

Document Control Information

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General Aspects

Use of the checklist and ET tube table (see below) is recommended.

- *Consider video laryngoscopic techniques and plan a failed intubation strategy (supraglottic airway or front of neck access).*
- *Consider passive delivery of oxygen (e.g. high flow humidified oxygen) during intubation attempts to minimise desaturation.*
- Administering a general anaesthetic in an unfamiliar environment (i.e. a referring hospital) requires two competent intubators, ideally involving a local anaesthetist with appropriate skill.
- If difficulty is anticipated, a consultant anaesthetist should be involved, and it may be appropriate to move the child to theatres with suitable equipment and staffing.
- *Approach all intubations with caution as it is impossible to exclude difficulty by examination.*

Assessment:

- Management of the difficult airway should proceed along guidelines from the APA (Association of Paediatric Anaesthetists) management of difficult airways in children.
- Involve the ENT team early if problems are anticipated.

<http://www.das.uk.com/guidelines/paediatric-difficult-airway-guidelines>

Inhalational agents and anaesthetic machines should only be used by doctors trained in their use.

Induction Agent:

- Fentanyl or ketamine are the agents of choice in children with cardiovascular instability and may be used in all age groups.
- For the unstable neonate an opiate-only technique may be used – fentanyl is preferable.

Several studies have demonstrated that ketamine does not cause any significant rise in intracranial pressure, so is a safe induction agent to use in cases of raised ICP e.g. meningitis/encephalitis, traumatic brain injury or space occupying lesion.

Thiopentone and propofol may be used for induction but should not be used in critically unwell children with cardiovascular compromise as they can cause profound hypotension.

Neuromuscular blockade in Rapid Sequence Induction (RSI):

- Suxamethonium (1-2mg/kg) has a rapid onset (30 seconds) and short duration of action (3-5mins).
- Rocuronium given at a dose of 1mg/kg provides neuromuscular blockade within 30-45 seconds with a longer duration of action (30-40 mins).

Suxamethonium is contraindicated in patients with hyperkalaemia, muscular dystrophy, myotonia, spinal cord injuries, after 24 hours of major burns and in those at risk of malignant hyperpyrexia. It may also cause bradycardia, so if used, atropine should be readily available.

Sugammadex (16mg/kg) can be used for the immediate reversal of aminosteroid neuromuscular blockade agents (rocuronium and vecuronium).

Ongoing sedation

Note that midazolam may cause hypotension in children with cardiovascular instability. High dose (>4mg/kg/hr) or prolonged (48hrs) propofol infusions are not recommended in children due to the risk of propofol-related infusion syndrome (PRIS) which can be fatal.

Intubation

As a group, the paediatric intensive care population is intolerant of low-pressure endotracheal leak.

- Stiff lungs need high positive end expiratory pressure (PEEP).
- Higher peak airway pressures may be required.
- Gas consumption for PEEP on transport needs to be minimised.

It is also desirable to minimise the number of re-intubations, especially in the early emergency/stabilisation phase.

In general, for emergency referrals to CATS we would suggest the use of a cuffed endotracheal tube and if changing a tube due to leak we would replace with a cuffed one.

Sizing (see size chart)

Cuff pressure

Inflate to just obliterate leak.

Ideally <20 cm H₂O pressure in cuff using cuff manometry.

Depth (CXR confirmation vital)	Estimated Length (cm) =	Oral (age/2 + 12)
		Nasal (age/2 +15)

Complications and hazards

- Avoid use of cuffed endotracheal tube with internal diameter **<3.0mm**
- The 'black line' as a guide to depth: this may result in inadvertent endobronchial intubation.
- Avoid laryngeal cuff placement.
- Monitor cuff pressures (manometer) and consider the relative risks of cuff pressure on tracheal perfusion in low cardiac output states.

Transport considerations

- Aeromedical transports: a climb in altitude will increase cuff pressure and this should be monitored/adjusted until cruise altitude.

Key messages

- PICU children may require higher peak and positive end expiratory pressures than would be routine in elective anaesthesia.
- With a cuffed endotracheal tube, it is possible to compensate for a slightly 'small' endotracheal tube or a patient with deteriorating lung compliance and increasing airway pressure requirements.

If in doubt discuss with duty CATS consultant.

CATS EMERGENCY INTUBATION CHECKLIST

Prepare for difficulty

Is a difficult airway anticipated?

- History of previous difficult intubation
- Stridor
- Large tongue/ tonsils/tumour
- Restricted jaw/neck movement
- Prominent upper teeth
- Small receding jaw
- Syndrome/Diagnosis associated with airway difficulty eg. Pierre-Robin, Hurler's

- ☐ No
☐ Yes: *call consultant*

Discuss strategies for dealing with difficult intubation or mask ventilation (see DAS guidelines)

Are complications anticipated?

- ☐ No
☐ Yes: *discuss management strategy*

Identify who to contact in an emergency. Do they need to be pre-warned?

- ☐ No
☐ Yes

Prepare Equipment

Apply monitoring

- ☐ ECG
- ☐ Blood pressure (1 min auto)
- ☐ SpO₂ probe (audio)
- ☐ Capnography

Check Equipment (BOX **A** + **B**)

- ☐ Mask
- ☐ Guedel airway(s)
- ☐ T-piece & oxygen supply
- ☐ Suction
- ☐ ET tubes (+/- sizes)
- ☐ Laryngoscope x2
- ☐ Equipment for alternative plans—*bougie, LMA, alt. blade*
- ☐ Tapes
- ☐ Bag Valve Mask

Prepare Drugs (CHART **C**)

- ☐ Induction agent/analgesic
- ☐ Muscle relaxant
- ☐ Drugs for circulatory support (fluid bolus, vasoactive drugs, atropine)
- ☐ Maintenance sedation

Prepare Patient

- ☐ Confirm IV access is patent

- ☐ Is pre-oxygenation optimal?

- ☐ Optimise patient's position (consider pillow)

- ☐ Does an NG tube need to be inserted or aspirated?

- ☐ Could the patient's condition be optimised further before intubation?

Prepare Team

Intubation should be a two-doctor/ ANP task. Are two appropriately experienced people present?

- ☐ No, *find a second intubator*
☐ Yes

Are any additional staff required?

Allocate Roles

- ☐ Intubator
- ☐ Intubator's Assistant
- ☐ Monitoring/Drugs

- ☐ Ready to proceed?

Disclaimer - The information provided on this checklist is intended as guidance only and is not intended to be a comprehensive guide to preparation for intubation. Conduct in individual cases should be determined by the facts pertaining to that case and should be confirmed by a specific risk assessment in each situation.



BOX A	
ETT size and length formulas	
Uncuffed ETT size	Age/4 + 4
Cuffed ETT size	Age/4 + 3.5
- use no smaller than 3.0 cuffed ETT	
Oral Length (cm)	Age/2 + 12
Nasal Length (cm)	Age/2 + 15

BOX B				
Age	UETT size	CETT size	Oral Length (cm)	LMA size
0-3 months	3.5	3.0	9.0-10.0	1.0
3-6 months	4.0	3.5	10.0-11.0	1.0-1.5
6-12 months	4.0-4.5	3.5 – 4.0	12.0	1.5
1 year	4.0-4.5	3.5 – 4.0	12.5	2.0
2 years	4.5-5.0	4.0 – 4.5	13.0	2.0
3 years	4.5-5.0	4.0 – 4.5	13.5	2.0
4 years	5.0-5.5	4.5 – 5.0	14.0	2.0-2.5
5 years	5.0-5.5	4.5 – 5.0	14.5	2.5
6 years	6.0	5.0 – 5.5	15.0	2.5
7 years	6.0	5.0 – 5.5	15.5	2.5-3.0
8 years	6.5	6.0	16.0	3.0
9 years	6.5	6.0	16.5	3.0
10 years	7.0	6.5	17.0	3.0-4.0
12 years	7.5	7.0	18.0	4.0

