NHS Children's Acute Transport Service

Clinical Guidelines

Intubation of the Critically Ill Child

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Applicable to	All CATS employees

Flowchart for induction of anaesthesia for non-elective intubation
Please read all notes below

Discuss case with CATS consultant and confirm clinical indication for intubation

Assessment

Complete CATS Emergency Intubation Checklist

Difficult airway: refer to algorithm and involve ENT

Cardiovascular instability: appropriate induction agent and prepare inotrope(s) + fluid bolus

Induction agent

Ketamine 1-2mg/kg +/- Fentanyl 2-5mcg/kg

Propofol 1-2mg/kg

Thiopentone 2mg/kg

(Etomidate 0.3mg/kg)

Aspiration risk: rapid sequence induction

Neuromuscular blockade

Rocuronium 1mg/kg

Atracurium 0.5mg/kg

Vecuronium 0.1mg/kg

Pancuronium 0.1mg/kg

Suxamethonium 1-2mg/ kg

Ongoing sedation

Morphine infusion 5-40mcg/kg/hr +/- boluses 50-100mcg/kg

Midazolam infusion 1-4mcg/kg/min +/- boluses 50-100mcg/kg

Ongoing NMB (if necessary)

Vecuronium infusion 1-6mcg/kg/min +/- boluses 100mcg/kg

Notes on Anaesthetic Drug Management

General Aspects
Note that administering a general anaesthetic in an unfamiliar environment (ie. a referring hospital) should be a two-doctor procedure, involving a local anaesthetist with appropriate skill, which enables rapid access to local resources in case of difficulty. 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 and Ketamine are the agents of choice in children with cardiovascular instability (including those with sepsis), and may be used in all age groups. 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 eg. meningitis/encephalitis, traumatic brain injury or space occupying lesion.

For the unstable neonate an opiate-only technique may be used. In these cases, fentanyl is preferable to morphine due to its rapid onset of action.

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. Etomidate has minimal cardiovascular effects but may cause adrenal insufficiency in critically unwell patients.

Neuromuscular blockade:
Suxamethonium is the classic neuromuscular blocker of choice for a rapid sequence induction (RSI) because it has a rapid onset (30 seconds) and short duration of action (3-5mins). However, it 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.

Rocuronium given at a dose of 1mg/kg provides neuromuscular blockade within 30-45 seconds but has a longer duration of action than suxamethonium (30-40 mins).

Ongoing sedation
Note that midazolam may cause hypotension in children with cardiovascular instability. Prolonged propofol infusions are not recommended in children due to the risk of propofol infusion syndrome.

Intubation

Indications for cuffed ETT

Cuffed endotracheal tube use in children remains controversial.

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
Internal diameter (ID)
Khine Formula: [ID(mm) =(age/4)+3.0] <2yrs
Motoyama formula: [ID(mm)= (age/4) + 3.5] > 2yrs

Cuff pressure

Inflate to just obliterate leak
Ideally <20 cm H_2O pressure in cuff

Depth (CXR confirmation vital)   **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. Consider using water to fill cuff.

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.

Children's Acute Transport Service provides paediatric intensive care retrieval for Great Ormond Street, The Royal Brompton and St Mary's NHS Trusts. Funded and accountable to the North Thames Paediatric Intensive Care Commissioning Group through Great Ormond Street NHS Trust.

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