Guideline for the Induction of Anaesthesia during Retrieval
1. **Introduction**

Safe induction of anaesthesia in a critically ill patient can be very challenging. Haemodynamic decompensation is common. Most induction agents are myocardial depressants and blunt the sympathetic drive, causing vasodilatation. The process can be more difficult during a retrieval, as you are removed from your normal familiar surroundings and personnel. Anaesthesia in these conditions should only be performed by appropriately trained clinicians with sufficient knowledge of the drugs they are using (indications, contra-indications, and side-effects), and sufficient ability to maintain an airway, intubate and ventilate a patient safely and proficiently. Intravenous induction with ketamine and either Rocuronium or Suxamethonium is the preferred technique in all cases except patients with Upper Airway obstruction.

2. **General Rules**

1. **No person** should attempt an induction of anaesthesia (especially on retrieval) unless they can maintain an airway and intubate.
2. No person should undertake the retrieval of a critically ill child unless they are competent to manage the child’s airway.
3. Within each referring hospital there will be sufficient skills to cope with most airway problems.
4. Always ask for the local anaesthetist to be present during an intubation.
5. **Nobody** should use an anaesthetic machine without supervision from either a PICU consultant or a trained anaesthetist unless they have been specifically trained to do so.
6. Intubation for severe upper airway obstruction should ideally be performed in theatre with a Consultant Anaesthetist / PICU Consultant and an ENT surgeon.
7. In critically ill children, especially sepsis, polytrauma, and congenital cardiac patients, use ½ the recommended dose of induction agent.
8. Rocuronium 1.0mg/kg is the preferred agent but suxamethonium can be used unless absolutely contra-indicated.
9. The following induction agents are preferred, although this may be changed after discussion with a PICU or anaesthetic consultant:

<table>
<thead>
<tr>
<th>Condition</th>
<th>Induction Agent</th>
<th>Muscle Relaxants</th>
<th>Agents with Relative Contra-Indications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sepsis</td>
<td>Ketamine</td>
<td>Rocuronium or Suxamethonium</td>
<td>Thiopentone, Propofol, Gaseous induction, Midazolam</td>
</tr>
<tr>
<td>Head Injury</td>
<td>Ketamine</td>
<td>Rocuronium or Suxamethonium</td>
<td></td>
</tr>
<tr>
<td>Status epilepticus</td>
<td>Thiopentone</td>
<td>Rocuronium or Suxamethonium</td>
<td>Ketamine</td>
</tr>
<tr>
<td>Upper Airway Obstruction</td>
<td>Gaseous Induction</td>
<td>Nil</td>
<td></td>
</tr>
<tr>
<td>Asthma</td>
<td>Ketamine</td>
<td>Rocuronium or Suxamethonium</td>
<td>Midazolam, Gaseous induction, Thiopentone, Propofol</td>
</tr>
<tr>
<td>Congenital Cardiac Defects</td>
<td>Ketamine</td>
<td>Rocuronium or Suxamethonium</td>
<td></td>
</tr>
<tr>
<td>Cardiomyopathy</td>
<td>Ketamine</td>
<td>Rocuronium or Suxamethonium</td>
<td>Midazolam, Gaseous induction, Thiopentone, Propofol</td>
</tr>
</tbody>
</table>
3. Retrieval Process

1. **At Referral Call**
   1.1 Ensure adequate discussion with referring team regarding:
      a. the need for intubation
      b. where the child will be intubated
      c. what induction agents will be used
      d. ongoing sedation and paralysis requirements
   1.2 A local anaesthetist should be requested to review the child, and intubate if necessary, while the retrieval is arranged.
   1.3 Every effort should be made to discuss the patient with the anaesthetist.
   1.4 Dependant on the complexity of the case, and the skill mix available, the duty consultant will decide on who will retrieve the patient.
   1.5 No person should undergo the retrieval of a critically ill child unless they are competent to manage the child’s airway.

2. **Pre-departure**
   2.1 Ensure all equipment has been checked (see pre-departure check-list).
   2.2 Ensure ventilator has been checked.
   2.3 Ensure refrigerator and CD drugs have been signed out and added to the retrieval kit.

3. **At referring Hospital**
   3.1 If the child is already intubated, proceed to (4) below.
   3.2 If the child is not intubated, assess need for intubation and ventilation.
   3.3 If the child needs to be intubated, the first step is to decide where the safest place to do so is.
   3.4 An unstable patient should not be moved, as long as it does not put the patient or the team at risk.
   3.5 A stable patient may be moved to AICU, theatres, or a paediatric resuscitation room, dependant on local hospital policy.
   3.6.1 **Induction of anaesthesia of a critically ill patient should be performed by 2 people.**
   3.6.2 If the child has an obstructed airway, it is essential an anaesthetic consultant is present and ideally an ENT surgeon.
   3.6.3 The correct induction agent should be chosen after discussion with the PICU consultant, or the anaesthetic consultant in the referring hospital. Refer to the table on page 1.
   3.6.4 It is important to remember the contra-indications and likely side effects for each agent (see appendices 1 and 2).
   3.6.5 Prior to intubation, it is important to ensure adequate suction, the correct ET tubes, laryngoscope, and mask is available.
   3.6.6 The stomach should be emptied via an NG/OG tube if in situ.
   3.6.7 Ensure you have prepared resuscitation drugs and fluids if patient at risk of decompensation

4. **Prior to departing Referring Hospital**
   4.1 Ensure adequate induction and muscle relaxant available for re-intubation.
   4.2 Ensure bag and correct size mask available, and attached to an oxygen source.
   4.3 Ensure patient adequately sedated and muscle relaxant for transfer.
   4.4 Check ET tube position with chest X-ray.
   4.5 Ensure the ET tube is correctly strapped using the Melbourne strapping technique.
   4.6 A blood gas should be performed on **ALL** patients once they have been placed on the transport ventilator and the $P_aCO_2$ correlated with the ETCO$_2$. 
## Appendix 1

### Inhalational Agents

<table>
<thead>
<tr>
<th>Dose</th>
<th>Onset</th>
<th>Duration of Action</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sevoflurane</strong></td>
<td>4-8% for induction 2-4% maintenance</td>
<td>Rapid Wake up soon after discontinuing gas</td>
</tr>
</tbody>
</table>

**Indications**
Inhalational induction for upper airway obstruction or for procedures. *Least broncho-irritant of all vapours.* Note very potent thus may induce apnoea and very rapid offset so limits time available for laryngoscopy.

**Contra-Indications**
Do not use to induce anaesthesia when RSI is needed.

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<tr>
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<tbody>
<tr>
<td><strong>Halothane</strong></td>
<td>2-5% for induction</td>
<td>Slow Wake up slowly after discontinuation</td>
</tr>
</tbody>
</table>

**Indications**
Slow onset but longer duration of action. Only use for UAO.

**Contra-Indications**
Can cause ventricular dysrhythmias especially in the context of high base-line adrenergic conditions, i.e. the sick child.

### Intravenous Agents

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<tr>
<th>Dose</th>
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<tbody>
<tr>
<td><strong>Ketamine</strong></td>
<td>1-2mg/kg Infuse at 10-40mcg/kg/min</td>
<td>Rapid Short acting</td>
</tr>
</tbody>
</table>

**Indications**

**Contra-Indications**
Severe ventricular dysrhythmia

**Special Considerations**
Specific bronchodilating properties. Good for induction and maintenance of anaesthesia in asthmatics. Causes hallucinations. Use with benzodiazepine in older patients.

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<tr>
<th>Dose</th>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>Thiopentone</strong></td>
<td>1-3mg/kg Infuse at 1-7mg/kg/hr</td>
<td>Rapid Short acting</td>
</tr>
</tbody>
</table>

**Indications**
Rapid Sequence Induction in haemodynamically stable head injuries & status epilepticus.

**Contra-Indications**
Do not use in cardiac children or those who are haemodynamically unstable

**Special Considerations**
May be used as an infusion for control of seizures. Has zero order clearance kinetics thus will accumulate rapidly even in the presence of normal hepatic and renal function.

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<tr>
<th>Dose</th>
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</tr>
</thead>
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<tr>
<td><strong>Propofol</strong></td>
<td>0.5-2mg/kg Infuse at 3-5mg/kg/hr</td>
<td>Rapid Short acting</td>
</tr>
</tbody>
</table>

**Indications**
Ideal for short period of sedation/anaesthesia esp. for procedures.

**Contra-Indications**
Prolonged infusions of propofol although safe in adults have caused lactic acidosis in children. Avoid more than 4mg/kg/hr for more than 8 hours if <16 years. Avoid infusions especially in those with neuro-muscular conditions. May cause hypotension in cardiac or septic shock.

**Special Considerations**
1ml of 0.5% lignocaine may be added to 20 mls propofol to reduce pain of injection.

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</thead>
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<tr>
<td><strong>Fentanyl</strong></td>
<td>1-10mcg/kg Infuse at 2-4mcg/kg/hr</td>
<td>Rapid 30 mins</td>
</tr>
</tbody>
</table>

**Indications**
Relatively stable haemodynamically. Good for cardiac patients. Useful as sedation in pulmonary hypertensive crises.

**Contra-indications**
In unventilated patients use smaller doses -1-2mcg/kg
## Appendix 2

<table>
<thead>
<tr>
<th>DRUG</th>
<th>Bolus</th>
<th>Infusion</th>
<th>Half Life</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suxamethonium</td>
<td>1-2mg/kg</td>
<td>Rapid offset: 4-5 mins</td>
<td></td>
</tr>
<tr>
<td>Indications</td>
<td>Onset 45-60 secs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Indications</td>
<td>Rapid Sequence Induction i.e. the rapid achievement of ideal intubating conditions in someone who has not prepared for anaesthesia and there is a high risk of regurgitation e.g. full stomach, reflux, delayed gastric emptying, raised intra-abdominal pressure. Post Intubation laryngospasm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contra-Indications</td>
<td>Known anaphylaxis, GBS, Spinal cord injury, burns, hyperkalaemia, known suxamethonium apnoea, known susceptibility to malignant hyperpyrexia.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Special Considerations</td>
<td>Masseter spasm induced by suxamethonium can be reversed by a non-depolarising muscle relaxant. Do not use 2 doses of SUX</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Rocuronium | 1mg/kg | N/A | Slow offset 40 mins |
| Indications | It has a faster onset than other non-depolarising muscle relaxants. It is therefore the most appropriate replacement for suxamethonium if it cannot be used and there is a genuine risk of aspiration |

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