Paediatric Quick Reference

Normal Physiology ranges:

<table>
<thead>
<tr>
<th>Age</th>
<th>Respiratory rate (per min)</th>
<th>Heart rate (per min)</th>
<th>Normal Systolic BP (mmHg)</th>
<th>Lowest Systolic BP (mmHg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 1 yr</td>
<td>30-40</td>
<td>110-160</td>
<td>80-90</td>
<td>65-75</td>
</tr>
<tr>
<td>1–2 yr</td>
<td>25-35</td>
<td>100-150</td>
<td>85-95</td>
<td>70-75</td>
</tr>
<tr>
<td>2–5 yr</td>
<td>25-30</td>
<td>95-140</td>
<td>85-100</td>
<td>70-80</td>
</tr>
<tr>
<td>5–12 yr</td>
<td>20-25</td>
<td>80-120</td>
<td>90-100</td>
<td>80-90</td>
</tr>
<tr>
<td>&gt;12 yr</td>
<td>15-20</td>
<td>60-100</td>
<td>100-120</td>
<td>90-105</td>
</tr>
</tbody>
</table>

Weight estimation:
(only to be used if weighing the child is not possible)

<table>
<thead>
<tr>
<th>Age</th>
<th>Weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Birth</td>
<td>3 – 3.5 kg</td>
</tr>
<tr>
<td>6 months</td>
<td>7.5 kg</td>
</tr>
<tr>
<td>1 year</td>
<td>10 kg</td>
</tr>
<tr>
<td>Over 1 year</td>
<td>(Age in years + 4) x 2</td>
</tr>
</tbody>
</table>

Above 10 years this formula may underestimate weight

Emergency drugs and equipment:

<table>
<thead>
<tr>
<th>Drug</th>
<th>Dosage</th>
</tr>
</thead>
<tbody>
<tr>
<td>ETT size (mm)</td>
<td>(Age / 4) + 4.5</td>
</tr>
<tr>
<td>ETT length (cm)</td>
<td>(Age / 2) + 12</td>
</tr>
<tr>
<td>Fluid bolus</td>
<td>10 – 20 ml/kg</td>
</tr>
<tr>
<td>Adrenaline</td>
<td>10 mcg/kg IV</td>
</tr>
<tr>
<td>(in cardiac arrest)</td>
<td>0.1 ml/kg of 1:10,000</td>
</tr>
<tr>
<td>10% glucose bolus</td>
<td>2 ml/kg</td>
</tr>
<tr>
<td>Atropine</td>
<td>20 mcg/kg IV</td>
</tr>
<tr>
<td>Suxamethonium</td>
<td>2 mg/kg IV</td>
</tr>
<tr>
<td></td>
<td>4 mg/kg IM</td>
</tr>
<tr>
<td>Defibrillation</td>
<td>4 J/kg</td>
</tr>
</tbody>
</table>
Foreword

Safer Anaesthesia From Education (SAFE) obstetric and paediatric courses have been developed for anaesthesia providers in low resource settings. This pocket handbook is designed to accompany the SAFE courses and to be used in clinical practice. The aim is to provide a quick reference guide for essential information and includes drug doses, important calculations and management protocols. The SAFE courses are supported by the Association of Anaesthetists of Great Britain and Ireland (AAGBI) and the World Federation of Societies of Anaesthesiologists (WFSA). We would like to thank the WFSA for funding this handbook.

Disclaimer

We have worked hard to ensure that all of the information provided in this handbook is accurate and up to date. Whilst every care has been taken to ensure that doses and recommendations are correct, the responsibility for final checking must rest with the prescriber. The authors cannot accept any responsibility for errors in this publication.

Maytinee Lilaonitkul
Nick Boyd

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Preoperative considerations

It is important to have a structured approach for pre-assessing a child for surgery. The following should be undertaken as a minimum:

### History

<table>
<thead>
<tr>
<th>Child’s age and weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Only use weight estimation if actual weight not possible</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>History of the current medical condition / reason for surgery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Past medical history</td>
</tr>
<tr>
<td>• Chronic illnesses (e.g. asthma, diabetes)</td>
</tr>
<tr>
<td>• Congenital conditions / syndromes (e.g. Down’s syndrome, cardiac disease)</td>
</tr>
<tr>
<td>• Does this child need specialist review? (see page 6)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Previous operations and problems with anaesthesia</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Family history of problems with anaesthesia</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Current medical status including:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Upper respiratory tract infections (see page 6)</td>
</tr>
<tr>
<td>• Current illnesses (e.g. malaria)</td>
</tr>
<tr>
<td>• Nutritional status</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Medications</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Regular medications</td>
</tr>
<tr>
<td>• Medications given prior to operation (e.g. paracetamol)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Allergies</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Fasting status</th>
</tr>
</thead>
<tbody>
<tr>
<td>(see page 5)</td>
</tr>
</tbody>
</table>

### Examination

<table>
<thead>
<tr>
<th>Airway and breathing</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Evaluate airway – could the child be difficult to intubate?</td>
</tr>
<tr>
<td>• Examine chest for respiratory rate and added sounds</td>
</tr>
<tr>
<td>• What are the oxygen saturations?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Circulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Heart rate and blood pressure</td>
</tr>
<tr>
<td>• Is the child well hydrated?</td>
</tr>
<tr>
<td>• Signs of anaemia? Is there a heart murmur?</td>
</tr>
<tr>
<td>• Assess sites for IV access</td>
</tr>
</tbody>
</table>

### Investigations

<table>
<thead>
<tr>
<th>Look at any investigations that have been done</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Consider asking for additional tests, if required</th>
</tr>
</thead>
<tbody>
<tr>
<td>(e.g. blood tests, cross match, malaria, sickle cell)</td>
</tr>
</tbody>
</table>
Explanation and Consent

Explain anaesthetic induction plan
- Explain to parents and child (if old enough to understand) what to expect at the induction of anaesthesia
- If appropriate, consider giving the child the choice of IV or gas induction

Consent parents for the risks of the anaesthetic
- Consent for common and serious risks of anaesthetic
- Consent for any additional procedures that you are planning (e.g. caudal or local anaesthetic block)

Fasting guidelines

<table>
<thead>
<tr>
<th>Oral intake</th>
<th>Minimum fasting time (before induction)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clear fluids</td>
<td>2 hours</td>
</tr>
<tr>
<td>Breast milk</td>
<td>4 hours</td>
</tr>
<tr>
<td>Solids (including formula milk)</td>
<td>6 hours</td>
</tr>
</tbody>
</table>

- Problems associated with prolonged fasting:
  - Dehydration
  - Difficult venous access
  - Hypoglycaemia
  - Irritable and miserable at induction

- Babies and small children should be scheduled first on an elective list to avoid prolonged dehydration

- If the operation will be delayed, allow the child to have clear fluids until 2 hours before induction of anaesthesia

- Sickle cell patients in particular should avoid dehydration due to the risk of sickle cell crises
### Upper Respiratory Tract Infection (URTI) guidance

An active URTI can increase the risk of complications, including:
- Laryngospasm and bronchospasm
- Airway obstruction
- More rapid desaturation

Therefore, **elective surgery** should be cancelled and postponed for **four weeks** if the following symptoms are present:
- Systemic illness (malaise, reduced appetite) with a fever above 38°C
- Productive cough
- Purulent nasal discharge
- Chest signs on auscultation (wheeze, crackles, reduced air entry)

### High risk children

Children who need paediatric review, further pre-operative investigations and possible transfer to a specialist centre include:
- Premature babies and neonates
- Oxygen saturations in air of less than 94%
- Heart disease
- Sickle cell disease
- Severely malnourished children
- Significant systemic diseases
- Congenital abnormalities or diseases

**Heart murmurs** are common and it can be difficult to decide if a child has a ‘flow’ murmur or a more concerning abnormality. **Pathological heart murmurs** are generally loud and may be associated with a thrill. Signs that may indicate significant heart disease include:
- **Babies**: cyanosis, sweating on feeding, hepatomegaly, failure to thrive
- **Younger children**: cyanosis, tachypnoea, failure to thrive
- **Older children**: cyanosis, history of reduced exercise tolerance, fainting episodes
**Facemask**
Fits comfortably from bridge of nose to below the mouth, without pressing on the eyes

**Oral (Guedel) airway**
Estimated as the distance from the incisors to the angle of the jaw

**Endotracheal tube (ETT)**
Internal Diameter (ID) for uncuffed tube (in mm):
- Neonate ETT size = 3.0 – 3.5
- 1 yr old ETT size = 4.0 – 4.5
- 2 yrs and older ETT size = \((\text{Age} / 4) + 4.5\)

*In addition to preparing the expected tube size, always prepare one size bigger and one size smaller*

ETT length at teeth (in cm) = \((\text{Age} / 2) + 12\)

*This length is only a guide. Care must be taken to ensure the correct length for every patient (using tracheal tube markings and/or clinical examination)*

**Laryngeal Mask Airway (LMA)**

<table>
<thead>
<tr>
<th>LMA size</th>
<th>Weight of child</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>&lt; 7.5 kg</td>
</tr>
<tr>
<td>1½</td>
<td>7.5 – 12.5 kg</td>
</tr>
<tr>
<td>2</td>
<td>12.5 – 20 kg</td>
</tr>
<tr>
<td>2½</td>
<td>20 – 30 kg</td>
</tr>
<tr>
<td>3</td>
<td>&gt; 30 kg</td>
</tr>
</tbody>
</table>
Normal physiological values according to age:

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Heart Rate (per min)</th>
<th>Systolic BP (mmHg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 1</td>
<td>110 – 160</td>
<td>80 – 90</td>
</tr>
<tr>
<td>1 - 2</td>
<td>100 – 150</td>
<td>85 – 95</td>
</tr>
<tr>
<td>2 - 5</td>
<td>95 – 140</td>
<td>85 – 100</td>
</tr>
<tr>
<td>5 - 12</td>
<td>80 – 120</td>
<td>90 – 110</td>
</tr>
<tr>
<td>&gt; 12</td>
<td>60 – 100</td>
<td>100 – 120</td>
</tr>
</tbody>
</table>

Estimated Blood Volume = 80 mls/kg

Resuscitation Fluids:

**Fluid bolus for resuscitation = 10 – 20 mls/kg**

**Blood bolus = 8 mls/kg of whole blood**
(or 5 mls/kg of packed cells)
increases Hb by approximately 1g/dL

**Glucose bolus = 2 mls/kg of 10% dextrose**
10% dextrose can be made by diluting 50% dextrose (e.g. 4mls of 50% dextrose diluted with 16mls of water)

Choice of fluid:
- Use 0.9% saline or Ringer’s Lactate
- **NEVER** use 5% dextrose for resuscitation fluids
Maintenance Fluids

• Always give oral fluids where possible
• If unable to tolerate oral fluids, use IV regime below:

**HOURLY intravenous fluid requirement (4-2-1 rule)**

<table>
<thead>
<tr>
<th>Weight of child</th>
<th>mls/kg/hr</th>
</tr>
</thead>
<tbody>
<tr>
<td>First 10kg</td>
<td>4</td>
</tr>
<tr>
<td>Second 10kg</td>
<td>2</td>
</tr>
<tr>
<td>Every additional kg</td>
<td>1</td>
</tr>
</tbody>
</table>

Example: Maintenance fluids for a 25kg child
- first 10kg = (4x10) = 40mls/hr
- second 10kg = (2x10) = 20mls/hr
- additional 5kg = (1x5) = 5mls/hr

Total maintenance fluid requirement = 65mls/hr

Choice of fluid:
- 5% dextrose 0.9% saline or
- 5% dextrose 0.45% saline or
- 5% dextrose Ringer’s Lactate

- NEVER use 5% dextrose for maintenance fluids

---

1Holliday M, Segar W. The maintenance need for water in parenteral fluid therapy. *Pediatr* 1957;19:823-32
Use the most appropriate assessment tool for the child’s age or development:

- Age 0 - 5 years: FLACC scale
- Age 4 -12 years: Faces pain scale
- Age 6 years and above: NRS / VAS

Face, Legs, Activity, Cry, Consolability (FLACC) Scale

- Five elements to assess pain
- Scores added up to give total score out of 10

<table>
<thead>
<tr>
<th></th>
<th>SCORE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
</tr>
<tr>
<td><strong>Face</strong></td>
<td>No particular expression or smile</td>
</tr>
<tr>
<td><strong>Leg</strong></td>
<td>Normal position</td>
</tr>
<tr>
<td><strong>Activity</strong></td>
<td>Normal position, moving easily</td>
</tr>
<tr>
<td><strong>Cry</strong></td>
<td>No cry (awake or asleep)</td>
</tr>
<tr>
<td><strong>Consolability</strong></td>
<td>Content, relaxed</td>
</tr>
</tbody>
</table>

Faces pain scale

• Assessment of pain based on child’s facial expression

![Faces Pain Scale](image)

Hicks CL et al. The Faces Pain Scale – Revised: Toward a common metric in pediatric pain measurement. *Pain, 2001; 93: 173-83*

Numeric rating scale (NRS) and Visual analogue score (VAS)

• Child asked to indicate how much pain they have on a line with 0 being no pain and 10 being the worst possible pain
• An example of the NRS is shown below

![Numeric Rating Scale](image)

Evaluating pain scores:

<table>
<thead>
<tr>
<th>PAIN SCORE</th>
<th>SEVERITY OF PAIN</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>None</td>
</tr>
<tr>
<td>1 - 3</td>
<td>Mild</td>
</tr>
<tr>
<td>4 - 7</td>
<td>Moderate</td>
</tr>
<tr>
<td>8 - 10</td>
<td>Severe</td>
</tr>
</tbody>
</table>

• Treat if moderate or severe pain
• Reassess 30 minutes later
• Use WHO analgesic ladder to treat pain, based on the severity of pain
Basic principles

- Always use a **multimodal analgesia approach**: Combine different classes of analgesia to achieve effective pain relief with minimal side effects.
- Use **WHO analgesic ladder**.
- Give analgesics **regularly**. Do not wait until severe pain develops as it will be more difficult to treat.
- Use **least invasive route**. Give oral medications where possible.
- All opioids can cause **respiratory depression** and require careful observation.
- **Ketamine can be useful for severe postoperative pain**. It has anaesthetic properties so it should only be administered by an experienced practitioner and requires careful observation.

### Adapted WHO Analgesic Ladder

<table>
<thead>
<tr>
<th>Mild pain</th>
<th>Moderate pain</th>
<th>Severe pain</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1:</strong> Non-opioids</td>
<td><strong>Step 2:</strong> Non-opioids + Weak opioids</td>
<td><strong>Step 3:</strong> Non-opioids + Strong opioids</td>
</tr>
</tbody>
</table>

#### Non-Opioids
- Paracetamol
- Ibuprofen / Diclofenac

#### Mild Opioids
- Codeine
- Tramadol

#### Strong Opioids
- Morphine
- Pethidine
- Fentanyl

Adapted from WHO Pain Relief Ladder. [www.who.int/cancer/palliative/painladder/en/](http://www.who.int/cancer/palliative/painladder/en/)
# Paediatric Analgesia Dosage Guidelines

<table>
<thead>
<tr>
<th>NON-OPIOIDS</th>
<th>Oral Dose</th>
<th>IV Dose</th>
<th>PR Dose</th>
<th>Important notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paracetamol</td>
<td>15mg/kg; 6 hourly</td>
<td>15mg/kg; 6 hourly</td>
<td>20mg/kg; 8 hourly</td>
<td>Max 60mg/kg/day. Liver damage in overdose</td>
</tr>
<tr>
<td>Ibuprofen (NSAID)</td>
<td>5mg/kg; 6 hourly (Only over 1 month)</td>
<td>-</td>
<td>-</td>
<td>Max 30mg/kg/day. Avoid in renal failure and asthmatics. Do not use with other NSAIDs</td>
</tr>
<tr>
<td>Diclofenac (NSAID)</td>
<td>1mg/kg; 8 hourly (Only &gt; 6 months)</td>
<td>0.5mg/kg; 8 hourly (Only &gt; 2 yrs old)</td>
<td>1mg/kg; 8 hourly (Only &gt; 6 months)</td>
<td>Max 150mg/day. Avoid in renal failure and asthmatics. Do not use with other NSAIDs</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MILD OPIOIDS</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Codeine</td>
<td>1mg/kg; 6 hourly (Only &gt; 12 yrs old)</td>
<td>-</td>
<td>-</td>
<td>Max 240mg/day. Avoid in obstructive sleep apnoea.</td>
</tr>
<tr>
<td>Tramadol</td>
<td>1mg/kg; 6 hourly (Only &gt; 1 yr old)</td>
<td>1mg/kg; 6 hourly (Only &gt; 1 yr old)</td>
<td>-</td>
<td>Caution in epilepsy</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>STRONG OPIOIDS</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Morphine</td>
<td>Under 1 yr old: 0.1mg/kg 4-6 hourly</td>
<td>Under 1 yr old Loading: 0.02-0.1mg/kg Max. 0.4mg/kg in 4 hours 1 yr old and older: Loading: 0.05-0.1mg/kg Max. 5mg per dose, may be repeated to max. of 20mg</td>
<td>-</td>
<td>Calculate EXACT doses for child’s weight Prolonged risk of respiratory depression Start with lowest dose Do not use regularly with other opioids</td>
</tr>
<tr>
<td>Pethidine</td>
<td>-</td>
<td>0.5-1mg/kg; 4 hourly (Only &gt; 1yr old)</td>
<td>-</td>
<td>Seizures possible in high dosages</td>
</tr>
<tr>
<td>Fentanyl</td>
<td>-</td>
<td>1-2 mcg/kg</td>
<td>-</td>
<td>Potent respiratory depression Only to be given by experienced practitioner</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>OTHER</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Ketamine</td>
<td>-</td>
<td>0.2 - 0.5mg/kg IV 2 - 4 mg/kg IM</td>
<td>-</td>
<td>Only to be given by experienced practitioner</td>
</tr>
</tbody>
</table>
Caudal block

Indications
• Surgery below umbilicus (e.g. inguinal hernia, club foot repair)

Anatomy
• The caudal space is identified by locating the sacral hiatus, found at the apex of an equilateral triangle, where the posterior superior iliac spines form the other two corners

Technique
• Usually performed under general anaesthe sia
• Position patient in lateral position with knees drawn into chest
• Identify landmarks and clean skin with antiseptic solution
• Using a 22G cannula or 23G needle, insert the needle into the sacral hiatus at 45° to skin. If you hit bone, withdraw slightly and flatten angle before advancing needle again
• A subtle “give” or “pop” will be felt as the needle enters the caudal space. If using a cannula, gently advance the plastic cannula a further 2mm and remove the needle. Ensure no CSF or blood returns from the needle or catheter
• Attach a syringe with local anaesthetic (see below), aspirate to check there is no blood and inject local anaesthetic slowly
• If it is in the correct position, it should be easy to inject the local anaesthetic and there should be no skin swelling

Local anaesthetic doses
• Use preservative free bupivacaine
• Scrotal/genital surgery: 0.5 ml/kg of 0.25% bupivacaine
• Inguinal surgery (T10-12): 0.75 ml/kg of 0.25% bupivacaine
• Peri-umbilical (T6-10): 1 ml/kg of 0.25% bupivacaine
• 0.25% bupivacaine will provide analgesia for 4-6 hours

Side effects / risks
• Failed block, motor block, infection, bleeding, intravascular injection, urinary retention, inadvertent sub-arachnoid block
**Indications**
- Simple block for inguinal hernia repair or orchidopexy

**Anatomy**
- The ilioinguinal and iliohypogastric nerves pass through the external and internal oblique muscle layers of the anterior abdominal wall

**Technique**
- Usually performed under general anaesthesia
- With the patient lying on their back, expose and identify the anterior superior iliac spine (ASIS) on the correct side
- Clean the skin with antiseptic solution
- The needle insertion point is located one patient finger breadth medial and inferior to the ASIS (see diagram) – avoid the groin skin crease as this will be the surgical incision site
- Blunt the tip of a 22G or 23G needle and insert the needle perpendicular to the skin at this point
- After passing through the skin, advance needle until a “pop” is felt as the needle punctures the external oblique muscle
- Aspirate to ensure the needle is not in a blood vessel
- Inject local anaesthetic, saving approximately 1-2mls
- Inject remaining 1-2mls of local anaesthetic in a subcutaneous fan laterally, medially and inferiorly to needle insertion point

**Local anaesthetic dose**
- Use a volume of 0.5mls/kg of 0.25% bupivacaine
- For example in a 10kg child, use 5mls of 0.25% bupivacaine

**Side effects / risks**
- Failed block, intravascular injection, femoral nerve block (this can cause temporary leg weakness)
Patients can lose large amounts of fluid following a major burn. Fluid replacement should be anticipated and replaced using the Parkland Formula, which requires an estimation of the body surface area (BSA) of burn (see diagram).

**Initial 24 hours**
- **Hypovolaemic shock**: IV bolus of 20mls/kg of crystalloid fluid. If more than one fluid bolus required, look for other signs of blood loss (e.g. from trauma)
- **Minor burn (<10% BSA)**: oral rehydration may be appropriate but be aware of post-burn ileus, which may decrease absorption
- **Major burn (>10% BSA)**: use Parkland Formula to estimate fluid requirement in initial 24 hours after a burn

**Parkland Formula:**

\[
\text{% BSA burn} \times \text{Weight} \times 4\text{mls}
\]

- Give this is the **first 24 hours**:
  - Give half the volume in first 8 hours
  - Give the remaining half over next 16 hours

**Subsequent days**
- 1ml / kg / %BSA burn, per day
- This is only a guide and fluid replacement should be based on clinical findings of hydration status

% Body Surface Area (BSA) estimation

• **Palmar surface**: the surface of the patient’s palm (including adducted fingers) is approximately 1% of the patient’s BSA

• **Wallace Rule of 9’s**: this divides the total BSA into areas of 9%, as shown in the diagram. However, it can overestimate the extent of the burn in young children

Adapted by permission from BMJ Publishing Group Ltd. Initial Management of Major Burn: II – Assessment and Resuscitation, Hettiaratchy S. *BMJ* 2004; 329: 101
Example of Burns Fluid Resuscitation calculation:

A 25kg child with burns to front of chest and abdomen, left arm and left leg

<table>
<thead>
<tr>
<th>STEP 1</th>
<th>% BSA burn estimation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Using Wallace Rule of Nines diagram: 18 + 9 + 13.5 = 40.5%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>STEP 2</th>
<th>Parkland Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>%BSA burn x Weight x 4mls</td>
</tr>
<tr>
<td></td>
<td>= 40.5% x 25kg x 4mls</td>
</tr>
<tr>
<td></td>
<td>= 4050 mls (to be given in the first 24 hours)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>STEP 3</th>
<th>Fluids in first 8 hours:</th>
<th>Fluids in next 16 hours:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4050mls / 2 = 2025mls</td>
<td>4050mls / 2 = 2025mls</td>
</tr>
<tr>
<td></td>
<td>2025mls / 8 (per hour)</td>
<td>2025mls / 16 (per hour)</td>
</tr>
<tr>
<td></td>
<td>= 253 mls/hr</td>
<td>= 126 mls/hr</td>
</tr>
</tbody>
</table>

| STEP 4 | Therefore, in first 8 hours, give approximately 250 mls/hr |
|        | in next 16 hours, give approximately 125 mls/hr |

Choice of fluid:
- Use Ringer's Lactate or 0.9% Saline
- Do not use 5% dextrose as replacement fluid
# Neonatal Anaesthesia

## Special Considerations

## Preoperative assessment
- Actual weight and post-conceptual age
- Assess for congenital abnormalities
- Ensure Vitamin K has been given
- Check baseline Hb (normally 16-18 g/dL at birth)

## Preparation
- Drug doses calculated and drawn up before induction
- At least 1 unit of blood cross-matched
- Warm theatre and keep baby covered at all times

## Intraoperatively
- Use NG tube to decompress abdominal distension
- Keep baby warm (cover head, warm fluid, warming devices)
- Check blood glucose level and treat if <3mmol/L

## Analgesia
- Consider local anaesthetic blocks and wound infiltration
- Regular paracetamol, avoid NSAIDs
- Cautious use of opioids (risk of postoperative apnoea)

## Postoperative management
- Extubate when fully awake
- Close postoperative monitoring in first 24 hours
- If oxygen is required postoperatively, saturations should be monitored and maintained at 95-98%
- Premature neonates are most at risk of postoperative apnoea
Paediatric Anaesthetic Emergencies

Topics:
- Paediatric Life Support
- Newborn Life Support
- Sick Laparotomy
- Anaphylaxis
- Status Epilepticus
- Local Anaesthetic Toxicity

General principles:
- Use ABCDE approach
- Call for HELP early
- WETFLAG mnemonic is useful to estimate drugs and tube size for a child in an emergency

<table>
<thead>
<tr>
<th>W</th>
<th>Weight (kg)</th>
<th>(Age + 4) x 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>E</td>
<td>Energy (J) for defibrillation</td>
<td>4 J/kg</td>
</tr>
<tr>
<td>T</td>
<td>Tube (mm)</td>
<td>(Age / 4) + 4.5</td>
</tr>
<tr>
<td>FI</td>
<td>Fluid bolus (ml)</td>
<td>20 mls/kg</td>
</tr>
<tr>
<td>A</td>
<td>Adrenaline (mcg)</td>
<td>10 mcg/kg</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.1 mls/kg of 1:10,000</td>
</tr>
<tr>
<td>G</td>
<td>Glucose 10% solution (mls)</td>
<td>2 mls/kg</td>
</tr>
</tbody>
</table>
Key Points

• The most common cause of paediatric cardiac arrest is hypoxia

• Effective oxygen delivery is the critical step in resuscitation

• Once cardiac arrest is recognized, start CPR immediately

• Ensure effective compressions: Push HARD, FAST and allow RECOIL

• Depth of compression is one third of anterior-posterior depth of chest and rate is 100 compressions per minute

• Minimise interruptions to CPR

• If defibrillator is available, attach early and assess rhythm (page 23)

Chest compression techniques

Two finger technique

Two thumb technique

One hand technique

Two hand technique
Paediatric Life Support
(Defibrillator *not* available)

**Unresponsive child**
No breathing or only occasional gasps
*If under anaesthetic, loss of central pulse*

**Start CPR**
- 5 initial breaths, then ratio of 15 chest compressions to 2 breaths
- If intubated, give continuous compressions

**Continue CPR**
Minimise interruptions
- **Give adrenaline every 3-5 mins** (see box)
- **Treat reversible causes** (see box)

**Return of pulse / signs of life**

**Immediate post cardiac arrest treatment**
- ABCDE assessment
- Controlled oxygenation and ventilation
- Treat precipitating cause
- Investigations and ongoing care

**During CPR**
- Ensure high quality CPR
- Give oxygen when available
- Gain IV or IO access
- **Give 10mcg/kg of adrenaline** *(0.1mls/kg of 1:10,000)* every 3-5 mins
- Correct reversible causes
- Continuous chest compressions when intubated

**Reversible Causes**
- Hypoxia
- Hypovolaemia
- Hypo / hyperkalaemia
- Hypothermia
- Toxins (e.g. deep halothane)
- Tension pneumothorax
- Thrombosis
- Tamponade
Paediatric Life Support
(Defibrillator available)

Unresponsive child
No breathing or only occasional gasps
*If under anaesthetic, loss of central pulse*

Start CPR
- 5 initial breaths, then ratio of 15 chest compressions to 2 breaths
- If intubated, give continuous compressions
- Attach defibrillator

Assess rhythm

- **Shockable** (VF / Pulseless VT)
  - 1 shock
  - 4 J/kg
  - Immediately resume CPR for 2 mins

- **Return of pulse / signs of life**
  - Immediate post cardiac arrest treatment
    - ABCDE assessment
    - Controlled oxygenation and ventilation
    - Treat precipitating cause
    - Investigations and ongoing care

- **Non-shockable** (PEA / Asystole)
  - Continue CPR for 2 mins
  - Minimise interruptions

During CPR
- Ensure high quality CPR
- Give oxygen when available
- Gain IV or IO access
- Give 10mcg/kg of adrenaline (0.1mls/kg of 1:10,000) every 3-5 mins
- Correct reversible causes
- Continuous chest compressions when intubated

Reversible Causes
- Hypoxia
- Hypovolaemia
- Hypo / hyperkalaemia
- Hypothermia
- Toxins (e.g. deep halothane)
- Tension pneumothorax
- Thrombosis
- Tamponade

VF - Ventricular fibrillation; VT - Ventricular tachycardia; PEA - Pulseless electrical activity
Newborn Life Support

Key Points
- The most important task of newborn resuscitation is to HELP THE BABY BREATHE
- If there is thick meconium and no respiratory effort, suction the airway but DO NOT DELAY RESCUE BREATHS
- There is little benefit in starting chest compressions if airway is not open and the lungs are not inflated
- Start chest compressions if heart rate is <60 beats per minute
- Resuscitation attempts should be stopped if there is no heart beat after 20 minutes

APGAR scoring
- The APGAR score should be performed at one and five minutes after delivery, to indicate the overall status of the baby
- APGAR scoring should not delay resuscitation
- A score of above 7 at one minute is normal
- A score of 3 is critically low
- A score of below 7 at 5 minutes is low and indicates the baby may need ongoing resuscitation and observation

<table>
<thead>
<tr>
<th></th>
<th>Score 0</th>
<th>Score 1</th>
<th>Score 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Activity (Activity)</td>
<td>Floppy</td>
<td>Limbs flexed</td>
<td>Active</td>
</tr>
<tr>
<td>Pulse rate</td>
<td>&lt;60</td>
<td>60 - 100</td>
<td>&gt;100</td>
</tr>
<tr>
<td>Grimeace (Response to stimulation)</td>
<td>No response</td>
<td>Grimace only</td>
<td>Sneezes, coughs or move away</td>
</tr>
<tr>
<td>Appearance (colour)</td>
<td>Pale or blue all over</td>
<td>Pink centrally with blue hands / feet</td>
<td>Pink all over</td>
</tr>
<tr>
<td>Respiration</td>
<td>No breathing</td>
<td>Irregular breathing</td>
<td>Regular breathing</td>
</tr>
</tbody>
</table>

Apgar V. A proposal for a new method of evaluation of the newborn infant. 
Newborn Life Support

(Antenatal counselling)
Team briefing and equipment check

Birth

Dry the baby
Maintain normal temperature
Start the clock or note the time

Assess (tone), breathing, heart rate

If gasping or not breathing:
Open the airway
Give 5 inflation breaths
Consider SpO₂ ± ECG monitoring

Re-assess
If no increase in heart rate look for chest movement during inflation

If chest not moving:
Recheck head position
Consider 2-person airway control and other airway manoeuvres
Repeat inflation breaths
SpO₂ ± ECG monitoring
Look for a response

Acceptable pre-ductal SpO₂
2 min 60%
3 min 70%
4 min 80%
5 min 85%
10 min 90%

If no increase in heart rate look for chest movement

When the chest is moving:
If heart rate is not detectable or very slow (< 60 min⁻¹) start chest compressions; coordinate with ventilation breaths (ratio 3:1)

Re-assess heart rate every 30 seconds
If heart rate is not detectable or very slow (< 60 min⁻¹) consider venous access and drugs

Update parents and debrief team

Increase oxygen (guided byometry if available)

AT
ALL TIMES
ASK:

DO
YOU NEED HELP?

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## Sick Laparotomy

### Signs and symptoms of intra-abdominal sepsis
- Fever >38°C, high respiratory rate, high heart rate, low BP
- Oliguria, altered conscious level, acute abdomen

### Give high flow oxygen

### Fluid resuscitation
- **IV access:** 2 x 20G cannulae
- **Blood investigations:** FBC, U&Es, clotting, blood cultures, cross match and **glucose**
- **Give IV fluids:** 20ml/kg of normal saline and assess response

If starting Hb is below 7g/dl, cross match and transfuse blood at the earliest time possible

### IV antibiotics: give within 1 hour of diagnosis
- Ciprofloxacin (10 mg/kg; max 400mg)
- or ceftriaxone (50 mg/kg; max 4g)
- **Plus** metronidazole (7.5 mg/kg; max 500mg)
- **Plus** gentamicin (7 mg/kg once daily dose; max 500mg)

### Analgesia
- Treat according to severity of pain
- Avoid NSAIDs and IM injections

### Insert NG tube and urinary catheter

### Definitive management: Surgery
- Make sure blood available before starting
- RSI with ketamine. Avoid deep halothane.

### Post-operative care
- High dependency care unit
- Continue antibiotics for 5 days. Give regular analgesia
Anaphylaxis

Diagnosis

• Signs include stridor, wheeze, desaturation, hypotension, tachycardia, rash and airway oedema
• May be associated with common triggers (e.g. antibiotics, muscle relaxants, latex gloves)

Immediate management

• ABC approach
• Call for help
• Stop administering any potential triggers (e.g. antibiotics)
• Give intramuscular (IM) adrenaline as early as possible:

<table>
<thead>
<tr>
<th>Adrenaline dose for anaphylaxis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Child under 6 years</td>
</tr>
<tr>
<td>Child 6-12 years</td>
</tr>
<tr>
<td>Child over 12 years</td>
</tr>
</tbody>
</table>

• Give high flow oxygen
• Give IV fluid resuscitation (20ml/kg bolus)
• Give hydrocortisone IV and consider giving an antihistamine (such as chlorphenamine) if available – see table
• Monitor heart rate, blood pressure and oxygen saturation
• May need further boluses of IV fluid if hypotensive
• Adrenaline dose may be repeated after 5 minutes if needed

<table>
<thead>
<tr>
<th>Hydrocortisone (IM or slow IV)</th>
<th>Chlorphenamine (IM or slow IV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Child under 6 months</td>
<td>25mg</td>
</tr>
<tr>
<td>6 months - 6 years</td>
<td>50mg</td>
</tr>
<tr>
<td>6 -12 years</td>
<td>100mg</td>
</tr>
<tr>
<td>Child over 12 years</td>
<td>200mg</td>
</tr>
</tbody>
</table>
# Status Epilepticus

## High flow oxygen

**DON’T FORGET TO CHECK GLUCOSE!**

## VASCULAR ACCESS

- **5 minutes**

## STEP 1

Lorazepam 0.1mg/kg IV/IO  
(or Diazepam 0.2mg/kg IV/IO)  
or  
Diazepam 0.5mg/kg PR  
(if no vascular access)

- **10 minutes**

## STEP 2

Lorazepam 0.1mg/kg IV/IO  
(or Diazepam 0.2mg/kg IV/IO)

- **10 minutes**

## CALL FOR HELP

## STEP 3

Phenytoin 20mg/kg over 20 min IV/IO  
or  
Phenobarbitone 20mg/kg over 20 min IV/IO

- **20 minutes**

## STEP 4

**RSI with Thiopentone 4mg/kg IV**  
Manage patient in critical care environment
## Local Anaesthetic Toxicity

| 1 Recognition | Signs of toxicity:  
• **Neurological**: Agitation, alteration in mental state, loss of consciousness, convulsions  
• **Cardiac**: Arrhythmias, cardiac arrest |
|---------------|-------------------------------------------------|
| 2 Immediate management | • **Stop injecting local anaesthetic**  
• Call for help  
• Maintain airway *(may need intubation)*  
• High flow oxygen (give ventilation if required)  
• Control seizures: give benzodiazepine or thiopentone in small incremental doses  
• Assess cardiovascular status throughout |
| 3 Treatment | **In circulatory arrest:**  
• Start cardio-pulmonary resuscitation (CPR)  
• Arrhythmias may be very resistant, may need prolonged resuscitation (>1hr)  
• Give IV lipid emulsion*  
**Without circulatory arrest:**  
• Treat arrhythmias and blood pressure as required  
• Consider IV lipid emulsion* |
| 4 Follow-up | • Monitor patient closely until sustained recovery  
• Document all events in patient notes |

* **IV lipid emulsion**, if available:  
  • **Initial bolus**: 1.5 mls/kg of 20% lipid solution  
  • **Followed by infusion**: 15 mls/kg/hr of 20% lipid solution  
  • **If no improvement, give up to two further boluses** (1.5mls/kg every 5 minutes) and **double the infusion rate** (30mls/kg/hr)  
  • Propofol is not a suitable alternative to lipid emulsion

Adapted from AAGBI Safety Guideline: Management of Severe Local Anaesthetic Toxicity Guideline 2010
## Pre-calculated Equipment and Drugs Table

**1 month old**  
*Estimated Weight = 4 kg*

<table>
<thead>
<tr>
<th>Airway</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>ETT size</td>
<td>3.0 – 3.5</td>
<td></td>
</tr>
<tr>
<td>ETT length</td>
<td>10 – 10.5 cm</td>
<td></td>
</tr>
<tr>
<td>LMA size</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Fluids</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Estimated blood volume</td>
<td>320 mls</td>
<td></td>
</tr>
<tr>
<td>Fluid bolus (20 mls/kg)</td>
<td>80 mls</td>
<td></td>
</tr>
<tr>
<td>Whole blood bolus (8 mls/kg)</td>
<td>32 mls</td>
<td></td>
</tr>
<tr>
<td>Packed cells bolus (5 mls/kg)</td>
<td>20 mls</td>
<td></td>
</tr>
<tr>
<td>10% glucose (2 mls/kg)</td>
<td>8 mls</td>
<td></td>
</tr>
<tr>
<td>Hourly maintenance fluid</td>
<td>16 mls/hr</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Drug doses</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Adrenaline (in cardiac arrest)</td>
<td>40 mcg IV (0.4 mls of 1:10,000)</td>
<td></td>
</tr>
<tr>
<td>Amoxicillin</td>
<td>120 mg</td>
<td></td>
</tr>
<tr>
<td>Atracurium</td>
<td>2 mg</td>
<td></td>
</tr>
<tr>
<td>Atropine</td>
<td>80 mcg</td>
<td></td>
</tr>
<tr>
<td>Ceftriaxone</td>
<td>200 mg</td>
<td></td>
</tr>
<tr>
<td>Diclofenac</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Fentanyl</td>
<td>4 – 8 mcg</td>
<td></td>
</tr>
<tr>
<td>Gentamicin</td>
<td>8 mg (surgical prophylaxis)</td>
<td></td>
</tr>
<tr>
<td>Ketamine</td>
<td>4 – 8 mg IV</td>
<td></td>
</tr>
<tr>
<td>Metronidazole</td>
<td>30 mg</td>
<td></td>
</tr>
<tr>
<td>Morphine</td>
<td>0.08 – 0.4 mg IV</td>
<td></td>
</tr>
<tr>
<td>Neostigmine</td>
<td>0.2 mg</td>
<td></td>
</tr>
<tr>
<td>Paracetamol</td>
<td>80 mg PR</td>
<td></td>
</tr>
<tr>
<td>Pethidine</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Propofol</td>
<td>8 - 20 mg</td>
<td></td>
</tr>
<tr>
<td>Suxamethonium</td>
<td>8 mg IV</td>
<td></td>
</tr>
<tr>
<td>Thiopentone</td>
<td>8 – 16 mg</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LAs</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2% Lignocaine (max. dose)</td>
<td>0.6 ml (without adrenaline)</td>
</tr>
<tr>
<td>0.25% Bupivacaine (max. dose)</td>
<td>1.4 mls (with adrenaline)</td>
</tr>
<tr>
<td></td>
<td>3.2 mls</td>
</tr>
</tbody>
</table>
# Pre-calculated Equipment and Drugs Table

**6 month old**  
Estimated Weight = 7 kg

<table>
<thead>
<tr>
<th>Airway</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>ETT size</td>
<td>3.5 – 4.0</td>
</tr>
<tr>
<td>ETT length</td>
<td>11.5 – 12.5 cm</td>
</tr>
<tr>
<td>LMA size</td>
<td>1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Fluids</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Estimated blood volume</td>
<td>560 mls</td>
</tr>
<tr>
<td>Fluid bolus (20 mls/kg)</td>
<td>140 mls</td>
</tr>
<tr>
<td>Whole blood bolus (8 mls/kg)</td>
<td>56 mls</td>
</tr>
<tr>
<td>Packed cells bolus (5 mls/kg)</td>
<td>35 mls</td>
</tr>
<tr>
<td>10% glucose (2 mls/kg)</td>
<td>14 mls</td>
</tr>
<tr>
<td>Hourly maintenance fluid</td>
<td>28 mls/hr</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Drug doses</th>
<th></th>
</tr>
</thead>
</table>
| Adrenaline (in cardiac arrest) | 70 mcg IV  
(0.7 mls of 1:10,000) |
| Amoxicillin | 210 mg |
| Atracurium | 3.5 mg |
| Atropine | 140 mcg |
| Ceftriaxone | 350 mg |
| Diclofenac | - |
| Fentanyl | 7 – 14 mcg |
| Gentamicin | 14 mg (surgical prophylaxis) |
| Ketamine | 7 – 14 mg IV |
| Metronidazole | 52 mg |
| Morphine | 0.14 – 0.7 mg IV |
| Neostigmine | 0.35 mg |
| Paracetamol | 140 mg PR |
| Pethidine | - |
| Propofol | 14 - 35 mg |
| Suxamethonium | 14 mg IV |
| Thiopentone | 14 – 28 mg |

<table>
<thead>
<tr>
<th>LAs</th>
<th></th>
</tr>
</thead>
</table>
| 2% Lignocaine (max. dose) | 1.0 ml (without adrenaline)  
2.5 mls (with adrenaline) |
| 0.25% Bupivacaine (max. dose) | 5.6 mls |
### Pre-calculated Equipment and Drugs Table

#### 1 year old  Estimated Weight = 10 kg

<table>
<thead>
<tr>
<th>Airway</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>ETT size</td>
<td>4.0 – 4.5</td>
<td></td>
</tr>
<tr>
<td>ETT length</td>
<td>12 – 13 cm</td>
<td></td>
</tr>
<tr>
<td>LMA size</td>
<td>1½</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Fluids</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Estimated blood volume</td>
<td>800 mls</td>
<td></td>
</tr>
<tr>
<td>Fluid bolus (20mls/kg)</td>
<td>200 mls</td>
<td></td>
</tr>
<tr>
<td>Whole blood bolus (8mls/kg)</td>
<td>80 mls</td>
<td></td>
</tr>
<tr>
<td>Packed cells bolus (5mls/kg)</td>
<td>50 mls</td>
<td></td>
</tr>
<tr>
<td>10% glucose (2mls/kg)</td>
<td>20 mls</td>
<td></td>
</tr>
<tr>
<td>Hourly maintenance fluid</td>
<td>40 mls/hr</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Drug doses</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Adrenaline (in cardiac arrest)</td>
<td>100 mcg IV</td>
<td>(1 mls of 1:10,000)</td>
</tr>
<tr>
<td>Amoxicillin</td>
<td>300 mg</td>
<td></td>
</tr>
<tr>
<td>Atracurium</td>
<td>5 mg</td>
<td></td>
</tr>
<tr>
<td>Atropine</td>
<td>200 mcg</td>
<td></td>
</tr>
<tr>
<td>Ceftriaxone</td>
<td>500 mg</td>
<td></td>
</tr>
<tr>
<td>Diclofenac</td>
<td>5mg IV or 10mg PR</td>
<td></td>
</tr>
<tr>
<td>Fentanyl</td>
<td>10 – 20 mcg</td>
<td></td>
</tr>
<tr>
<td>Gentamicin</td>
<td>20mg (surgical prophylaxis)</td>
<td></td>
</tr>
<tr>
<td>Ketamine</td>
<td>10 – 20 mg IV</td>
<td></td>
</tr>
<tr>
<td>Metronidazole</td>
<td>75 mg</td>
<td></td>
</tr>
<tr>
<td>Morphine</td>
<td>0.5 – 1 mg IV</td>
<td></td>
</tr>
<tr>
<td>Neostigmine</td>
<td>0.5 mg</td>
<td></td>
</tr>
<tr>
<td>Paracetamol</td>
<td>200 mg PR</td>
<td></td>
</tr>
<tr>
<td>Pethidine</td>
<td>5 – 10 mg</td>
<td></td>
</tr>
<tr>
<td>Propofol</td>
<td>20 – 50 mg</td>
<td></td>
</tr>
<tr>
<td>Suxamethonium</td>
<td>20 mg IV</td>
<td></td>
</tr>
<tr>
<td>Thiopentone</td>
<td>20 – 40 mg</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LAs</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2% Lignocaine (max. dose)</td>
<td>1.5 mls (without adrenaline)</td>
<td></td>
</tr>
<tr>
<td>0.25% Bupivacaine (max. dose)</td>
<td>3.5 mls (with adrenaline)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>8 mls</td>
<td></td>
</tr>
</tbody>
</table>
### Pre-calculated Equipment and Drugs Table

#### 3 year old  
Estimated Weight = **14 kg**

<table>
<thead>
<tr>
<th>Airway</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>ETT size</td>
<td>5.0</td>
</tr>
<tr>
<td>ETT length</td>
<td>13 – 14 cm</td>
</tr>
<tr>
<td>LMA size</td>
<td>2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Fluids</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Estimated blood volume</td>
<td><strong>1100 mls</strong></td>
</tr>
<tr>
<td>Fluid bolus (20 mls/kg)</td>
<td><strong>280 mls</strong></td>
</tr>
<tr>
<td>Whole blood bolus (8 mls/kg)</td>
<td><strong>112 mls</strong></td>
</tr>
<tr>
<td>Packed cells bolus (5 mls/kg)</td>
<td><strong>70 mls</strong></td>
</tr>
<tr>
<td>10% glucose (2 mls/kg)</td>
<td><strong>28 mls</strong></td>
</tr>
<tr>
<td>Hourly maintenance fluid</td>
<td><strong>48 mls/hr</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Drug doses</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Adrenaline (in cardiac arrest)</td>
<td><strong>140 mcg IV</strong> (1.4 mls of 1:10,000)</td>
</tr>
<tr>
<td>Amoxicillin</td>
<td><strong>420 mg</strong></td>
</tr>
<tr>
<td>Atracurium</td>
<td>7 mg</td>
</tr>
<tr>
<td>Atropine</td>
<td><strong>280 mcg</strong></td>
</tr>
<tr>
<td>Ceftriaxone</td>
<td>700 mg</td>
</tr>
<tr>
<td>Diclofenac</td>
<td>7 mg IV or 14 mg PR</td>
</tr>
<tr>
<td>Fentanyl</td>
<td>14 – 28 mcg</td>
</tr>
<tr>
<td>Gentamicin</td>
<td><strong>28 mg</strong> (surgical prophylaxis)</td>
</tr>
<tr>
<td>Ketamine</td>
<td>14 – 28 mg IV</td>
</tr>
<tr>
<td>Metronidazole</td>
<td>105 mg</td>
</tr>
<tr>
<td>Morphine</td>
<td>0.7 – 1.4 mg IV</td>
</tr>
<tr>
<td>Neostigmine</td>
<td>0.7 mg</td>
</tr>
<tr>
<td>Paracetamol</td>
<td><strong>280 mg PR</strong></td>
</tr>
<tr>
<td>Pethidine</td>
<td>7 – 14 mg</td>
</tr>
<tr>
<td>Propofol</td>
<td>28 – 70 mg</td>
</tr>
<tr>
<td>Suxamethonium</td>
<td>28 mg IV</td>
</tr>
<tr>
<td>Thiopentone</td>
<td>28 – 56 mg</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LAs</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2% Lignocaine (max. dose)</td>
<td><strong>2.1 mls</strong> (without adrenaline)</td>
</tr>
<tr>
<td>0.25% Bupivacaine (max. dose)</td>
<td><strong>4.9 mls</strong> (with adrenaline)</td>
</tr>
<tr>
<td></td>
<td><strong>11.2 mls</strong></td>
</tr>
</tbody>
</table>
# Pre-calculated Equipment and Drugs Table

**6 year old  Estimated Weight = 20 kg**

<table>
<thead>
<tr>
<th>Airway</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>ETT size</td>
<td>6.0</td>
<td></td>
</tr>
<tr>
<td>ETT length</td>
<td>14 – 16 cm</td>
<td></td>
</tr>
<tr>
<td>LMA size</td>
<td>2 or 2½</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Fluids</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Estimated blood volume</td>
<td>1600 mls</td>
<td></td>
</tr>
<tr>
<td>Fluid bolus (20mls/kg)</td>
<td>240 mls</td>
<td></td>
</tr>
<tr>
<td>Whole blood bolus (8mls/kg)</td>
<td>160 mls</td>
<td></td>
</tr>
<tr>
<td>Packed cells bolus (5mls/kg)</td>
<td>100 mls</td>
<td></td>
</tr>
<tr>
<td>10% glucose (2mls/kg)</td>
<td>40 mls</td>
<td></td>
</tr>
<tr>
<td>Hourly maintenance fluid</td>
<td>60 mls/hr</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Drug doses</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Adrenaline (in cardiac arrest)</td>
<td>200 mcg IV (2 mls of 1:10,000)</td>
<td></td>
</tr>
<tr>
<td>Amoxicillin</td>
<td>600 mg</td>
<td></td>
</tr>
<tr>
<td>Atracurium</td>
<td>10 mg</td>
<td></td>
</tr>
<tr>
<td>Atropine</td>
<td>400 mcg</td>
<td></td>
</tr>
<tr>
<td>Ceftriaxone</td>
<td>1 g</td>
<td></td>
</tr>
<tr>
<td>Diclofenac</td>
<td>10mg IV or 20mg PR</td>
<td></td>
</tr>
<tr>
<td>Fentanyl</td>
<td>20 – 40 mcg</td>
<td></td>
</tr>
<tr>
<td>Gentamicin</td>
<td>40mg (surgical prophylaxis)</td>
<td></td>
</tr>
<tr>
<td>Ketamine</td>
<td>20 – 40 mg IV</td>
<td></td>
</tr>
<tr>
<td>Metronidazole</td>
<td>150 mg</td>
<td></td>
</tr>
<tr>
<td>Morphine</td>
<td>1 – 2 mg IV</td>
<td></td>
</tr>
<tr>
<td>Neostigmine</td>
<td>1 mg</td>
<td></td>
</tr>
<tr>
<td>Paracetamol</td>
<td>400 mg PR</td>
<td></td>
</tr>
<tr>
<td>Pethidine</td>
<td>10 – 20 mg</td>
<td></td>
</tr>
<tr>
<td>Propofol</td>
<td>40 - 100 mg</td>
<td></td>
</tr>
<tr>
<td>Suxamethonium</td>
<td>40 mg IV</td>
<td></td>
</tr>
<tr>
<td>Thiopentone</td>
<td>40 – 80 mg</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LAs</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2% Lignocaine (max. dose)</td>
<td>3 mls (without adrenaline)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>7 mls (with adrenaline)</td>
<td></td>
</tr>
<tr>
<td>0.25% Bupivacaine (max. dose)</td>
<td>16 mls</td>
<td></td>
</tr>
</tbody>
</table>
# Pre-calculated Equipment and Drugs Table

### 8 year old Estimated Weight = 25 kg

<table>
<thead>
<tr>
<th>Airway</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>ETT size</td>
<td>6.5</td>
</tr>
<tr>
<td>ETT length</td>
<td>15 – 17 cm</td>
</tr>
<tr>
<td>LMA size</td>
<td>2½</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Fluids</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Estimated blood volume</td>
<td>2000 mls</td>
</tr>
<tr>
<td>Fluid bolus (20mls/kg)</td>
<td>500 mls</td>
</tr>
<tr>
<td>Whole blood bolus (8mls/kg)</td>
<td>200 mls</td>
</tr>
<tr>
<td>Packed cells bolus (5mls/kg)</td>
<td>125 mls</td>
</tr>
<tr>
<td>10% glucose (2mls/kg)</td>
<td>50 mls</td>
</tr>
<tr>
<td>Hourly maintenance fluid</td>
<td>65 mls/hr</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Drug doses</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Adrenaline (in cardiac arrest)</td>
<td>250 mcg IV (2.5 mls of 1:10,000)</td>
</tr>
<tr>
<td>Amoxicillin</td>
<td>750 mg</td>
</tr>
<tr>
<td>Atracurium</td>
<td>12.5 mg</td>
</tr>
<tr>
<td>Atropine</td>
<td>500 mcg</td>
</tr>
<tr>
<td>Ceftriaxone</td>
<td>1.2 g</td>
</tr>
<tr>
<td>Diclofenac</td>
<td>12.5mg IV or 25mg PR</td>
</tr>
<tr>
<td>Fentanyl</td>
<td>25 – 50 mcg</td>
</tr>
<tr>
<td>Gentamicin</td>
<td>50mg (surgical prophylaxis)</td>
</tr>
<tr>
<td>Ketamine</td>
<td>25 – 50 mg IV</td>
</tr>
<tr>
<td>Metronidazole</td>
<td>188 mg</td>
</tr>
<tr>
<td>Morphine</td>
<td>1.25 – 2.5 mg IV</td>
</tr>
<tr>
<td>Neostigmine</td>
<td>1.2 mg</td>
</tr>
<tr>
<td>Paracetamol</td>
<td>500 mg PR</td>
</tr>
<tr>
<td>Pethidine</td>
<td>12 – 25 mg</td>
</tr>
<tr>
<td>Propofol</td>
<td>50 – 125 mg</td>
</tr>
<tr>
<td>Suxamethonium</td>
<td>50 mg IV</td>
</tr>
<tr>
<td>Thiopentone</td>
<td>50 – 100 mg</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LAs</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2% Lignocaine (max. dose)</td>
<td>3.8 mls (without adrenaline) 8.8 mls (with adrenaline)</td>
</tr>
<tr>
<td>0.25% Bupivacaine (max. dose)</td>
<td>20 mls</td>
</tr>
</tbody>
</table>
# Pre-calculated Equipment and Drugs Table

<table>
<thead>
<tr>
<th>10 year old</th>
<th>Estimated Weight = 30kg</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Airway</strong></td>
<td></td>
</tr>
<tr>
<td>ETT size</td>
<td>7.0</td>
</tr>
<tr>
<td>ETT length</td>
<td>16 – 18 cm</td>
</tr>
<tr>
<td>LMA size</td>
<td>2½ or 3</td>
</tr>
<tr>
<td><strong>Fluids</strong></td>
<td></td>
</tr>
<tr>
<td>Estimated blood volume</td>
<td>2400 mls</td>
</tr>
<tr>
<td>Fluid bolus (20mls/kg)</td>
<td>600 mls</td>
</tr>
<tr>
<td>Whole blood bolus (8mls/kg)</td>
<td>240 mls</td>
</tr>
<tr>
<td>Packed cells bolus (5mls/kg)</td>
<td>150 mls</td>
</tr>
<tr>
<td>10% glucose (2mls/kg)</td>
<td>60 mls</td>
</tr>
<tr>
<td>Hourly maintenance fluid</td>
<td>70 mls/hr</td>
</tr>
<tr>
<td><strong>Drug doses</strong></td>
<td></td>
</tr>
<tr>
<td>Adrenaline (in cardiac arrest)</td>
<td>300 mcg IV (3 mls of 1:10,000)</td>
</tr>
<tr>
<td>Amoxicillin</td>
<td>900 mg</td>
</tr>
<tr>
<td>Atracurium</td>
<td>15 mg</td>
</tr>
<tr>
<td>Atropine</td>
<td>600 mcg</td>
</tr>
<tr>
<td>Ceftriaxone</td>
<td>1.5 g</td>
</tr>
<tr>
<td>Diclofenac</td>
<td>15mg IV or 30mg PR</td>
</tr>
<tr>
<td>Fentanyl</td>
<td>30 – 60 mcg</td>
</tr>
<tr>
<td>Gentamicin</td>
<td>60mg (surgical prophylaxis)</td>
</tr>
<tr>
<td>Ketamine</td>
<td>30 – 60 mg IV</td>
</tr>
<tr>
<td>Metronidazole</td>
<td>225 mg</td>
</tr>
<tr>
<td>Morphine</td>
<td>1.5 – 3 mg IV</td>
</tr>
<tr>
<td>Neostigmine</td>
<td>1.5 mg</td>
</tr>
<tr>
<td>Paracetamol</td>
<td>600 mg PR</td>
</tr>
<tr>
<td>Pethidine</td>
<td>15 – 30 mg</td>
</tr>
<tr>
<td>Propofol</td>
<td>60 – 150 mg</td>
</tr>
<tr>
<td>Suxamethonium</td>
<td>60 mg IV</td>
</tr>
<tr>
<td>Thiopentone</td>
<td>60 – 120 mg</td>
</tr>
<tr>
<td><strong>LAs</strong></td>
<td></td>
</tr>
<tr>
<td>2% Lignocaine (max. dose)</td>
<td>4.5 mls (without adrenaline)</td>
</tr>
<tr>
<td>0.25% Bupivacaine (max. dose)</td>
<td>10.5 mls (with adrenaline)</td>
</tr>
<tr>
<td></td>
<td>24 mls</td>
</tr>
</tbody>
</table>
### Obstetric Anaesthesia

**Physiological changes in pregnancy**

<table>
<thead>
<tr>
<th>System</th>
<th>Changes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cardiovascular</strong></td>
<td>• Increase in blood volume (50% increase)</td>
</tr>
<tr>
<td></td>
<td>• Increase in red cell mass (30% increase)</td>
</tr>
<tr>
<td></td>
<td>• Physiological <strong>anaemia of pregnancy</strong> (10-20% decrease in Hb concentration)</td>
</tr>
<tr>
<td></td>
<td>• Increase in cardiac output (50% increase)</td>
</tr>
<tr>
<td></td>
<td>• Aortocaval compression, most marked when mother is lying flat on back</td>
</tr>
<tr>
<td></td>
<td>• <strong>Hyper-coagulable</strong> state after 1(^{st}) trimester</td>
</tr>
<tr>
<td><strong>Respiratory</strong></td>
<td>• <strong>Swelling of airway</strong> soft tissues which can make intubation more difficult</td>
</tr>
<tr>
<td></td>
<td>• Increase in minute ventilation leading to respiratory alkalosis</td>
</tr>
<tr>
<td></td>
<td>• Increase in oxygen consumption (25% increase) making the mother more susceptible to hypoxia</td>
</tr>
<tr>
<td></td>
<td>• Upward displacement of diaphragm by uterus leading to reduced functional residual capacity (FRC) and total lung capacity (TLC)</td>
</tr>
<tr>
<td><strong>Gastrointestinal</strong></td>
<td>• Slower gastric emptying during labour which increases risk of reflux and regurgitation</td>
</tr>
<tr>
<td></td>
<td>• Increased risk of aspiration under general anaesthesia</td>
</tr>
<tr>
<td><strong>Renal</strong></td>
<td>• Increase in <strong>renal blood flow</strong></td>
</tr>
<tr>
<td></td>
<td>• Fall in urea and creatinine levels</td>
</tr>
</tbody>
</table>
All patients requiring anaesthetic intervention need a preoperative assessment and should be seen at the earliest time possible. This allows identification of high risk mothers and planning of patient’s care. The following should be taken as a minimum:

### History

<table>
<thead>
<tr>
<th>Category</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Establish indication and degree of urgency for surgery</td>
<td>(see page 42)</td>
</tr>
<tr>
<td>Past medical history</td>
<td></td>
</tr>
<tr>
<td>• Cardiovascular</td>
<td>congenital heart disease, arrhythmia</td>
</tr>
<tr>
<td>• Respiratory</td>
<td>severe asthma, tuberculosis</td>
</tr>
<tr>
<td>• Central nervous system</td>
<td>epilepsy</td>
</tr>
<tr>
<td>• Endocrine</td>
<td>diabetes</td>
</tr>
<tr>
<td>• Infectious disease</td>
<td>HIV, hepatitis</td>
</tr>
<tr>
<td>Obstetric history</td>
<td></td>
</tr>
<tr>
<td>• Gravida parity</td>
<td></td>
</tr>
<tr>
<td>• Pregnancy induced conditions</td>
<td>(e.g. PET, gestational diabetes)</td>
</tr>
<tr>
<td>• Problems with previous deliveries</td>
<td></td>
</tr>
<tr>
<td>Anaesthetic history</td>
<td></td>
</tr>
<tr>
<td>• Family history</td>
<td>(e.g. suxamethonium apnoea, malignant hyperthermia)</td>
</tr>
<tr>
<td>• Problems with previous epidural or spinal anaesthesia</td>
<td></td>
</tr>
<tr>
<td>• History of difficult airway</td>
<td></td>
</tr>
<tr>
<td>Medications</td>
<td></td>
</tr>
<tr>
<td>• Regular medications</td>
<td></td>
</tr>
<tr>
<td>• Medication given during labour</td>
<td></td>
</tr>
<tr>
<td>• Is the patient on any anticoagulation?</td>
<td></td>
</tr>
<tr>
<td>Allergies</td>
<td></td>
</tr>
<tr>
<td>Fasting status</td>
<td></td>
</tr>
</tbody>
</table>

### Examination

<table>
<thead>
<tr>
<th>Category</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Airway and breathing</td>
<td>Respiratory rate, breath sounds, oxygen saturations</td>
</tr>
<tr>
<td></td>
<td>Careful airway assessment helps to predict for difficult intubation</td>
</tr>
<tr>
<td>Circulation</td>
<td>Heart rate and blood pressure</td>
</tr>
<tr>
<td></td>
<td>Signs of anaemia</td>
</tr>
<tr>
<td>Spine and Weight</td>
<td>Inspect for spinal deformities. Are landmarks easily palpable?</td>
</tr>
<tr>
<td></td>
<td>Obesity is associated with difficult venous access, difficult intubation</td>
</tr>
<tr>
<td></td>
<td>difficult spinal anaesthesia</td>
</tr>
</tbody>
</table>

### Investigations

<table>
<thead>
<tr>
<th>Category</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ensure FBC and Group &amp; Save are performed prior to surgery</td>
<td></td>
</tr>
<tr>
<td>In PET- need platelet count within last 4 hours before spinal anaesthesia; check renal function, electrolytes and clotting</td>
<td></td>
</tr>
</tbody>
</table>
**Explanation and Consent**

<table>
<thead>
<tr>
<th>Obtain consent prior to any GA or spinal anaesthesia</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Discuss risks associated with spinal anaesthesia</strong></td>
</tr>
<tr>
<td>• Low blood pressure; failure for spinal to work (common)</td>
</tr>
<tr>
<td>• Headache (uncommon)</td>
</tr>
<tr>
<td>• Nerve damage (rare)</td>
</tr>
<tr>
<td>• Infection (very rare)</td>
</tr>
<tr>
<td><strong>Discuss risks associated with GA</strong></td>
</tr>
<tr>
<td>• Sore throat; nausea (common)</td>
</tr>
<tr>
<td>• Failed intubation; awareness (uncommon)</td>
</tr>
<tr>
<td>• Damage to teeth (rare)</td>
</tr>
<tr>
<td>• Anaphylaxis (very rare)</td>
</tr>
</tbody>
</table>

**Predictors for difficult intubation**

- Mallampati 3-4
- Mouth opening <3 fingers
- Neck flexion/extension <90°
- Inability to protrude lower jaw beyond upper incisors
- Thyromental distance <7cm
- Obesity
- PET- associated with laryngeal oedema

*Risk of failed intubation is 10 times higher in the obstetric population*

*If you suspect a difficult airway, get help and prepare for possible failed intubation (page 52)*

**Measures to reduce aspiration risk in pregnant women**

- Starve patient 6 hours prior to elective surgery
- Ranitidine 150mg PO QDS during labour
- Sodium citrate 30ml of 0.3molar solution just before pre-oxygenation
Urgency of Caesarean Section

Key points:
• Timing depends on the indication for surgery and the condition of the mother and fetus
• Good communication with obstetric team is vital
• Regardless of urgency, ensure mother’s condition is stabilised as much as possible before surgery

<table>
<thead>
<tr>
<th>Emergency: Immediate threat to the life of the mother or fetus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Timing: As soon as possible, ideally within 30 minutes</td>
</tr>
<tr>
<td>Examples:</td>
</tr>
<tr>
<td>• Prolonged fetal bradycardia secondary to abruption</td>
</tr>
<tr>
<td>• Severe APH from bleeding placenta praevia</td>
</tr>
<tr>
<td>• Severe fetal distress associated with cord prolapse</td>
</tr>
<tr>
<td>• Uterine rupture</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Urgent: Maternal or fetal compromise NOT immediately life threatening</th>
</tr>
</thead>
<tbody>
<tr>
<td>Timing: Promptly after decision has been made, once mother’s condition has been optimised</td>
</tr>
<tr>
<td>Examples:</td>
</tr>
<tr>
<td>• Malpresentation (face or brow)</td>
</tr>
<tr>
<td>• Failure to progress, with thick meconium</td>
</tr>
<tr>
<td>• Severe PET where vaginal delivery is not possible</td>
</tr>
<tr>
<td>→ need to control hypertension first</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Scheduled: No maternal or fetal compromise but needs early delivery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Timing: Early but when safe to do so</td>
</tr>
<tr>
<td>Examples:</td>
</tr>
<tr>
<td>• Failed induction of labour</td>
</tr>
<tr>
<td>• Breech presentation in early labour</td>
</tr>
<tr>
<td>• Macrosomic baby in early labour</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Elective</th>
</tr>
</thead>
<tbody>
<tr>
<td>Timing: Delivery at time to suit the mother and maternity services</td>
</tr>
<tr>
<td>Examples:</td>
</tr>
<tr>
<td>• Twin pregnancy, first fetus is breech presentation</td>
</tr>
<tr>
<td>• Two or more previous caesarean sections</td>
</tr>
<tr>
<td>• HIV positive</td>
</tr>
<tr>
<td>• Herpes simplex infection of vagina</td>
</tr>
</tbody>
</table>
Spinal Anaesthesia

Spinal anaesthesia is the method of choice for most caesarean sections, providing there are no contraindications.

### Contra-indications:

- Maternal refusal
- Untrained anaesthetic provider
- Skin infection at needle injection site
- Severe maternal sepsis
- Poor clotting function (INR > 1.5 or platelets < 80x10⁹/L)
- Severe aortic or mitral valve stenosis

### Preparation:

- Obtain **consent** from patient
- Complete ‘**Pre-anaesthetic checklist**’ (page 67)
- Ensure vasoconstrictors and all equipment for general anaesthesia are immediately available
- **Monitor saturations and BP** before and during procedure
- Ensure large bore intravenous access
- Consider preloading patients with intravenous crystalloid (10-15ml/kg) especially if bleeding, septic or dehydrated
- **Note:** Avoid preloading in pre-eclampsia

### Technique:

- Ensure **strict asepsis**
- Spinal should be performed at L3/4 or L4/5 levels
- Ideally, use **25G or smaller** pencil point spinal needle
- Do not inject spinal solution if patient complains of pain radiating to back, legs or bottom
- Only use preservative free local anaesthetic
- Bupivacaine is preferable to lidocaine
- Minimum height of block required for caesarean section is **T5**
- Ensure **antibiotics** are given prior to surgical incision
- Ensure **left lateral tilt** of table or wedge patient’s right hip
- Give **5-10iu oxytocin IV** at delivery. If there are risk factors for uterine atony, follow this with an infusion of 40iu in 500ml normal saline over 4 hours
Dermatomes and important innervations

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Spinal Anaesthetic Dose

<table>
<thead>
<tr>
<th>Local Anaesthetic (preservative free)</th>
<th>Concentration</th>
<th>Volume</th>
<th>Duration of block</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heavy Bupivacaine</td>
<td>0.5%</td>
<td>2.0-2.5ml</td>
<td>2-3 hours</td>
</tr>
<tr>
<td>Plain Bupivacaine</td>
<td>0.5%</td>
<td>1.8-2.0ml</td>
<td>2-3 hours</td>
</tr>
<tr>
<td>Lidocaine</td>
<td>2%</td>
<td>3-4ml</td>
<td>30-45min</td>
</tr>
<tr>
<td>Lidocaine</td>
<td>5%</td>
<td>1.0-1.5ml</td>
<td>60-90min</td>
</tr>
</tbody>
</table>
### Common problems with spinal anaesthesia

<table>
<thead>
<tr>
<th>Problem</th>
<th>Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Failed spinal anaesthesia</td>
<td>No block</td>
</tr>
<tr>
<td></td>
<td>• a repeat spinal may be performed</td>
</tr>
<tr>
<td>‘Patchy’/ inadequate block before surgery</td>
<td>• Repeat spinal may be performed but beware of high spinal or worsening haemodynamic status</td>
</tr>
<tr>
<td>Intraoperative inadequate block</td>
<td>• Inhaled nitrous oxide (if available)</td>
</tr>
<tr>
<td></td>
<td>• IV opioid (e.g. 25mcg fentanyl). Inform midwife as baby at risk of respiratory depression</td>
</tr>
<tr>
<td></td>
<td>• IV Ketamine (0.2-0.5mg/kg)</td>
</tr>
<tr>
<td></td>
<td>• Surgical infiltration of local anaesthetic</td>
</tr>
<tr>
<td></td>
<td>• <strong>Convert to GA</strong> if above measures fail</td>
</tr>
<tr>
<td>Hypotension</td>
<td>• Ensure wedge or increase left lateral tilt</td>
</tr>
<tr>
<td></td>
<td>• Intravenous fluid 250ml bolus</td>
</tr>
<tr>
<td></td>
<td>• Avoid head down position after giving heavy bupivacaine</td>
</tr>
<tr>
<td></td>
<td>• Vasoactive medication may be required</td>
</tr>
<tr>
<td></td>
<td>• Ephedrine (3-6mg IV bolus)</td>
</tr>
<tr>
<td></td>
<td>• Phenylephrine (50-100mcg IV bolus)</td>
</tr>
<tr>
<td></td>
<td>• Metaraminol (0.5mg IV bolus)</td>
</tr>
<tr>
<td></td>
<td>• Atropine for bradycardia (0.3mg IV bolus)</td>
</tr>
<tr>
<td></td>
<td>• <strong>Cautious dosing in pre-eclamptic patients</strong></td>
</tr>
<tr>
<td>High spinal</td>
<td>See page 53</td>
</tr>
<tr>
<td>LA toxicity</td>
<td>See page 29</td>
</tr>
<tr>
<td>Post-dural puncture headache</td>
<td>• Minimise risk by using pencil point needle 25G or smaller</td>
</tr>
<tr>
<td></td>
<td>• Exclude other serious causes of headache</td>
</tr>
<tr>
<td></td>
<td>• Avoid dehydration and ensure regular analgesia</td>
</tr>
<tr>
<td></td>
<td>• Epidural blood patch should only be performed by an experienced practitioner</td>
</tr>
</tbody>
</table>
Indications for General Anaesthesia

- **Maternal request**
- **Failed regional anaesthesia**
- **Urgency of surgery** - many guidelines recommend a GA for emergency caesarean section because it is often quicker. However, the decision will depend on the situation, the patient and the anaesthetist’s preference.
- **Maternal instability** - this is often a difficult decision and depends on the severity of the maternal condition and the anaesthetist’s preference.
- **Contra-indication to regional anaesthesia** (see page 43)

Preparation

- **Pre-assess** and consent patient
- **Give antacid medication**, if available
- **Complete ‘Pre-anaesthetic checklist’** (page 67)
- **Monitor saturations and BP** before and during procedure
- **Large bore IV access** with fluid infusion running
- **Use left lateral tilt**
- **Position head in optimal position for intubation** and plan for potentially difficult intubation

Technique

- **Pre-oxygenate mother** for 3 minutes
- **Use Rapid Sequence Induction (RSI)**
- **Suxamethonium** is advised as muscle relaxation at induction
- **All opioids and anaesthetic drugs can be transmitted to the baby before delivery** – inform midwife as baby at risk of respiratory depression
- **Give antibiotics** before knife to skin
- **Deep halothane can contribute to uterine atony**
- **Give 5-10iu oxytocin IV** at delivery. If there are risk factors for uterine atony, follow this with an infusion of 40iu in 500ml normal saline over 4 hours.
- **Extubate mother fully awake** to avoid aspiration
Postoperative Pain Management

Key Points

- Caesarean sections are painful post-operatively
- All patients should be offered analgesia
- Pain is associated with worse outcomes, including a delay to mobilise, poor coughing, increased risk of chest infections and a longer hospital stay
- Use the WHO analgesic ladder to treat pain (see page 12)
- Most analgesics are safe to give while breastfeeding, but use opioids with caution as they can be transmitted to the baby in breast milk, making the baby more drowsy
- NSAIDS are very effective and reduce opioid requirements. They should be given regularly with paracetamol unless contraindicated
- Contraindications to NSAIDS: pre-eclampsia, renal impairment, thrombocytopenia, significant haemorrhage, asthmatics sensitive to NSAIDs

Example analgesic regime after caesarean section

**Mild Pain**
- Paracetamol 1g every 6 hours
- Combine NSAID (e.g. Diclofenac 50mg 8 hourly) if no contraindications

**Moderate Pain**
- As with mild pain PLUS:
- Tramadol 50-100mg 6 hourly

**Severe Pain**
- As with mild pain PLUS:
- Oral morphine 10-20mg every 2 hours, as required
Topics:

- Maternal Life Support
- Failed Intubation
- High Spinal and Total Spinal
- Major Obstetric Haemorrhage
- Pre-eclampsia and Eclampsia
### Maternal Life Support

#### Key Points

- **Minimise aorto caval compression** - the mother must be tilted to the left. Tilt can be achieved by wedge or pillow under right hip. If not available, get an assistant to kneel and wedge the patient’s right hip onto the knees of the assistant.

- **Early intubation** is helpful as hypoxia occurs rapidly in pregnant patients.

- **Caesarean section should be performed within 5 minutes** if the mother remains in cardiac arrest. This is to improve maternal chances of survival.

- A resuscitation team member should be ready to take the baby to provide **neonatal resuscitation**.

- If maternal resuscitation is successful, the mother should remain on controlled ventilation and be taken to high dependency or intensive care unit for treatment of precipitating cause.

#### Possible causes of maternal cardiac arrest

<table>
<thead>
<tr>
<th>Obstetric causes</th>
<th>Non-obstetric causes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Massive haemorrhage</td>
<td>Pulmonary embolism</td>
</tr>
<tr>
<td>Amniotic fluid embolus</td>
<td>Anaphylaxis</td>
</tr>
<tr>
<td>Eclampsia</td>
<td>Septic shock</td>
</tr>
<tr>
<td>Peripartum cardiomyopathy</td>
<td>Myocardial infarction</td>
</tr>
<tr>
<td></td>
<td>Trauma</td>
</tr>
<tr>
<td></td>
<td>Intracranial haemorrhage</td>
</tr>
<tr>
<td></td>
<td>Anaesthetic complications: LA toxicity, high or total spinal</td>
</tr>
</tbody>
</table>
Maternal Life Support
(Defibrillator *not* available)

- Collapse or unresponsive
  - Shout for help and call for obstetrician
    - Open airway
      - Check for signs of life
    - Left lateral tilt
  - Start CPR
    - 30 chest compressions to every 2 breaths
    - Intubate as soon as possible
      - Ventilate with 100% oxygen
        - Once intubated, give continuous compressions
    - Establish IV access: Give 1mg adrenaline IV (10mls of 1:10,000) every 3-5 minutes during CPR
    - Reassess for return of pulse every 2 minutes
  - If no response to CPR after 4 minutes, proceed to delivery/ perimortem caesarean

**Reversible causes for cardiac arrest**
4 H’s and 4 T’s

- Hypoxia
- Hypovolaemia
- Hypo- / Hyperkalaemia
- Hypothermia
- Toxins (Local anaesthetic)
- Tension pneumothorax
- Tamponade (cardiac)
- Thromboembolism (pulmonary & amniotic fluid)

Don’t forget ECLAMPSIA as possible cause in pregnancy
Maternal Life Support
(Defibrillator available)

1. Collapse or unresponsive
2. Shout for help and call for obstetrician
3. Open airway
   - Check for signs of life
4. Left lateral tilt
5. Start CPR
   - 30 chest compressions to every 2 breaths
6. Intubate as soon as possible
   - Ventilate with 100% oxygen
   - Once intubated, give continuous compressions
   - Establish IV access
7. Attach monitor and defibrillator pads at the earliest time possible
8. Assess heart rhythm
   - VF or pulseless VT
     - 1 shock 150J biphasic or 360J monophasic
     - Immediately resume CPR for 2 minutes (minimise interruptions)
   - Asystole/PEA
     - Immediately resume CPR for 2 minutes (minimise interruptions)
9. If no response to CPR after 4 minutes, proceed to delivery/peri-mortem caesarean

During CPR:
- Give 1mg adrenaline IV (10mls of 1:10,000) every 3-5 minutes
- Correct reversible causes (see page 50)

VF- Ventricular fibrillation; VT- Ventricular tachycardia; PEA- Pulseless electrical activity
Failed Intubation

1st intubating attempt
If poor view of larynx optimise attempt by:
• Reducing/removing cricoid pressure
• External laryngeal manipulation
• Repositioning head/neck
• Using bougie/ stylet

Unsuccessful

2nd intubating attempt
Consider:
• Alternative laryngoscope
• Removing cricoid pressure

Unsuccessful

3rd intubation attempt only by experienced colleague

Unsuccessful

Declare failed intubation
Call for help
Priority is to maintain oxygenation

Supraglottic airway device
Remove cricoid pressure during insertion (maximum 2 attempts)

Facemask +/- oropharyngeal airway
Consider:
• 2-person facemask technique
• Reducing/removing cricoid pressure

*Is adequate oxygenation possible

No

Declare emergency to theatre team
Call for specialist help if available (ENT surgeon, intensivist)
Give 100% oxygen
Exclude laryngospasm- ensure neuromuscular blockade

Perform front-of-neck procedure

*Is oxygenation restored

No

Maternal life support
Perimortem caesarean section

*If oxygenation is adequate at this stage, consider if it is essential to proceed with surgery immediately.
If Yes → Maintain anaesthesia and consider merits of controlled versus spontaneous ventilation
If No → Wake the patient. Consider regional anaesthesia technique or awake intubation

**High Spinal and Total Spinal**

**High spinal** = Local anaesthetic block extending above T4 level  
**Total spinal** = Intracranial spread of local anaesthetic leading to loss of consciousness

Prompt recognition and management will minimise harm to mother and baby (see important innervations on page 44)

<table>
<thead>
<tr>
<th>Recognition</th>
<th></th>
</tr>
</thead>
</table>
|               | • Weakness or tingling of arms, neck or jaw  
|               | • Nausea, vomiting and feeling faint  
|               | • Marked hypotension or bradycardia  
|               | • Difficulty breathing or coughing  
|               | • Change in voice or hoarseness  
|               | • Loss of consciousness  

Recognise symptoms and signs early as they can lead to respiratory and cardiac arrest

<table>
<thead>
<tr>
<th>Management</th>
<th></th>
</tr>
</thead>
</table>
| Call for help and alert surgeon  
Assess patient using ABC approach  
Treatment is mainly supportive until spinal wears off  
A Give high flow oxygen and support airway  
May need intubation – **remember cricoid pressure**  
B Ventilate patient if poor respiratory effort  
C Confirm patient is in left lateral tilt  
**Treat hypotension:**  
• IV fluids and IV vasopressors (ephedrine, phenylephrine, metaraminol or adrenaline)  
**Treat bradycardia:**  
• IV atropine  
Start **Cardio-Pulmonary Resuscitation** if patient has a cardiac arrest  
**Consider delivery of baby,** whilst treating mother  
Ventilation is usually necessary for 1-2 hours until the spinal block has worn off – remember to provide low dose anaesthetic while intubated (e.g. halothane)
Major Obstetric Haemorrhage

Major Obstetric Haemorrhage = Blood loss > 1500ml

Recognition of blood loss and hypovolaemia:

- Blood loss is often underestimated
- Better estimation will help identify high risk mothers and will guide fluid resuscitation
- Note that a fall in BP may only occur after 2 litres of blood loss
- Remember:
  - Blood soaked large swab (mop) = 300mls blood
  - Blood soaked bed sheet = 1000mls blood
  - Blood soaked bed sheet and pool on floor = 2000mls blood

<table>
<thead>
<tr>
<th>Circulating volume lost (% estimated blood volume)</th>
<th>Signs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 500 ml (10%)</td>
<td>No symptoms or signs</td>
</tr>
<tr>
<td>1.5 litres (30%)</td>
<td>Increase in pulse and respiratory rate, cold, pale</td>
</tr>
<tr>
<td>2 litres (40%)</td>
<td>Increase in pulse and respiratory rate, fall in blood pressure, cold, clammy</td>
</tr>
<tr>
<td>Over 2 litres (&gt;40%)</td>
<td>Rapid pulse and respiratory rate, low blood pressure, cold, clammy, confused</td>
</tr>
</tbody>
</table>

Causes of obstetric haemorrhage (the Four T’s)

<table>
<thead>
<tr>
<th>Cause</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tone</td>
<td>Uterine atony (the most common cause)</td>
</tr>
<tr>
<td>Tissue</td>
<td>Retained products within the uterus or placental diseases (e.g. placenta accreta)</td>
</tr>
<tr>
<td>Trauma</td>
<td>Genital tract trauma, surgical bleeding</td>
</tr>
<tr>
<td>Thrombin</td>
<td>Poor clotting function</td>
</tr>
</tbody>
</table>
Management of major obstetric haemorrhage

**CALL FOR HELP**

- Put mother in left lateral tilt (if APH)

- Give high flow oxygen
  If required, intubate and ventilate patient

**Ensure large bore IV access**
**Give IV fluid resuscitation**

- Send blood for FBC, clotting and cross-matching immediately
- If possible, send blood for fibrinogen and ionised calcium
- **Warmed** IV fluids (up to 2000mls crystalloid) then consider blood
- Blood should be given when estimated loss is > 1.5L (30% EBV)
- Give FFP and platelets if coagulopathic, or over 4 bags of RBC given

**Definitive management**

- **APH:** If severe, consider immediate delivery
- **PPH:** Treatment will depend on cause (Four T’s)

**Important considerations for any major obstetric haemorrhage:**

### Anaesthetic considerations

- GA with RSI usually indicated – avoid spinal if cardiovascular instability
- Keep patient warm >36°C
- Observe blood loss closely (swabs, suction, floor)
- Monitor urine output
- Use of vasopressors may be required (e.g. ephedrine or dilute adrenaline)
- **Give uterotonic drugs in PPH** – see next page
- Give **1g tranexamic acid IV** over 10minutes if available
- Consider **10ml of 10% calcium chloride IV** for every 4 units RBC
- Treatment goals for transfusion – see next page

### Surgical treatment options

- Uterine massage if atony
- Bimanual uterine compression
- Balloon tamponade
- B-Lynch suture
- Ligation of uterine/internal iliac arteries
- Hysterectomy

**Consider HDU or ICU care postoperatively**
| **Uterotonic Drugs for the management of PPH** |
|-----------------|-----------------|-----------------|
| **Drug**        | **Dose**        | **Comment**     |
| Oxytocin (Syntocinon) | 5 iu IV bolus 40iu infusion over 4 hours | Can cause tachycardia, flushing and hypotension |
| Ergometrine     | 0.5 mg IM or slow IV injection | Extreme caution in PET or cardiac disease – can cause severe hypertension |
| Syntometrine    | As above        | Combination of oxytocin and ergometrine |
| Carboprost      | 0.25 mg IM every 15 minutes (max. 2mg) | Caution in asthmatics – can cause severe bronchospasm |
| Misoprostol     | 1 mg PR         | Can only be given rectally |

**Treatment goals for transfusion in major obstetric haemorrhage**

- Haematocrit >0.3
- Platelets >100x10^9/L
- Fibrinogen >2g/L
- Ionised calcium >1
- Temperature >36°C
## Pre-eclampsia and Eclampsia

### Pre-eclamptic toxaemia (PET)

- PET is a leading cause of maternal death
- It is characterised by hypertension and proteinuria
- It is a multi-systemic disorder occurring after 20 weeks of pregnancy
- Pathophysiological changes are described below

<table>
<thead>
<tr>
<th>CVS</th>
<th>Haematological</th>
<th>Renal</th>
<th>Cerebral</th>
<th>Placenta</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Hypertension (BP &gt;140/90mmHg)</td>
<td>• Reduced platelet count and risk of disseminated intravascular coagulation</td>
<td>• Increased permeability giving proteinuria</td>
<td>• Headache, visual disturbance, hyperreflexia</td>
<td>• Poor perfusion and reduced fetal growth</td>
</tr>
<tr>
<td>• Reduced intravascular volume but increased total body water</td>
<td></td>
<td>• Oliguria and renal failure in severe disease</td>
<td>• Cerebrovascular haemorrhage</td>
<td></td>
</tr>
<tr>
<td>• Increased sensitivity to vasopressors</td>
<td></td>
<td></td>
<td>• Eclampsia</td>
<td></td>
</tr>
<tr>
<td>• Increased capillary permeability which leads to pulmonary and laryngeal oedema</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Key points in management of PET

- Eclampsia is an emergency that requires immediate treatment
- PET or eclampsia do **not** require immediate caesarean section
- It is essential that seizures are treated and blood pressure is **under control before proceeding to caesarean section**
- Treatment should aim to **reduce BP to <140/90mmHg**
- If caesarean section is required, either spinal or general anaesthetic technique can be used but special considerations should be taken (see next page)
- Careful fluid management is important (see next page)
Anaesthesia for caesarean sections with PET

• Either spinal or general anaesthesia can be considered
  • Spinal anaesthesia may be safer if the patient is cooperative and is not coagulopathic (platelet count should be >80x10^9/L within last 4 hours before spinal)
  • Fluid preloading for spinal anaesthesia is not recommended
  • GA may be required if there is abnormal coagulation, severe haemorrhage, frequent seizures or need for immediate delivery
  • Make sure a smaller size ETT is available (airway oedema)
  • Aim to reduce hypertensive response of intubation by using IV labetalol, magnesium sulphate or fentanyl before induction
  • Use smaller doses of vasoconstrictors (increased sensitivity)
  • Ergometrine should be avoided
  • NSAIDs should be avoided for post-operative analgesia
  • Patient should be managed in HDU after delivery

Fluid management

• Fluid management can be difficult in pre-eclampsia
• Excessive fluid load may lead to pulmonary oedema but underfilling may affect renal function and fetal circulation
• Post partum fluid management needs careful attention – fluid restrict to 1ml/kg/hr of normal saline and reassess regularly
• Fluid balance chart recording all input and losses is essential

Drugs used to control hypertension in pre-eclampsia

<table>
<thead>
<tr>
<th>Drug</th>
<th>Dose and Route</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methyldopa</td>
<td>PO: 250mg 8 - 12 hourly</td>
<td>Slow onset of action</td>
</tr>
<tr>
<td>Nifedipine</td>
<td>PO: 5mg, repeated once</td>
<td>Do not use sublingually</td>
</tr>
<tr>
<td>Labetalol</td>
<td>PO: 200mg 12 hourly IV: 5-10mg every 5 mins Maximum of 200mg</td>
<td>Not in severe asthma May cause neonatal hypoglycaemia</td>
</tr>
<tr>
<td>Hydralazine</td>
<td>IV: 5-10mg every 5 mins Maximum of 40mg</td>
<td>Can cause headache, flushing, vomiting</td>
</tr>
<tr>
<td>Magnesium Sulphate</td>
<td>IV: Loading 4g over 10 min IM: Loading 10g, then maintenance of 5g 4 hourly</td>
<td>See next page for further details</td>
</tr>
</tbody>
</table>
Management of Eclampsia

CALL for HELP: obstetrician, midwife and anaesthetist

Full left lateral position

ABC approach

A
Give high flow oxygen and support airway (jaw thrust, chin lift)

B
If there is poor respiratory effort, assist with bag valve mask ventilation. Intubation may be required

C
Gain IV access

Definitive treatment

Stopping seizure minimises cerebral hypoxia and oedema

Magnesium sulphate is the drug of choice

Loading dose:
• 4g magnesium sulphate IV (slow injection over 5-10 minutes)

Maintenance dose:
• IV infusion at rate of 1g/hr (if infusion pump available) OR
• 8g IM after loading dose, followed by 4g IM every 4 hours. Add 1ml 2% lidocaine with each IM to reduce pain of injection
• Continue treatment for 24 hours after delivery (or after last seizure)

Note: If magnesium is unavailable, 10mg diazepam IV can be used but respiratory rate must be monitored until patient fully awake.

Further management

• Control high BP to reduce risk of cerebral haemorrhage
• Plan for delivery of baby once mother is stable
• Cautious fluid management to minimise risk of pulmonary oedema

Magnesium toxicity

Withhold or delay a further dose of magnesium if:
• Respiratory rate <14 per minute
• Patella reflexes are absent
• Urine output <30ml/hr in the past 4 hours

In case of respiratory arrest: intubate, ventilate and give 1g of calcium gluconate IV (10ml of 10% calcium gluconate)
A reminder about drug concentrations:

**Calculation of Drug Concentrations**

**Percentage solutions** (e.g. local anaesthetics)

To convert a % solution to mg/ml, multiply by 10

For example:
- 1% solution = 10mg/ml
- 2% solution = 20mg/ml
- 0.5% solution = 5mg/ml
- 0.25% solution = 2.5mg/ml

**Ratio solutions** (e.g. adrenaline)

1:1000 means there is 1g (1000mg) in 1000mls or 1mg / ml

For example:
- 1:1000 = 1mg/ml
- 1:10,000 = 0.1mg/ml = 100 mcg/ml
- 1:100,000 = 0.01mg/ml = 10 mcg/ml
## Paediatric Drug Doses

<table>
<thead>
<tr>
<th>Drug</th>
<th>Dose</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adrenaline (cardiac arrest)</td>
<td>10 mcg/kg IV (0.1mls/kg 1:10,000)</td>
<td>Give every 3-5 mins in cardiac arrest</td>
</tr>
<tr>
<td>Adrenaline (anaphylaxis)</td>
<td>150 mcg IM (0.15mls of 1:1000)</td>
<td>Child under 6 years</td>
</tr>
<tr>
<td></td>
<td>300 mcg IM (0.3mls of 1:1000)</td>
<td>Child 6 – 12 years</td>
</tr>
<tr>
<td></td>
<td>500 mcg IM (0.5mls of 1:1000)</td>
<td>Child over 12 years</td>
</tr>
<tr>
<td>Adrenaline (severe hypotension)</td>
<td>1 – 10 mcg/kg IV (0.01-0.1mls/kg 1:10,000)</td>
<td>Can cause arrhythmias with halothane</td>
</tr>
<tr>
<td>Amoxicillin</td>
<td>30 mg/kg IV Every 8 hours</td>
<td>Max. 1g every 8hrs Contains penicillin</td>
</tr>
<tr>
<td>Atracurium</td>
<td>0.5 mg/kg IV</td>
<td>Duration 20-30 mins</td>
</tr>
<tr>
<td>Atropine</td>
<td>10 – 20 mcg/kg IV</td>
<td>Max. 1.2mg</td>
</tr>
<tr>
<td></td>
<td>10 – 30 mcg/kg IM</td>
<td></td>
</tr>
<tr>
<td></td>
<td>40 mcg/kg PO</td>
<td></td>
</tr>
<tr>
<td>Benzylpenicillin</td>
<td>25 – 50 mg/kg IV Every 6 hours</td>
<td>Max. 2.4g every 6hrs Contains penicillin</td>
</tr>
<tr>
<td>Bupivacaine</td>
<td>Max safe dose: 2 mg/kg</td>
<td>Duration 3 – 5 hours</td>
</tr>
<tr>
<td>Cefotaxime</td>
<td>25 – 50 mg/kg IV Every 8 hours</td>
<td>Max. 12g daily Caution in penicillin allergic patients</td>
</tr>
<tr>
<td>Ceftriaxone</td>
<td>50 mg/kg IV Every 24 hours</td>
<td>Max. 4g daily Caution in penicillin allergic patients</td>
</tr>
<tr>
<td>Cefuroxime</td>
<td>20 - 50 mg/kg IV Every 8 hours</td>
<td>Max. 1.5g every 8hrs Caution in penicillin allergic patients</td>
</tr>
<tr>
<td>Ciprofloxacin</td>
<td>10 mg/kg PO/IV Neonate: every 12hrs</td>
<td>Max. 400mg per dose</td>
</tr>
<tr>
<td>Cisatracurium</td>
<td>150 mcg/kg IV</td>
<td>Duration 40-60 mins</td>
</tr>
<tr>
<td>Co-amoxiclav (Augmentin)</td>
<td>30 mg/kg IV Neonate every 12hrs</td>
<td>Max. 1.2g per dose Contains penicillin</td>
</tr>
<tr>
<td>Codeine Phosphate</td>
<td>1 mg/kg PO Every 6 hours</td>
<td>Max. 60mg per dose Only use for children over 12 years; avoid in sleep apnoea</td>
</tr>
<tr>
<td>Cyclizine</td>
<td>0.5 – 1 mg/kg IV/IM Every 8 hours</td>
<td>Max. per dose: &lt;12yrs: 25mg &gt;12yrs: 50mg Causes drowsiness</td>
</tr>
<tr>
<td>Drug</td>
<td>Dose</td>
<td>Route</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>-----------------------</td>
<td>-------------</td>
</tr>
<tr>
<td><strong>Dexamethasone</strong></td>
<td>0.1 mg/kg</td>
<td>IV</td>
</tr>
<tr>
<td><strong>Diamorphine</strong></td>
<td>20-50 mcg/kg</td>
<td>IV/SC</td>
</tr>
<tr>
<td>(in seizures)</td>
<td>0.2 – 0.3 mg/kg</td>
<td>IV</td>
</tr>
<tr>
<td><strong>Diazepam</strong></td>
<td>0.5 mg/kg</td>
<td>PR</td>
</tr>
<tr>
<td><strong>Diclofenac</strong></td>
<td>0.5 mg/kg</td>
<td>IV/IM</td>
</tr>
<tr>
<td></td>
<td>1 mg/kg</td>
<td>PO/PR</td>
</tr>
<tr>
<td><strong>Epinephrine</strong></td>
<td>see Adrenaline</td>
<td></td>
</tr>
<tr>
<td><strong>Erythromycin</strong></td>
<td>12.5 mg/kg</td>
<td>IV/PO</td>
</tr>
<tr>
<td><strong>Etomidate</strong></td>
<td>0.15 – 0.3 mg/kg</td>
<td>IV</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Fentanyl</strong></td>
<td>1 – 2 mcg/kg</td>
<td>IV</td>
</tr>
<tr>
<td><strong>Flucloxacillin</strong></td>
<td>25 mg/kg</td>
<td>IV</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Every 6 hrs</td>
</tr>
<tr>
<td><strong>Frusemide</strong></td>
<td>0.5 – 1 mg/kg</td>
<td>IV</td>
</tr>
<tr>
<td>(surgical prophylaxis)</td>
<td></td>
<td>Every 12 hrs</td>
</tr>
<tr>
<td><strong>Gentamicin</strong></td>
<td>2 mg/kg</td>
<td>SLOW IV</td>
</tr>
<tr>
<td>(treatment of sepsis)</td>
<td></td>
<td>injection</td>
</tr>
<tr>
<td><strong>Glucose (dextrose)</strong></td>
<td>2 mls/kg of 10% glucose IV</td>
<td></td>
</tr>
<tr>
<td><strong>Glycopyrrolate</strong></td>
<td>10 mcg/kg</td>
<td>IV</td>
</tr>
<tr>
<td><strong>Hydrocortisone</strong></td>
<td>2-4 mg/kg</td>
<td>IV</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Every 6-8 hrs</td>
</tr>
<tr>
<td><strong>Ibuprofen</strong></td>
<td>5 mg/kg</td>
<td>PO</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Every 6-8 hrs</td>
</tr>
<tr>
<td><strong>Ketamine</strong></td>
<td>1 – 2 mg/kg</td>
<td>IV</td>
</tr>
<tr>
<td>(induction)</td>
<td>5 – 10 mg/kg</td>
<td>IM</td>
</tr>
<tr>
<td><strong>Ketamine</strong></td>
<td>0.2 – 0.5 mg/kg</td>
<td>IV</td>
</tr>
<tr>
<td>(analgesic)</td>
<td>2 – 4 mg/kg</td>
<td>IM</td>
</tr>
<tr>
<td><strong>Lignocaine</strong></td>
<td>Max safe doses:</td>
<td></td>
</tr>
<tr>
<td>(Lidocaine)</td>
<td>3 mg/kg (no adr.)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>7 mg/kg (with adr.)</td>
<td></td>
</tr>
<tr>
<td><strong>Lorazepam</strong></td>
<td>0.1 mg/kg</td>
<td>IV</td>
</tr>
<tr>
<td><strong>Metaraminol</strong></td>
<td>0.5 mg</td>
<td>IV bolus,</td>
</tr>
<tr>
<td><strong>Metoclopramide</strong></td>
<td>0.1 mg/kg</td>
<td>PO/IM/IV</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Every 8 hours</td>
</tr>
<tr>
<td><strong>Metronidazole</strong></td>
<td>7.5 mg/kg</td>
<td>IV/PO</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Every 8 hours</td>
</tr>
<tr>
<td><strong>Midazolam</strong></td>
<td>0.1 – 0.2 mg/kg</td>
<td>IV</td>
</tr>
<tr>
<td></td>
<td>0.5 mg/kg</td>
<td>PO/PR</td>
</tr>
<tr>
<td>Drug</td>
<td>Dose Details</td>
<td>Note</td>
</tr>
<tr>
<td>--------------</td>
<td>--------------------------------------------------</td>
<td>--------------------------------------------</td>
</tr>
<tr>
<td>Morphine</td>
<td>Under 1 yr old: 0.02 – 0.1 mg/kg IV&lt;br&gt;0.1 mg/kg PO&lt;br&gt;Every 4-6 hours 1yr and older: 0.05-0.1mg/kg IV (Max 5mg per dose, repeated to 20mg)&lt;br&gt;0.2-0.4mg/kg PO every 4 hours (Max dose 10mg)</td>
<td>See also page 13 Prolonged risk of respiratory depression, needs close observation: calculate exact doses for child’s weight</td>
</tr>
<tr>
<td>Naloxone</td>
<td>5 – 10 mcg/kg IV</td>
<td>Max. 2mg total</td>
</tr>
<tr>
<td>Neostigmine</td>
<td>0.05 mg/kg IV</td>
<td>Max. 2.5mg total Add atropine or glycopyrrolate to avoid bradycardias</td>
</tr>
<tr>
<td>Ondansetron</td>
<td>0.15 mg/kg IV Every 8 hours</td>
<td>Max. 4mg per dose Only over 2 yrs old</td>
</tr>
<tr>
<td>Pancuronium</td>
<td>0.08 – 0.15 mg/kg IV</td>
<td>Duration 60 minutes</td>
</tr>
<tr>
<td>Paracetamol</td>
<td>15 mg/kg PO/IV Every 6 hours 20 mg/kg PR Every 8 hours</td>
<td>Max. 60mg/kg daily</td>
</tr>
<tr>
<td>Pethidine</td>
<td>0.5 – 1 mg/kg IV Every 4 hours</td>
<td>Max. 400mg daily Only over 1 year old</td>
</tr>
<tr>
<td>Phenobarbital</td>
<td>20 mg/kg IV</td>
<td>Max. 1g per dose</td>
</tr>
<tr>
<td>Phenytoin</td>
<td>20mg/kg IV loading</td>
<td>Slow IV infusion</td>
</tr>
<tr>
<td>Propofol</td>
<td>2 – 5 mg/kg IV (induction)</td>
<td>Caution in egg, nuts or soya allergies</td>
</tr>
<tr>
<td>Rocuronium</td>
<td>0.6 mg/kg IV</td>
<td>Duration 40 minutes</td>
</tr>
<tr>
<td>Salbutamol</td>
<td>Nebulised: 2.5mg (under 5 yrs)&lt;br&gt;2.5-5mg (over 5 yrs)</td>
<td>Causes tachycardia</td>
</tr>
<tr>
<td>Suxamethonium</td>
<td>2 mg/kg IV&lt;br&gt;4 mg/kg IM (Max. 100mg IV&lt;br&gt;Max. 150mg IM)</td>
<td></td>
</tr>
<tr>
<td>Thiopentone</td>
<td>2 – 4 mg/kg IV (induction)</td>
<td></td>
</tr>
<tr>
<td>Tramadol</td>
<td>1 mg/kg PO/IV Every 6 hours</td>
<td>Max. 100mg every 6hrs Only over 1 year old</td>
</tr>
<tr>
<td>Vecuronium</td>
<td>0.1 mg/kg IV</td>
<td>Duration 30-40 mins</td>
</tr>
<tr>
<td>Vitamin K</td>
<td>1 mg IM</td>
<td>Recommended for all newborns</td>
</tr>
</tbody>
</table>
# Obstetric Emergency Drug Doses

<table>
<thead>
<tr>
<th>Drug</th>
<th>Dose</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adrenaline (cardiac arrest)</td>
<td>1 mg IV (10 mls of 1:10,000)</td>
<td>Give every 3-5 mins in cardiac arrest</td>
</tr>
<tr>
<td>Adrenaline (anaphylaxis)</td>
<td>500 mcg IM (0.5mls of 1:1000)</td>
<td></td>
</tr>
<tr>
<td>Adrenaline (severe hypotension)</td>
<td>50 mcg IV boluses (0.5 ml of 1:10,000)</td>
<td>Can cause arrhythmias with halothane</td>
</tr>
<tr>
<td>Atropine</td>
<td>300 – 600 mcg IV</td>
<td></td>
</tr>
<tr>
<td>Carboprost</td>
<td>250 mcg IM Every 15 mins</td>
<td>Max. dose 2mg</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Not to be given IV</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Caution in asthma</td>
</tr>
<tr>
<td>Diazepam (eclampsia)</td>
<td>10 mg IV 20 mg PR</td>
<td>Can be repeated once after 10 mins</td>
</tr>
<tr>
<td>Ephedrine</td>
<td>3 mg IV bolus</td>
<td>Reducing effect after multiple doses</td>
</tr>
<tr>
<td>Ergometrine</td>
<td>0.5 mg IV or IM Slow IV injection</td>
<td>Caution in PET and cardiac disease</td>
</tr>
<tr>
<td>Hydralazine</td>
<td>5 – 10 mg IV every 5 mins</td>
<td>Max. dose 40mg</td>
</tr>
<tr>
<td>Labetolol</td>
<td>200mg PO 12 hourly 5 – 10 mg IV every 5 mins (max of 200mg)</td>
<td>Caution in asthma</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Can cause neonatal hypoglycaemia</td>
</tr>
<tr>
<td>Magnesium Sulphate</td>
<td>4g IV loading dose</td>
<td>For full dosing see page 59</td>
</tr>
<tr>
<td>Metaraminol</td>
<td>0.5mg IV bolus</td>
<td>Reflex bradycardia</td>
</tr>
<tr>
<td>Methyldopa</td>
<td>250mg PO 12 hourly</td>
<td>Slow onset of action</td>
</tr>
<tr>
<td>Misoprostol</td>
<td>1 mg PR</td>
<td></td>
</tr>
<tr>
<td>Nifedipine</td>
<td>5mg PO, repeat once</td>
<td>Not sublingual</td>
</tr>
<tr>
<td>Oxytocin (Syntocinon)</td>
<td>5 iu IV, then infusion of 40iu over 4 hours</td>
<td>Slow IV injection</td>
</tr>
<tr>
<td>Phenylephrine</td>
<td>50-100 mcg IV bolus</td>
<td>Reflex bradycardia</td>
</tr>
<tr>
<td>Tranexamic acid</td>
<td>1g IV over 10min</td>
<td>Repeat 1g over 1 hour if required</td>
</tr>
</tbody>
</table>
Tips on using your Lifebox pulse oximeter

| • Monitor ALL your patients, even for minor procedures |
| • Keep the yellow cover on whenever possible to protect your Lifebox |
| • Only use soapy water to clean the probe |
| • If you are unsure about the readings, test the Lifebox on yourself |
| • You can plug the charging lead directly into the bottom of the Lifebox – you do not need to use the stand |
| • If the battery fails and there is no mains supply, you can use 3 x AA batteries in place of the rechargeable battery (remove battery cover). However, the AA batteries cannot be recharged so remember to keep the rechargeable battery safe |
| • For optimal battery life, when you first receive the oximeter, use it on battery power until empty and then charge fully again. If mains power supply is unreliable, remember to charge whenever possible to ensure you have as much battery charge as possible |
| • The Lifebox can be used on the mains supply, but remove the rechargeable battery if you use on mains supply all the time to avoid overcharging the battery; remember to keep the rechargeable battery safe if you remove it |

Are you having problems with your Lifebox?  
Do you have any questions or need support?  
Is your Lifebox broken?

WE CAN HELP - PLEASE E-MAIL US:  
oximeters@lifebox.org

Please include these details: your name, hospital, country, when you received the Lifebox and describe what the problem is.  
We will e-mail you back.

www.lifebox.org
**SBAR handover**

**Situation, Background, Assessment, Response**

- SBAR is a structured way of **handing over a patient**, **requesting help** or **referring a patient** to another hospital
- It improves **communication** and **patient safety**

| Situation | • Explain the current situation or your immediate concern about a patient  
| | • Include the patient’s name, age and location  
| | **Example**: I am in maternity theatre with 32 year old lady having a caesarean section for fetal distress. There is a large PPH and we are unable to control the bleeding |
| Background | • Provide the important background history  
| | **Example**: She is gravida 6, she is HIV positive but is on no medications normally |
| Assessment | • Describe the vital signs and your assessment of the patient so far  
| | **Example**: She is having a GA, her BP is 80/40 and pulse rate is 120bpm. She has lost 2L blood and her uterus is still atonic |
| Response / Recommendation | • Make any of your own suggestions  
| | • Explain what response or help you would like, making it clear so this is understood  
| | **Example**: We have given syntocinon, ergometrine and carboprost. She has had 2 units of blood. The intern who is operating would like senior assistance immediately |
## 10-step Anaesthetic Preparation Checklist

To be completed at the start of every list

<table>
<thead>
<tr>
<th>Step</th>
<th>Task</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Anaesthetic machine check</td>
</tr>
<tr>
<td></td>
<td>- Perform your standard <strong>anaesthetic machine check</strong></td>
</tr>
<tr>
<td></td>
<td>- Make sure the <strong>vaporiser is filled</strong></td>
</tr>
<tr>
<td>2</td>
<td>Oxygen supply and backup</td>
</tr>
<tr>
<td></td>
<td>- Check <strong>primary oxygen supply</strong></td>
</tr>
<tr>
<td></td>
<td>- Check <strong>backup oxygen supply</strong></td>
</tr>
<tr>
<td>3</td>
<td>Airway equipment</td>
</tr>
<tr>
<td></td>
<td>- Ensure <strong>following items are ready</strong>, as a minimum:</td>
</tr>
<tr>
<td></td>
<td>- Facemask, Guedel, LMA, Laryngoscope, ETT, Bougie</td>
</tr>
<tr>
<td>4</td>
<td>Alternative ventilation</td>
</tr>
<tr>
<td></td>
<td>- Ensure <strong>self-inflating bag</strong> is immediately available</td>
</tr>
<tr>
<td>5</td>
<td>Suction</td>
</tr>
<tr>
<td></td>
<td>- Check <strong>suction is available and working</strong></td>
</tr>
<tr>
<td>6</td>
<td>Monitoring</td>
</tr>
<tr>
<td></td>
<td>- Check <strong>pulse oximeter and BP monitor</strong> are ready</td>
</tr>
<tr>
<td>7</td>
<td>Operating table</td>
</tr>
<tr>
<td></td>
<td>- Ensure the <strong>operating table can be tilted</strong></td>
</tr>
<tr>
<td>8</td>
<td>IV access and fluids</td>
</tr>
<tr>
<td></td>
<td>- Ensure <strong>cannulae, fluids and IV giving lines</strong> are ready</td>
</tr>
<tr>
<td>9</td>
<td>Drugs, including emergency drugs</td>
</tr>
<tr>
<td></td>
<td>- Prepare <strong>emergency drugs</strong></td>
</tr>
<tr>
<td>10</td>
<td>Help</td>
</tr>
<tr>
<td></td>
<td>- Where is your <strong>help and assistance</strong> if you need it?</td>
</tr>
<tr>
<td>Step</td>
<td>Yes</td>
</tr>
<tr>
<td>----------------------------------------------------------------------</td>
<td>-----</td>
</tr>
<tr>
<td>Has the patient confirmed his/her identity, site, procedure, and consent?</td>
<td></td>
</tr>
<tr>
<td>Is the site marked?</td>
<td></td>
</tr>
<tr>
<td>Is the anaesthesia machine and medication check complete?</td>
<td></td>
</tr>
<tr>
<td>Is the pulse oximeter on the patient and functioning?</td>
<td></td>
</tr>
<tr>
<td>Does the patient have:</td>
<td></td>
</tr>
<tr>
<td>- Known allergy?</td>
<td>No</td>
</tr>
<tr>
<td>- Difficult airway or aspiration risk?</td>
<td>No</td>
</tr>
<tr>
<td>- Risk of &gt;500ml blood loss (7ml/kg in children)?</td>
<td>No</td>
</tr>
</tbody>
</table>

Confirm all team members have introduced themselves by name and role.

Before induction of anaesthesia:

- Risk of >500ml blood loss (7ml/kg in children)?
- Does the patient have:
  - Known allergy?
  - Difficult airway or aspiration risk?
  - Risk of >500ml blood loss?

Anticipated Critical Events

To Surgeon:
- What are the critical or non-routine steps?
- How long will the case take?
- What is the anticipated blood loss?
- Which are the critical or non-routine steps?

To Anaesthetist:
- Are there any patient-specific concerns?

To Nursing Team:
- Has sterility (including indicator results) been confirmed?
- Are there any patient-specific concerns?
- Is essential imaging displayed?
- Are there any equipment problems to be addressed?
- Whether there are any equipment problems to be addressed

Nurse Verbally Confirms:
- The name of the procedure
- Completion of instrument, sponge and needle counts
- Specimen labelling (read specimen labels aloud, including patient name)
- Whether there are any equipment problems to be addressed
- The name of the procedure
- Specimen labelling (read specimen labels aloud, including patient name)
- Whether there are any equipment problems to be addressed

Before induction of anaesthesia:

- The patient confirmed his/her identity?
- The patient left the operating room?

Before skin incision:

- The patient confirmed his/her identity?
- The patient left the operating room?

Before patient leaves operating room:

- The patient confirmed his/her identity?
- The patient left the operating room?