PAEDIATRIC

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Current until December 2019
Emergency Protocols is a non-profit organisation dedicated to integrating and improving emergency medical guidelines.

These protocols are current at the time of publication, based on guidelines from peak medical organisations and published expert opinion. They do not replace clinical judgement, and should not be seen as inflexible authoritative statements but rather as cognitive aids to assist practitioners managing each individual situation. These protocols are not a substitute for seeking appropriate expert advice.

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This edition is current as of June 2018, and should not be used after December 2019.

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We welcome any comments via e-mail: info@emergencyprotocols.org.au

Sources
Advanced Paediatric Life Support (www.apls.org.au)
Australia and New Zealand Emergency Department Airway Registry (www.airwayregistry.org.au)
Australian Resuscitation Council (www.resus.org.au)
Australian Society of Clinical Immunology (www.allergy.org.au)
Difficult Airway Society (www.das.uk.com)
Newborn & Paediatric Emergency Transfer Service (www.nets.org.au)
NSW Health (www.health.nsw.gov.au)
Stanford Anesthesia Emergency Manual (www.emergencymanual.stanford.edu)

Do not use after December 2019
Open and clear the airway:

- **sniffing position** (unless cervical spine injury)

  ![Illustration of sniffing position for older child, small child, and infant]

  - External auditory canal anterior to shoulder
  - Infants may need a towel under the shoulders
  - Older children may need a towel under the head

- **chin lift**
- **jaw thrust**
- **suction**

Insert **oropharyngeal airway** or **nasopharyngeal airway** (nasopharyngeal route relatively contra-indicated with facial or basal skull fractures)

- **Oropharyngeal size:** incisor to angle of mandible
- **Nasopharyngeal size:** nostril to tragus of ear

---

**continued next page**
Bag-mask ventilate with 100% oxygen

<table>
<thead>
<tr>
<th>Age</th>
<th>Mask size</th>
</tr>
</thead>
<tbody>
<tr>
<td>newborn</td>
<td>00</td>
</tr>
<tr>
<td>neonate</td>
<td>0/1</td>
</tr>
<tr>
<td>infant</td>
<td>2</td>
</tr>
<tr>
<td>small child</td>
<td>3</td>
</tr>
<tr>
<td>large child</td>
<td>4</td>
</tr>
<tr>
<td>adult</td>
<td>5</td>
</tr>
</tbody>
</table>

Correct size fits over mouth and nose but does not press on eyes

Look for chest rise with each squeeze of the bag
If no chest rise then:
   - check mask seal
   - optimise sniffing position
   - bag-mask ventilate with two pairs of hands

IF UNABLE TO VENTILATE THEN GO TO PAGE 12 (AIRWAY - FAILED)

continued next page
**Pre-oxygenate** using **bag-mask ventilation** with 100% oxygen for 3 minutes

Additional **high flow oxygen** via **nasal prongs** at 2 L/kg/min (maximum 15 L/min)

Consider **end-tidal CO₂ monitoring**

**Assess for difficult airway**: (any one of the following)
- small mouth
- small jaw
- large tongue
- short neck
- Down syndrome or cerebral palsy
- facial anomaly or other chronic disability
- signs of airway obstruction
- trauma or swelling to the face
- morbid obesity
- cervical collar
- unstable haemodynamics
- failed non-invasive ventilation
- upright position of comfort
- history of known difficult airway or anaesthesia complication

*continued next page*
**PAEDIATRIC AIRWAY**

---

**ESTIMATE WEIGHT AND ETT SIZE**

*Choose ETT sizes using chart above*

---

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Weight</th>
<th>Cuffed ETT size (mm)</th>
<th>ETT length at lips (cm)</th>
<th>LMA size</th>
</tr>
</thead>
<tbody>
<tr>
<td>birth</td>
<td>3 kg</td>
<td>3.0</td>
<td>9</td>
<td>1</td>
</tr>
<tr>
<td>3 months</td>
<td>6 kg</td>
<td>3.0</td>
<td>11</td>
<td>1.5</td>
</tr>
<tr>
<td>6 months</td>
<td>7.5 kg</td>
<td>3.0</td>
<td>12</td>
<td>1.5</td>
</tr>
<tr>
<td>1</td>
<td>10 kg</td>
<td>3.5</td>
<td>13</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>12 kg</td>
<td>3.5</td>
<td>13</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
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<td>2</td>
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<td>7 - 8</td>
<td>25 kg</td>
<td>5.0</td>
<td>15.5</td>
<td>2.5</td>
</tr>
<tr>
<td>9 - 10</td>
<td>30 kg</td>
<td>5.5</td>
<td>16.5</td>
<td>3</td>
</tr>
<tr>
<td>11 - 12</td>
<td>40 kg</td>
<td>6.0</td>
<td>18</td>
<td>3</td>
</tr>
<tr>
<td>≥ 13</td>
<td>50 kg</td>
<td>7.0</td>
<td>18</td>
<td>3</td>
</tr>
</tbody>
</table>

*Use equipment from weight-based drawer if available*

**IF PREDICTED DIFFICULT AIRWAY GO TO PAGE 11 (AIRWAY - DIFFICULT)**

*If not predicted difficult airway then continue on next page*

*continued next page*
**INTUBATION DRUGS**

**Draw up induction** drug:

- **IV ketamine 2 mg/kg** (preferred in sepsis, hypotension, asthma)

  OR

- **IV propofol 3 mg/kg**

  OR

- **IV thiopentone 2 to 5 mg/kg** (preferred in status epilepticus, raised ICP)

**Draw up paralysis** drug:

- **IV suxamethonium 2 mg/kg**, but do not use suxamethonium if:
  - hyperkalaemia
  - 48 to 72 hours after burn, crush or denervating injury
  - malignant hyperthermia
  - chronic myopathy
  - denervating neuromuscular disease

  OR

- **IV rocuronium 1.2 mg/kg**
  
  if suxamethonium contra-indicated, but paralysis lasts 10 to 40 minutes

**PRE-INTUBATION CHECKLIST (NEXT TWO PAGES)**

continued next page
Team leader identified
Everyone introduced, by name and role, and each briefed in turn by team leader
If cervical spine injury is suspected then person doing in-line cervical spine immobilisation briefed?
Do you have enough help?
Predicted to be difficult?

Verbalise the airway strategy:
A. Initial tracheal intubation
B. Secondary tracheal intubation
C. Maintenance of oxygenation (LMA)
D. Surgical airway (cricothyroidotomy)

Anticipated problems?
Questions or concerns?

Position:
- sniffing
- ramp if obese

Haemodynamics:
- consider fluid bolus (IV normal saline 20 mL/kg)
- consider pressors (IV metaraminol 5 to 10 mcg/kg)

Pre-oxygenation:
- 3 minutes
- > 15 L/min O$_2$ via mask
- and 2 L/kg/min (maximum 15 L/min) via nasal prongs

Non-invasive ventilation if:
obese
obstructive sleep apnoea
sats < 95% despite O$_2$

Monitoring equipment:
- end-tidal CO$_2$
- oxygen saturations
- ECG monitoring
- non-invasive BP:
  - non-IV-fluid arm
  - 2 minute intervals
CHECKLIST

DRUGS

First IV cannula or intraosseous line: fluid running

Second IV cannula or intraosseous line

Induction drug:
- ketamine 2 mg/kg
- propofol 3 mg/kg
- thiopentone 2 to 5 mg/kg

Paralysis drug:
- suxamethonium 2 mg/kg
- rocuronium 1.2 mg/kg

Vasopressor drug:
- metaraminol 5 to 10 mcg/kg

Post-intubation drug infusion:
- propofol
- morphine & midazolam
- or other

Draw up drugs

Draw up normal saline flushes

Label drugs and flushes

Check drug contra-indications

Check allergies

EQUIPMENT

Suction working

Oxygen:
- bag-valve mask
- end-tidal CO₂ connected

Oropharyngeal airway

Nasopharyngeal airway

Laryngoscopes x 2:
- check light
- check blade size

Endotracheal tubes x 2:
- choose sizes
- test cuffs with syringe
- lubricate

Bougie or stylet:
- lubricate

Ventilator settings and circuit

Tube tie or tape

Magill’s forceps

Laryngeal mask airway:
- check size

Needle cricothyroidotomy equipment:
- large cannula
- three-way tap
- oxygen tubing
VERBALISE THE AIRWAY STRATEGY

Verbalise the airway strategy:

**Plan A**: tracheal intubation: direct laryngoscopy or video laryngoscopy, bougie, two attempts in 30 seconds, sats ≥ 90%

**Plan B**: secondary tracheal intubation: different blade or video laryngoscopy, two attempts in 30 seconds, sats ≥ 90%

**Plan C**: maintenance of oxygenation: laryngeal mask airway, three attempts, sats ≥ 80% and heart rate not falling

**Plan D**: surgical airway: cannula cricothyroidotomy

TRACHEAL INTUBATION

Give **induction** drug and flush

Give **paralysis** drug and flush

Direct laryngoscopy or video laryngoscopy

If poor view apply external laryngeal manipulation

**Bougie** or stylet

Maximum of two attempts in 30 seconds

If sats < 90% then re-insert oropharyngeal airway and/or nasopharyngeal airway and bag-mask ventilate using two pairs of hands

IF CANNOT OXYGENATE THEN GO TO PAGE 12 (AIRWAY - FAILED)

continued next page
CONSIDER WHAT OTHER HELP IS AVAILABLE

Improve patient position:
- sniffing position
- chin lift
- jaw thrust

SECONDARY TRACHEAL INTUBATION

Prepare ETT with bougie or stylet

Video laryngoscopy or direct laryngoscopy with different blade

Avoid cricoid pressure

External laryngeal manipulation

Maximum of two attempts in 30 seconds

If sats < 90% then re-insert oropharyngeal airway and/or nasopharyngeal airway and bag-mask ventilate using two pairs of hands

IF UNSUCCESSFUL THEN GO TO PAGE 12 (AIRWAY - FAILED)
PATIENT UNRESPONSIVE AND NEAR DEATH

CALL FOR HELP  INFORM TEAM  CRASH CART

Maintain oxygenation

Attempt intubation. If successful then go to Airway - Secure (page 14)

Bag-mask ventilate with 100% oxygen and check for chest rise

IF UNABLE TO VENTILATE THEN GO TO PAGE 12 (AIRWAY - FAILED)

IV suxamethonium 2 mg/kg

Attempt intubation. If successful then go to Airway - Secure (page 14)

Bag-mask ventilate with 100% oxygen

IF UNABLE TO VENTILATE THEN GO TO PAGE 12 (AIRWAY - FAILED)

Attempt intubation. If successful then go to Airway - Secure (page 14)

Bag-mask ventilate with 100% oxygen

GO TO PAGE 12 (AIRWAY - FAILED)
If forced to act:

give induction and paralysis drugs (page 5)

one best attempt by most experienced operator

if successful then go to Airway - Secure (page 14)

if failed then go to Airway - Failed (next page)

IF UNABLE TO VENTILATE THEN GO TO NEXT PAGE (AIRWAY - FAILED)

If any one of:

- bag-mask ventilation
- laryngeal mask airway
- intubation

are predicted to be unsuccessful then use awake technique with:

- direct laryngoscopy
- video laryngoscopy
- intubating LMA
- fibreoptic scope
- blind intubation

if anaesthetist and equipment available

or transtracheal airway

otherwise use RSI with double setup (second airway doctor ready for surgical airway)

If successful intubation then go to Airway - Secure (page 14)

IF UNSUCCESSFUL THEN GO TO NEXT PAGE (AIRWAY - FAILED)
CALL FOR HELP  INFORM TEAM  CRASH CART

“CAN’T INTUBATE”

Cricoid pressure off
Insert laryngeal mask airway (LMA)

Maximum of three attempts with laryngeal mask airway
Consider changing device or size (see sizing chart on page 4)

If successful oxygenation then go to Airway - Secure (page 14)

IF SATS < 90% THEN “FAILED LARYNGEAL MASK AIRWAY”

Bag-mask ventilate using two pairs of hands
Optimise sniffing position
Maximum jaw thrust
Oropharyngeal and/or nasopharyngeal airway

If successful oxygenation then calm down and consider other options

If heart rate is falling then go to next page (Cricothyroidotomy)

IF SATS < 80% THEN “CAN’T INTUBATE, CAN’T OXYGENATE”

GO TO NEXT PAGE (CRICOTHYROIDOTOMY)
Extend neck (unless cervical spine injury)

Use non-dominant hand to stabilise the larynx

Attach a syringe to the largest available cannula (12, 14 or 16 gauge). Use dominant hand to palpate the cricothyroid membrane, then insert cannula through the cricothyroid membrane, aiming downwards at 45° towards the feet. Stay in the midline.

When air is aspirated advance the cannula over the needle into the trachea

Withdraw the needle, attach the oxygen tubing to a three-way tap, and attach the three-way tap to the cannula. If there is no three-way tap available then connect an IV giving set to the cannula, insert spike of giving set into oxygen tubing, remove barrel from a syringe, and attach open syringe to side port of giving set.

Turn the oxygen flow rate (in litres) to the patient’s age (in years)

Inspiration: occlude for 1 second the open end of the three-way tap (or the open end of the syringe attached to the side port of the IV giving set).
If the chest does not rise then increase the oxygen flow rate in 1 L/min increments.

Expiration (via upper airway): release for 4 seconds

Needle cricothyroidotomy only gains time for a definitive airway to be established
If the patient is >12 years old then consider surgical cricothyroidotomy (Adult book page 11)
### Inflating Cuff and Checking Cuff Pressure

Inflate cuff and check cuff pressure.

### Checking Tube Placement:

- **end-tidal CO$_2$** (if using colourimeter then “go for gold” within six breaths)
- auscultation

### Secure Tube

Secure tube and record position at lips.

### Inserting Nasogastric or Orogastric Tube

Insert nasogastric or orogastric tube (avoid nasogastric tube if head injury).

### Maintaining Sedation

Maintain sedation (e.g., mix morphine 50 mg and midazolam 50 mg and make up to 50 mL with normal saline. Titrate infusion rate.)

### Checking Portable CXR

Check portable CXR.

### Inserting Urinary IDC

Insert urinary IDC.

### Raising Head of Bed to 45°

Raise head of bed to 45°.

### Checking for Complications on the Ventilator

If complications on the ventilator, check:

- **Dislodgement**: check end-tidal CO$_2$ waveform, repeat laryngoscopy
- **Obstruction**: check for high peak inspiratory pressure, suction secretions
- **Pneumothorax**: check breath sounds, pleural sliding on ultrasound, repeat CXR
- **Equipment Failure**: disconnect from ventilator, bag patient
- **Stacking Breaths**: bag slowly, push on chest to assist
**PAEDIATRIC ANAPHYLAXIS**

**REMOVE ALLERGEN**

**CALL FOR HELP** — Inform Team — **CRASH CART**

**Lie patient flat** unless upright position required to maintain airway

**IM adrenaline 10 micrograms/kg up to 500 micrograms** into mid-lateral thigh

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Weight</th>
<th>Adrenaline dose</th>
<th>Adrenaline volume 1:1000</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 1</td>
<td>5 - 10 kg</td>
<td>50 - 100 mcg</td>
<td>0.05 - 0.1 mL</td>
</tr>
<tr>
<td>1 - 2</td>
<td>10 kg</td>
<td>100 mcg</td>
<td>0.1 mL</td>
</tr>
<tr>
<td>3 - 4</td>
<td>15 kg</td>
<td>150 mcg</td>
<td>0.15 mL</td>
</tr>
<tr>
<td>5 - 6</td>
<td>20 kg</td>
<td>200 mcg</td>
<td>0.2 mL</td>
</tr>
<tr>
<td>7 - 10</td>
<td>30 kg</td>
<td>300 mcg</td>
<td>0.3 mL</td>
</tr>
<tr>
<td>11 - 12</td>
<td>40 kg</td>
<td>400 mcg</td>
<td>0.4 mL</td>
</tr>
<tr>
<td>≥ 13</td>
<td>50 kg</td>
<td>500 mcg</td>
<td>0.5 mL</td>
</tr>
</tbody>
</table>

**High-flow oxygen**

**Repeat adrenaline dose** every 5 minutes as needed

**Intravenous or intraosseous access**

If hypotensive give **IV normal saline 20 mL/kg bolus**

If normotensive consider IV maintenance fluids

continued next page
If multiple doses of adrenaline required, inadequate response or deterioration, then start an **IV adrenaline infusion**: adrenaline 0.3 mg/kg body weight in 50 mL dextrose 5%, so that 1 mL/h ≈ 0.1 micrograms/kg/min. Start infusion at 0.5 mL/h (≈ 0.05 mcg/kg/min) and titrate to a maximum of 10 mL/h (≈ 1 mcg/kg/min).

If adrenaline infusion **ineffective or unavailable**, consider:

**for persistent hypotension/shock:**
- give IV normal saline (maximum 50 mL/kg in the first 30 minutes)
- in patients with cardiogenic shock (especially if taking beta-blockers)
- consider an **IV glucagon bolus** of 20 to 30 micrograms/kg (maximum 1 mg) over five minutes. Rapid administration can cause vomiting. Dose can be repeated or followed by an infusion.
- consider **IV metaraminol** 10 micrograms/kg

**for upper airway obstruction:**
- **nebulised adrenaline** (0.5 mL/kg of 1:1,000 to a maximum of 5 mL)
- consider **intubation** (anticipate difficult airway and call for expert help)

**for persistent wheeze:**
- bronchodilators: **salbutamol**:
  - < 5 years: 6 puffs of 100 micrograms via spacer or nebulised 2.5 mg
  - ≥ 5 years: 12 puffs of 100 micrograms via spacer or nebulised 5 mg
- **PO prednisone** 1 mg/kg (maximum 50 mg) or **IV hydrocortisone** 5 mg/kg (maximum 200 mg)

**Observe for at least 4 hours after last dose of adrenaline**
This protocol is only for LIFE-THREATENING ASTHMA in children

SPEAKING IN WORDS ONLY
or UNABLE TO SPEAK
ALTERED CONSCIOUSNESS
EXHAUSTION or CYANOSIS
MARKED TACHYCARDIA
or RELATIVE BRADYCARDIA FOR AGE
OXYGEN SATURATIONS < 90 %

CALL FOR HELP
INFORM TEAM
CRASH CART

If peri-arrest give IM adrenaline 10 micrograms/kg into mid-lateral thigh (maximum 500 micrograms, see chart below)

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Weight</th>
<th>Adrenaline dose</th>
<th>Adrenaline volume 1:1000</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - 2</td>
<td>10 kg</td>
<td>100 mcg</td>
<td>0.1 mL</td>
</tr>
<tr>
<td>3 - 4</td>
<td>15 kg</td>
<td>150 mcg</td>
<td>0.15 mL</td>
</tr>
<tr>
<td>5 - 6</td>
<td>20 kg</td>
<td>200 mcg</td>
<td>0.2 mL</td>
</tr>
<tr>
<td>7 - 10</td>
<td>30 kg</td>
<td>300 mcg</td>
<td>0.3 mL</td>
</tr>
<tr>
<td>11 - 12</td>
<td>40 kg</td>
<td>400 mcg</td>
<td>0.4 mL</td>
</tr>
<tr>
<td>≥ 13</td>
<td>50 kg</td>
<td>500 mcg</td>
<td>0.5 mL</td>
</tr>
</tbody>
</table>

Nebuliser mask with continuous salbutamol nebs:
age 0 to 5 years: salbutamol 5 mg
age ≥ 6 years: salbutamol 10 mg (two neules given together)
PAEDIATRIC ASTHMA

Aim for oxygen saturations ≥ 95%

Add nebulised ipratropium every 20 minutes for first hour then hourly
  age 0 to 5 years: ipratropium 250 micrograms
  age ≥ 6 years: ipratropium 500 micrograms
(ipratropium can be added to the nebuliser with the salbutamol)

Continuous salbutamol nebs in the nebuliser mask:
  age 0 to 5 years: salbutamol 5 mg
  age ≥ 6 years: salbutamol 10 mg (two nebules given together)

IV/IO hydrocortisone 4 mg/kg (maximum 200 mg, see chart below) Q6H

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Weight</th>
<th>IV hydrocortisone 4 mg/kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - 2</td>
<td>10 kg</td>
<td>40 mg</td>
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<tr>
<td>3 - 4</td>
<td>15 kg</td>
<td>60 mg</td>
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<tr>
<td>5 - 6</td>
<td>20 kg</td>
<td>80 mg</td>
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<tr>
<td>7 - 10</td>
<td>30 kg</td>
<td>120 mg</td>
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<tr>
<td>11 - 12</td>
<td>40 kg</td>
<td>160 mg</td>
</tr>
<tr>
<td>≥ 13</td>
<td>50 kg</td>
<td>200 mg</td>
</tr>
</tbody>
</table>

Seek expert advice

Continuous nebulised salbutamol and ipratropium

continued next page
Consider **IV magnesium 50 mg/kg** (see chart below) in **50 mL normal saline 0.9%** over **20 minutes**

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Weight</th>
<th>IV magnesium dose (mg)</th>
<th>IV magnesium dose (mmol)</th>
<th>IV magnesium volume (49.3%) in 50 mL normal saline over 20 minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - 2</td>
<td>10 kg</td>
<td>500 mg</td>
<td>2 mmol</td>
<td>1 mL</td>
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<td>3 - 4</td>
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<td>3 mmol</td>
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<td>5 - 6</td>
<td>20 kg</td>
<td>1000 mg</td>
<td>4 mmol</td>
<td>2 mL</td>
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<td>7 - 10</td>
<td>30 kg</td>
<td>1500 mg</td>
<td>6 mmol</td>
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<td>2000 mg</td>
<td>8 mmol</td>
<td>4 mL</td>
</tr>
<tr>
<td>≥ 13</td>
<td>50 kg</td>
<td>2500 mg</td>
<td>10 mmol</td>
<td>5 mL</td>
</tr>
</tbody>
</table>

**continued next page**

Usually nebulised salbutamol is effective and **IV salbutamol is rarely required (and only started after expert advice)**. Consider **IV salbutamol 5 mcg/kg/min** loading dose (see chart below) in **50 mL normal saline 0.9%** over **60 minutes**. Side effects are tremor, tachyarrhythmia, lactic acidosis and hypokalaemia. Monitor serum K level.

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Weight</th>
<th>IV salbutamol dose</th>
<th>IV salbutamol volume (5 mg in 5 mL) in 50 mL normal saline over 60 minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - 2</td>
<td>10 kg</td>
<td>3 mg</td>
<td>3 mL</td>
</tr>
<tr>
<td>3 - 4</td>
<td>15 kg</td>
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<td>4.5 mL</td>
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<tr>
<td>5 - 6</td>
<td>20 kg</td>
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<td>6 mL</td>
</tr>
<tr>
<td>7 - 10</td>
<td>30 kg</td>
<td>9 mg</td>
<td>9 mL</td>
</tr>
<tr>
<td>11 - 12</td>
<td>40 kg</td>
<td>12 mg</td>
<td>12 mL</td>
</tr>
<tr>
<td>≥ 13</td>
<td>50 kg</td>
<td>15 mg</td>
<td>15 mL</td>
</tr>
</tbody>
</table>
Seek expert opinion before using IV aminophylline 10 mg/kg loading dose (see chart below) in 50 mL dextrose 5% over 60 minutes through separate IV line. Do not give loading dose if theophylline (Nuelin) has been given in last 24 hours.

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Weight</th>
<th>IV aminophylline dose</th>
<th>IV aminophylline volume (250 mg in 10 mL) in 50 mL dextrose 5% over 60 minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - 2</td>
<td>10 kg</td>
<td>100 mg</td>
<td>4 mL</td>
</tr>
<tr>
<td>3 - 4</td>
<td>15 kg</td>
<td>150 mg</td>
<td>6 mL</td>
</tr>
<tr>
<td>5 - 6</td>
<td>20 kg</td>
<td>200 mg</td>
<td>8 mL</td>
</tr>
<tr>
<td>7 - 10</td>
<td>30 kg</td>
<td>300 mg</td>
<td>12 mL</td>
</tr>
<tr>
<td>11 - 12</td>
<td>40 kg</td>
<td>400 mg</td>
<td>16 mL</td>
</tr>
<tr>
<td>≥ 13</td>
<td>50 kg</td>
<td>500 mg</td>
<td>20 mL</td>
</tr>
</tbody>
</table>

Monitor respiratory rate, saturations, heart rate, blood pressure, and ECG

Consider CXR

Consider EUC and blood gas

Consider diagnoses other than asthma

Consider non-invasive ventilation or intubation

Arrange retrieval or PICU
PAEDIATRIC ASYSTOLE

**CPR:**
- 15 COMPRESSIONS : 2 BREATHS
- 100 TO 120 PER MINUTE
- COMPRESSION DEPTH 1/3 OF CHEST
- HAND ON LOWER HALF OF STERNUM
- MINIMISE INTERRUPTIONS

CALL FOR HELP | INFORM TEAM | CRASH CART

START CPR

**Attach defibrillator** or **monitor**
Consider **airway** adjuncts (oro- or naso-pharyngeal airway, and if skilled LMA or ETT)
High-flow **oxygen**
**Intravenous** or **intraosseous access**

**IV adrenaline 10 micrograms/kg** followed by normal saline flush

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Weight</th>
<th>Adrenaline dose</th>
<th>Adrenaline volume 1:10,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 1</td>
<td>5 - 10 kg</td>
<td>50 - 100 mcg</td>
<td>0.5 - 1 mL</td>
</tr>
<tr>
<td>1 - 2</td>
<td>10 kg</td>
<td>100 mcg</td>
<td>1 mL</td>
</tr>
<tr>
<td>3 - 4</td>
<td>15 kg</td>
<td>150 mcg</td>
<td>1.5 mL</td>
</tr>
<tr>
<td>5 - 6</td>
<td>20 kg</td>
<td>200 mcg</td>
<td>2 mL</td>
</tr>
<tr>
<td>7 - 10</td>
<td>30 kg</td>
<td>300 mcg</td>
<td>3 mL</td>
</tr>
<tr>
<td>11 - 12</td>
<td>40 kg</td>
<td>400 mcg</td>
<td>4 mL</td>
</tr>
<tr>
<td>≥ 13</td>
<td>50 kg</td>
<td>500 mcg</td>
<td>5 mL</td>
</tr>
</tbody>
</table>

If only 1:1,000 adrenaline available then dilute to 10 mL with normal saline and dose as above

continued on page 25
FIND AND TREAT CAUSE

**FIND AND TREAT CAUSE**

**OBTAIN BEDSIDE BLOODS AND CONSIDER CARDIAC ULTRASOUND**

If hypoxia give high-flow oxygen, check connections, check for bilateral breath sounds, suction endotracheal tube and reconfirm placement, consider CXR

If hypovolaemia give IV normal saline 20 mL/kg and check haemoglobin

If hyperkalaemia:
- give IV calcium gluconate 10% 0.7 mL/kg or IV calcium chloride 10% 0.2 mL/kg
- give IV insulin 0.1 units/kg with IV dextrose 10% 5 mL/kg
- give IV sodium bicarbonate 8.4% 1 mL/kg (maximum 50 mL)

If hypokalaemia give IV potassium chloride 1 mmol/mL 0.03 to 0.07 mL/kg (maximum 5 mL) slow injection and IV magnesium sulphate 50% 0.05 to 0.10 mL/kg bolus (maximum 2.5 mL)

If profound acidosis consider IV sodium bicarbonate 8.4% 1 mL/kg (maximum 50 mL)

If hypothermia use forced air blanket, warm IV fluids, raise room temperature

If hyperthermia consider sepsis, heat stroke, malignant hyperthermia, serotonin toxicity, and neuroleptic malignant syndrome (seek expert advice)

If hypocalcaemia give IV calcium gluconate 10% 0.7 mL/kg (maximum 20 mL) or IV calcium chloride 10% 0.2 mL/kg

Consider toxins including medications, infusions, ingestions, and medication error

Consider tension pneumothorax. Check for signs and perform emergency needle decompression or finger thoracostomy. Call for CXR but do not delay treatment.

Consider thrombosis including pulmonary embolus, myocardial infarct and stroke

Consider cardiac tamponade
Simultaneously Find and Treat Cause (facing page)

Waveform capnography
Plan actions before interrupting compressions

CPR 2 minutes
Look at the clock

If the rhythm is shockable (VF or pulseless VT) then shock using 4 J/kg

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Weight</th>
<th>Shock</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 1</td>
<td>5 - 10kg</td>
<td>20 - 40 J</td>
</tr>
<tr>
<td>1 - 2</td>
<td>10 kg</td>
<td>40 J</td>
</tr>
<tr>
<td>3 - 4</td>
<td>15 kg</td>
<td>60 J</td>
</tr>
<tr>
<td>5 - 6</td>
<td>20 kg</td>
<td>80 J</td>
</tr>
<tr>
<td>7 - 10</td>
<td>30 kg</td>
<td>120 J</td>
</tr>
<tr>
<td>11 - 12</td>
<td>40 kg</td>
<td>160 J</td>
</tr>
<tr>
<td>≥ 13</td>
<td>50 kg</td>
<td>200 J</td>
</tr>
</tbody>
</table>

CPR 2 minutes

Shockable? then shock

IV adrenaline 10 micrograms/kg
CPR 2 minutes

continued next page
**PAEDIATRIC ASYSTOLE**

---

**Shockable? then shock**  
After third shock give **IV amiodarone 5 mg/kg** in dextrose 5% 20 mL

---

**CPR 2 minutes**

---

**Shockable? then shock**

---

**IV adrenaline 10 micrograms/kg**  
**CPR 2 minutes**

---

**Shockable? then shock**

---

**CPR 2 minutes**

---

**Shockable? then shock**

---

**IV adrenaline 10 micrograms/kg**  
**CPR 2 minutes**

---

**Shockable? then shock**

---

**CPR 2 minutes**

---

**Shockable? then shock**

---

*continued next page*
**PAEDIATRIC ASYSTOLE**

**IV adrenaline 10 micrograms/kg**
CPR 2 minutes

**Shockable? then shock**

**CPR 2 minutes**

**CPR now exceeds 20 minutes. Seek expert advice and consider stopping.**

---

**Post-resuscitation care:**
Re-evaluate **ABCDE** and re-assess **all tubes and lines**
Cervical **collar** if required
Twelve lead **ECG**
CXR, IDC, **nasogastric tube**
**Temperature probe** in nasopharynx, oesophagus or bladder
Assess for **injuries** from resuscitation
Treat **precipitating causes** (consider antibiotics, seizure management)
Aim for **normal sats** and **normal PaCO₂** unless specific conditions
Aim for **normoglycaemia**
Targeted temperature management aiming **32 to 37 °C**
Psychological support for family and staff

**Seek expert advice regarding ongoing care and transfer**
**PAEDIATRIC BRADYCARDIA**

< 100/MINUTE IF AGE < 2 YEARS  
< 60/MINUTE IF AGE 2 TO 12 YEARS  
< 50/MINUTE IF AGE > 12 YEARS

**IF NO PULSE THEN GO TO PAGE 55 (PEA)**

**CALL FOR HELP**  
**INFORM TEAM**  
**CRASH CART**

Maintain **airway**  
Assist **breathing** as necessary  
High-flow **oxygen**  
Attach oximetry, blood pressure monitor and cardiac monitor  
**Intravenous** or **intraosseous** access  
12-lead ECG if available (don’t delay therapy)

**If compromised:**  
**bag-mask** ventilation  
if age < 12 and heart rate < 60/minute then **chest compressions**  
if age ≥ 12 and heart rate < 50/minute then **chest compressions**  
**treat shock** (IV normal saline 20 mL/kg, repeated as necessary)

**If compromised and high vagal tone** (eg. from nasopharyngeal or oesophageal stimulation, tracheal intubation, tracheal suctioning, increased ICP) then give  
**IV or IO atropine 20 mcg/kg** (minimum dose 100 mcg, maximum dose 600 mcg, may be repeated after five minutes to a maximum total of 1 mg in child or 2 mg in adolescent).

See next page for atropine dose chart

continued next page
If compromised and high vagal tone, continued:

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Weight</th>
<th>Atropine dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 1</td>
<td>5 - 10kg</td>
<td>100 - 200 mcg</td>
</tr>
<tr>
<td>1 - 2</td>
<td>10 kg</td>
<td>200 mcg</td>
</tr>
<tr>
<td>3 - 4</td>
<td>15 kg</td>
<td>300 mcg</td>
</tr>
<tr>
<td>5 - 6</td>
<td>20 kg</td>
<td>400 mcg</td>
</tr>
<tr>
<td>7 - 10</td>
<td>30 kg</td>
<td>600 mcg</td>
</tr>
<tr>
<td>11 - 12</td>
<td>40 kg</td>
<td>600 mcg</td>
</tr>
<tr>
<td>≥ 13</td>
<td>50 kg</td>
<td>600 mcg</td>
</tr>
</tbody>
</table>

If still compromised give IV or IO adrenaline 10 micrograms/kg

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Weight</th>
<th>Adrenaline dose</th>
<th>Adrenaline volume 1:10,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 1</td>
<td>5 - 10kg</td>
<td>50 - 100 mcg</td>
<td>0.5 - 1 mL</td>
</tr>
<tr>
<td>1 - 2</td>
<td>10 kg</td>
<td>100 mcg</td>
<td>1 mL</td>
</tr>
<tr>
<td>3 - 4</td>
<td>15 kg</td>
<td>150 mcg</td>
<td>1.5 mL</td>
</tr>
<tr>
<td>5 - 6</td>
<td>20 kg</td>
<td>200 mcg</td>
<td>2 mL</td>
</tr>
<tr>
<td>7 - 10</td>
<td>30 kg</td>
<td>300 mcg</td>
<td>3 mL</td>
</tr>
<tr>
<td>11 - 12</td>
<td>40 kg</td>
<td>400 mcg</td>
<td>4 mL</td>
</tr>
<tr>
<td>≥ 13</td>
<td>50 kg</td>
<td>500 mcg</td>
<td>5 mL</td>
</tr>
</tbody>
</table>

If still compromised consider:

**IV adrenaline infusion:** adrenaline 0.3 mg/kg in 50 mL dextrose 5%, so that 1 mL/h ≈ 0.1 micrograms/kg/min. Start infusion at 0.5 to 10 mL/h (≈ 0.05 to 1 micrograms/kg/min). Titrate rate according to response.

**transcutaneous pacing**

and seek **expert advice**

If not compromised then seek **expert advice**
# PAEDIATRIC DIABETIC KETOACIDOSIS

## Symptoms:
- THIRST
- VOMITING
- ABDOMINAL PAIN
- WEAKNESS
- CONFUSION
- POLYURIA
- WEIGHTLOSS

## Signs:
- DEHYDRATION
- DEEP SIGHING RESPIRATIONS
- SMELL OF KETONES ON BREATH
- LETHARGY
- DROWSINESS

## Diagnosis:
- KETONES: ketones in urine or blood (> 0.6 mmol/L)
- ACIDOSIS: pH < 7.3

This protocol is for unwell patients. Patients with pH > 7.3 who are not dehydrated or vomiting may tolerate oral fluids and subcutaneous insulin.

## CALL FOR HELP | INFORM TEAM | RESUS BAY

## RESUSCITATION

### Airway:
- protect airway as required (see page 1). Naso-gastric tube if coma or vomiting

### Breathing:
- 100% oxygen via mask if oxygen saturations < 95% on room air

### Circulation: only if shocked (hypotension, peripheral capillary return > 3 seconds)
- give bolus of **10 mL/kg** normal saline 0.9% over 15 minutes

continued next page
### Disability assessed by Glasgow Coma Scale (GCS)

<table>
<thead>
<tr>
<th></th>
<th>Age &lt; 4</th>
<th>Age ≥ 4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Eye Opening</strong></td>
<td>Spontaneous 4</td>
<td>Spontaneous 4</td>
</tr>
<tr>
<td></td>
<td>To voice 3</td>
<td>To voice 3</td>
</tr>
<tr>
<td></td>
<td>To pain 2</td>
<td>To pain 2</td>
</tr>
<tr>
<td></td>
<td>No response to pain 1</td>
<td>No response to pain 1</td>
</tr>
<tr>
<td><strong>Verbal Response</strong></td>
<td>Appropriate words or smiles, fixes, follows 5</td>
<td>Oriented 5</td>
</tr>
<tr>
<td></td>
<td>Cries but consolable, less words than usual 4</td>
<td>Confused 4</td>
</tr>
<tr>
<td></td>
<td>Persistently irritable 3</td>
<td>Inappropriate words 3</td>
</tr>
<tr>
<td></td>
<td>Moans to pain 2</td>
<td>Incomprehensible sounds 2</td>
</tr>
<tr>
<td></td>
<td>No response to pain 1</td>
<td>No response to pain 1</td>
</tr>
<tr>
<td><strong>Motor Response</strong></td>
<td>Spontaneous movements or obeys commands 6</td>
<td>Obey's commands 6</td>
</tr>
<tr>
<td></td>
<td>Localises pain 5</td>
<td>Localises pain 5</td>
</tr>
<tr>
<td></td>
<td>Withdraws from pain 4</td>
<td>Withdraws from pain 4</td>
</tr>
<tr>
<td></td>
<td>Abnormal flexion 3</td>
<td>Abnormal flexion 3</td>
</tr>
<tr>
<td></td>
<td>Abnormal extension 2</td>
<td>Abnormal extension 2</td>
</tr>
<tr>
<td></td>
<td>No response to pain 1</td>
<td>No response to pain 1</td>
</tr>
</tbody>
</table>

Glasgow Coma Scale (GCS) is the sum of the best responses

**Weigh** patient

continued next page
INVESTIGATIONS

**IV access:**
- FBC EUC CaMgPh lipase BGL serum osmolality
- blood ketones (fingerprick)
- **venous gas**
  - investigations for precipitating cause (consider full septic workup)
**if first presentation of diabetes:** insulin antibodies, GAD antibodies, IA-2 antibodies, TSH, thyroid antibodies, coeliac screen, C-peptide, lipids

**Urine:**
- ketones
- culture (if clinical evidence of infection)
- consider β-HCG

**ECG monitoring:**
- hyperkalaemia: peaked T waves, widened QRS ((for management see page 41))
- hypokalaemia: flattened or inverted T waves, ST depression, wide PR interval

**Calculate corrected sodium** = measured sodium + (glucose/3)

**Calculate osmolality** = (measured sodium + potassium) x 2 + glucose + urea

continued next page
Is this Hyperosmolar Hyperglycaemic State (HHS)?

- osmolality > 320 mosmol/kg
- BGL > 30 mmol/L
- pH > 7.3 and HCO₃ > 15 mmol/L
- low or no ketones on fingerprick test (< 0.6 mmol/L)

Then different management is required. Seek expert advice.

**SEVERITY**

Use initial pH to determine severity:

<table>
<thead>
<tr>
<th>pH</th>
<th>Severity</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 7.3 to 7.2</td>
<td>Mild</td>
</tr>
<tr>
<td>&lt; 7.2 to 7.1</td>
<td>Moderate</td>
</tr>
<tr>
<td>&lt; 7.1</td>
<td>Severe</td>
</tr>
</tbody>
</table>

Correct fluid deficit over 48 hours (see chart on next page) to avoid cerebral oedema

If hypernatraemia (corrected sodium > 150 mmol/L) or hyperosmolality (osmolality > 310 mosmol/L) then correct fluid deficit over 72 hours (see chart on next page)
REHYDRATION RATE

Estimate % dehydration and use chart below for rehydration rate:

<table>
<thead>
<tr>
<th>Weight</th>
<th>MILD 4% over 48 hours (mL/h)</th>
<th>MODERATE 7% over 48 hours (mL/h)</th>
<th>SEVERE 10% over 48 hours (mL/h)</th>
<th>MILD 4% over 72 hours (mL/h)</th>
<th>MODERATE 7% over 72 hours (mL/h)</th>
<th>SEVERE 10% over 72 hours (mL/h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 kg</td>
<td>19</td>
<td>22</td>
<td>24</td>
<td>18</td>
<td>20</td>
<td>22</td>
</tr>
<tr>
<td>6 kg</td>
<td>29</td>
<td>33</td>
<td>37</td>
<td>27</td>
<td>30</td>
<td>32</td>
</tr>
<tr>
<td>8 kg</td>
<td>39</td>
<td>44</td>
<td>49</td>
<td>36</td>
<td>40</td>
<td>43</td>
</tr>
<tr>
<td>10 kg</td>
<td>48</td>
<td>55</td>
<td>61</td>
<td>46</td>
<td>50</td>
<td>54</td>
</tr>
<tr>
<td>12 kg</td>
<td>54</td>
<td>62</td>
<td>69</td>
<td>51</td>
<td>56</td>
<td>61</td>
</tr>
<tr>
<td>14 kg</td>
<td>60</td>
<td>68</td>
<td>77</td>
<td>56</td>
<td>62</td>
<td>67</td>
</tr>
<tr>
<td>16 kg</td>
<td>65</td>
<td>75</td>
<td>85</td>
<td>61</td>
<td>68</td>
<td>74</td>
</tr>
<tr>
<td>18 kg</td>
<td>71</td>
<td>82</td>
<td>94</td>
<td>66</td>
<td>74</td>
<td>81</td>
</tr>
<tr>
<td>20 kg</td>
<td>77</td>
<td>89</td>
<td>102</td>
<td>71</td>
<td>79</td>
<td>88</td>
</tr>
<tr>
<td>25 kg</td>
<td>86</td>
<td>101</td>
<td>117</td>
<td>79</td>
<td>89</td>
<td>100</td>
</tr>
<tr>
<td>30 kg</td>
<td>95</td>
<td>114</td>
<td>133</td>
<td>87</td>
<td>99</td>
<td>112</td>
</tr>
<tr>
<td>35 kg</td>
<td>104</td>
<td>126</td>
<td>148</td>
<td>94</td>
<td>109</td>
<td>124</td>
</tr>
<tr>
<td>40 kg</td>
<td>113</td>
<td>138</td>
<td>163</td>
<td>102</td>
<td>119</td>
<td>136</td>
</tr>
<tr>
<td>45 kg</td>
<td>123</td>
<td>151</td>
<td>179</td>
<td>110</td>
<td>129</td>
<td>148</td>
</tr>
<tr>
<td>50 kg</td>
<td>132</td>
<td>163</td>
<td>194</td>
<td>118</td>
<td>139</td>
<td>159</td>
</tr>
<tr>
<td>55 kg</td>
<td>141</td>
<td>175</td>
<td>210</td>
<td>126</td>
<td>148</td>
<td>171</td>
</tr>
<tr>
<td>60 kg</td>
<td>150</td>
<td>188</td>
<td>225</td>
<td>133</td>
<td>158</td>
<td>183</td>
</tr>
<tr>
<td>65 kg</td>
<td>159</td>
<td>200</td>
<td>240</td>
<td>141</td>
<td>168</td>
<td>195</td>
</tr>
<tr>
<td>70 kg</td>
<td>168</td>
<td>212</td>
<td>256</td>
<td>149</td>
<td>178</td>
<td>207</td>
</tr>
</tbody>
</table>

continued next page
**REHYDRATION FLUID**

Use **serum potassium** to determine **rehydration fluid** (see chart below)

<table>
<thead>
<tr>
<th>Serum potassium (mmol/L)</th>
<th>Rehydration fluid</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 5.5</td>
<td>IV sodium chloride 0.9% or PlasmaLyte 148</td>
</tr>
<tr>
<td></td>
<td><strong>Recheck K in one hour</strong></td>
</tr>
<tr>
<td>3.0 to 5.5</td>
<td>IV sodium chloride 0.9% with KCl 40 mmol/L or PlasmaLyte 148 with KCl 40 mmol/L</td>
</tr>
<tr>
<td>&lt; 3.0</td>
<td><strong>Monitor ECG and seek expert advice</strong></td>
</tr>
</tbody>
</table>

**Do not give potassium** if **no urine output** or **renal failure**

If **IV fluids have been given elsewhere**, prior to assessment, then that volume should be included in the fluid calculations

Do not change the rehydration rate as the pH changes

Do not increase the rehydration rate to replace ongoing fluid losses

**Nil by mouth** except for ice to suck

**Beware of falling corrected sodium level**

continued next page
**PAEDIATRIC DIABETIC KETOACIDOSIS**

**INSULIN INFUSION**

Start IV insulin infusion _one hour_ after starting IV rehydration fluid.

Use _short-acting insulin_ (Actrapid or Humulin R) made up to _50 mL_ with normal saline 0.9% (see chart at right).

Run insulin infusion as _sideline_ with IV fluids.

Use _syringe pump_ and _prime_ the line.

Start insulin infusion at _1 mL/hour_ (_= 0.05 u/kg/hour_, see chart at right).

Aim for _BGL_ to _fall_ by _4 mmol/L/hour_.

Can increase insulin infusion to _2 mL/hour_ (_= 0.1 u/kg/hour_).

Do not give IV insulin bolus.

If patient has Continuous Subcutaneous Insulin Infusion (CSII) pump then _turn off CSII pump_.

---

**Table:**

<table>
<thead>
<tr>
<th>Weight</th>
<th>Insulin in 50 mL normal saline</th>
<th>Starting rate (0.05 u/kg/h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 kg</td>
<td>10 units</td>
<td>1 mL/h</td>
</tr>
<tr>
<td>6 kg</td>
<td>15 units</td>
<td>1 mL/h</td>
</tr>
<tr>
<td>8 kg</td>
<td>20 units</td>
<td>1 mL/h</td>
</tr>
<tr>
<td>10 kg</td>
<td>25 units</td>
<td>1 mL/h</td>
</tr>
<tr>
<td>12 kg</td>
<td>30 units</td>
<td>1 mL/h</td>
</tr>
<tr>
<td>14 kg</td>
<td>35 units</td>
<td>1 mL/h</td>
</tr>
<tr>
<td>16 kg</td>
<td>40 units</td>
<td>1 mL/h</td>
</tr>
<tr>
<td>18 kg</td>
<td>45 units</td>
<td>1 mL/h</td>
</tr>
<tr>
<td>20 kg</td>
<td>50 units</td>
<td>1 mL/h</td>
</tr>
<tr>
<td>25 kg</td>
<td>65 units</td>
<td>1 mL/h</td>
</tr>
<tr>
<td>30 kg</td>
<td>75 units</td>
<td>1 mL/h</td>
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<tr>
<td>35 kg</td>
<td>90 units</td>
<td>1 mL/h</td>
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<tr>
<td>40 kg</td>
<td>100 units</td>
<td>1 mL/h</td>
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<td>45 kg</td>
<td>115 units</td>
<td>1 mL/h</td>
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<td>125 units</td>
<td>1 mL/h</td>
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<td>55 kg</td>
<td>140 units</td>
<td>1 mL/h</td>
</tr>
<tr>
<td>60 kg</td>
<td>150 units</td>
<td>1 mL/h</td>
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<tr>
<td>65 kg</td>
<td>165 units</td>
<td>1 mL/h</td>
</tr>
<tr>
<td>70 kg</td>
<td>175 units</td>
<td>1 mL/h</td>
</tr>
</tbody>
</table>
**PAEDIATRIC DIABETIC KETOACIDOSIS**

**MONITORING**

**Hourly** RR, saturations, HR, BP, temperature, neuro observations, **blood ketones, BGL**

Strict **fluid balance**

**2 hourly EUC** and **venous gas** (then 2 to 4 hourly)

Aim to **keep blood glucose level between 5 and 12 mmol/L**

**Continue insulin infusion until ketosis cleared**, so will require additional dextrose once BGL < 15 mmol/L or if BGL falls by > 5 mmol/L/hour

**CHANGE REHYDRATION FLUID**

If **BGL < 15 mmol/L** or **falling by > 5 mmol/L/hour** then change to sodium chloride **0.45%** with **dextrose 5%** and **KCl 40 mmol/L** (see chart below if correct IV fluid unavailable)

If **BGL < 6 mmol/L** or **continues to fall by > 5 mmol/L/hour** then change to sodium chloride **0.45%** with **dextrose 10%** and **KCl 40 mmol/L** (see chart below if unavailable)

<table>
<thead>
<tr>
<th>Start with</th>
<th>Remove</th>
<th>Add</th>
<th>Finish with</th>
</tr>
</thead>
<tbody>
<tr>
<td>1000 mL sodium chloride 0.9%</td>
<td>50 mL</td>
<td>50 mL dextrose 50%</td>
<td>1000 mL sodium chloride 0.9% and dextrose 5%</td>
</tr>
<tr>
<td>1000 mL sodium chloride 0.45%</td>
<td>50 mL</td>
<td>50 mL dextrose 50%</td>
<td>1000 mL sodium chloride 0.45% and dextrose 5%</td>
</tr>
<tr>
<td>1000 mL sodium chloride 0.45%</td>
<td>100 mL</td>
<td>100 mL dextrose 50%</td>
<td>1000 mL sodium chloride 0.45% and dextrose 10%</td>
</tr>
</tbody>
</table>

Seek expert advice and arrange high-level care

*continued next page*
TROUBLESHOOTING

If pH is not correcting:

- check that patient is receiving the insulin (check dose, syringe, line, cannula, and that line was primed)
- consider inadequate perfusion (check fluid balance and cardiac status)
- consider sepsis (examine ears, throat, chest, abdomen, urine and skin)
- consider insulin resistance (these patients will need higher insulin infusion rates)
- consider electrolyte disturbance (eg. hypercholaemic acidosis, hypophosphataemia, hypomagesaemia)
- consider cerebral oedema (see next page)
- consider lactic acidosis (reperfusion of tissues following fluid resuscitation releases tissue lactate in first 2 hours, but pH should be improving by 4 hours)

HYPOGLYCAEMIA

If symptomatic or BGL < 3 mmol/L:

- cease insulin infusion
- give IV dextrose 10% 2 mL/kg (see chart on page 44)
- recheck BGL in 15 minutes

If not symptomatic and BGL 3 to 4 mmol/L:

- cease insulin infusion
- check that sodium chloride 0.45% with dextrose 10% is running
- recheck BGL in 30 minutes

continued next page
CEREBRAL OEDEMA

**Risk factors:**
- SEVERE ACIDOSIS AND DEHYDRATION
- EXTENDED PERIOD of POOR GLYCAEMIC CONTROL
- YOUNG AGE
- HYPERNATRAEMIA or HYponatraemia
- FALLING SERUM SODIUM DURING THERAPY
- EXCESSIVE FLUID REPLACEMENT

**Danger signs:**
- HEADACHE or LETHARGY
- RECURRENCE OF VOMITING
- INCONTINENCE INAPPROPRIATE FOR AGE
- CHANGE IN NEUROLOGICAL STATUS or SPECIFIC SIGNS
- FALL IN SERUM SODIUM CONCENTRATION
- FALL IN SERUM OSMOLALITY OF > 3 mosmol/kg/hour

**Seek expert advice**

**If cerebral oedema is suspected:**
- exclude hypoglycaemia (which can mimic cerebral oedema)
- elevate head of bed
- halve the IV fluid infusion rate
- IV mannitol 0.5 g/kg over 20 minutes (ie. 2.5 mL/kg of 20% mannitol solution)
  - if IV mannitol unavailable give IV hypertonic sodium chloride 3% (5 to 10 mL/kg over 30 minutes)
- consider intubation if GCS < 8
NEONATE: K > 6.0 mmol/L  
CHILD: K > 5.5 mmol/L  
URGENT MANAGEMENT IS NEEDED TO PREVENT FATAL CARDIAC ARRHYTHMIA

**CALL FOR HELP**  **INFORM TEAM**  **CRASH CART**

Stop IV potassium and PO potassium and NGT feeding  
Stop any medication causing hyperkalaemia (eg. ACE-inhibitor, spirinolactone, beta-blocker, digoxin, NSAID)

**Continuous cardiac monitoring** and ECG:  
the first manifestation may be ventricular fibrillation, or ECG changes may progress:

- **K > 6.5**  
  - tall “tented” symmetrical T waves  
  - prolonged PR interval, flat P waves

- **K > 7.5**  
  - wide QRS (increased risk of arrhythmia)  
  - progresses to disappearance of P wave  
  - fusion of QRS and T wave into a sine wave

**IV access:**
confirm hyperkalaemia with second sample  
if renal failure then assume hyperkalaemia is correct until proven otherwise  
check electrolytes, urea, creatinine and glucose  
venous blood gas  
consider CK, cortisol, aldosterone, and digoxin level

continued next page
If specific ECG changes of hyperkalaemia then give IV calcium gluconate 10% 0.5 mL/kg (maximum 30 mL, diluted with normal saline 20 mL, give over 3 minutes, see chart below)

Nebulised salbutamol (see chart below)

If $K > 6.0$ mmol/L then give:

**IV dextrose 10% 5 mL/kg** (see chart below)

**IV short-acting insulin** (Actrapid or Humulin R) 0.1 unit/kg bolus (maximum 10 units, see chart below)

Check BGL and serum potassium level after 15 and 30 minutes

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Weight</th>
<th>IV calcium gluconate 10% 0.5 mL/kg</th>
<th>Nebulised salbutamol</th>
<th>IV dextrose 10% 5 mL/kg</th>
<th>IV insulin 0.1 unit/kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 months</td>
<td>6 kg</td>
<td>3 mL</td>
<td>2.5 mg</td>
<td>30 mL</td>
<td>0.6 units</td>
</tr>
<tr>
<td>6 months</td>
<td>7.5 kg</td>
<td>4 mL</td>
<td>2.5 mg</td>
<td>38 mL</td>
<td>0.8 units</td>
</tr>
<tr>
<td>1</td>
<td>10 kg</td>
<td>5 mL</td>
<td>2.5 mg</td>
<td>50 mL</td>
<td>1 unit</td>
</tr>
<tr>
<td>2</td>
<td>12 kg</td>
<td>6 mL</td>
<td>2.5 mg</td>
<td>60 mL</td>
<td>1.2 units</td>
</tr>
<tr>
<td>3</td>
<td>14 kg</td>
<td>7 mL</td>
<td>2.5 mg</td>
<td>70 mL</td>
<td>1.4 units</td>
</tr>
<tr>
<td>4</td>
<td>16 kg</td>
<td>8 mL</td>
<td>2.5 mg</td>
<td>80 mL</td>
<td>1.6 units</td>
</tr>
<tr>
<td>5</td>
<td>18 kg</td>
<td>9 mL</td>
<td>2.5 mg</td>
<td>90 mL</td>
<td>1.8 units</td>
</tr>
<tr>
<td>6</td>
<td>20 kg</td>
<td>10 mL</td>
<td>5 mg</td>
<td>100 mL</td>
<td>2 units</td>
</tr>
<tr>
<td>7 - 8</td>
<td>25 kg</td>
<td>13 mL</td>
<td>5 mg</td>
<td>125 mL</td>
<td>2.5 units</td>
</tr>
<tr>
<td>9 - 10</td>
<td>30 kg</td>
<td>15 mL</td>
<td>7.5 mg</td>
<td>150 mL</td>
<td>3 units</td>
</tr>
<tr>
<td>11 - 12</td>
<td>40 kg</td>
<td>20 mL</td>
<td>7.5 mg</td>
<td>200 mL</td>
<td>4 units</td>
</tr>
<tr>
<td>≥ 13</td>
<td>50 kg</td>
<td>25 mL</td>
<td>10 mg</td>
<td>250 mL</td>
<td>5 units</td>
</tr>
</tbody>
</table>

continued next page
If $K > 7.0$ mmol/L and $pH < 7.35$ then give IV sodium bicarbonate 8.4% 1 mL/kg (see chart below, do not give simultaneously with calcium).

If normal ECG and no symptoms (respiratory depression, paraesthesia, paralysis, arrhythmia) then give PO or PR polystyrene sulfonate (Resonium) 1 g/kg (maximum 30 g, see chart below, avoid in neonates, ileus, recent abdominal surgery, perforation, hypernatraemia).

Consider acute adrenal insufficiency:
may present with hypotension, hyponatraemia and hyperkalaemia
is there a history of Addison’s disease or suddenly ceasing steroids? (eg. prednisone)
if < 1 year old then seek expert advice regarding undiagnosed metabolic disorder
if > 1 year old then treat with IV hydrocortisone 4 mg/kg and volume replacement

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Weight</th>
<th>IV sodium bicarbonate 8.4% 1 mL/kg</th>
<th>PO or PR polystyrene sulfonate 1 g/kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 months</td>
<td>6 kg</td>
<td>6 mL</td>
<td>6 g</td>
</tr>
<tr>
<td>6 months</td>
<td>7.5 kg</td>
<td>7.5 mL</td>
<td>7.5 g</td>
</tr>
<tr>
<td>1</td>
<td>10 kg</td>
<td>10 mL</td>
<td>10 g</td>
</tr>
<tr>
<td>2</td>
<td>12 kg</td>
<td>12 mL</td>
<td>12 g</td>
</tr>
<tr>
<td>3</td>
<td>14 kg</td>
<td>14 mL</td>
<td>14 g</td>
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<tr>
<td>4</td>
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<td>18 kg</td>
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<td>18 g</td>
</tr>
<tr>
<td>6</td>
<td>20 kg</td>
<td>20 mL</td>
<td>20 g</td>
</tr>
<tr>
<td>7 - 8</td>
<td>25 kg</td>
<td>25 mL</td>
<td>25 g</td>
</tr>
<tr>
<td>9 - 10</td>
<td>30 kg</td>
<td>30 mL</td>
<td>30 g</td>
</tr>
<tr>
<td>11 - 12</td>
<td>40 kg</td>
<td>40 mL</td>
<td>30 g</td>
</tr>
<tr>
<td>≥ 13</td>
<td>50 kg</td>
<td>50 mL</td>
<td>30 g</td>
</tr>
</tbody>
</table>
If patient can swallow safely:

- Oral glucose 15 g or soft drink/juice 150 mL
- Then two biscuits

For investigation of first presentation of isolated hypoglycaemia see next page

If IV access (and cannot swallow) give IV dextrose 10% 2 mL/kg (see chart below)

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Weight</th>
<th>IV dextrose 10% 2 mL/kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 1</td>
<td>5 - 10 kg</td>
<td>10 to 20 mL</td>
</tr>
<tr>
<td>1 - 2</td>
<td>10 kg</td>
<td>20 mL</td>
</tr>
<tr>
<td>3 - 4</td>
<td>15 kg</td>
<td>30 mL</td>
</tr>
<tr>
<td>5 - 6</td>
<td>20 kg</td>
<td>40 mL</td>
</tr>
<tr>
<td>7 - 10</td>
<td>30 kg</td>
<td>60 mL</td>
</tr>
<tr>
<td>11 - 12</td>
<td>40 kg</td>
<td>80 mL</td>
</tr>
<tr>
<td>≥ 13</td>
<td>50 kg</td>
<td>100 mL</td>
</tr>
</tbody>
</table>

If no IV access (and cannot swallow):

- < 25 kg (under 8 years): IM glucagon 0.5 unit (half vial)
- > 25 kg (8 years and over): IM glucagon 1.0 unit (full vial)

continued next page
Identify and treat the **cause** of hypoglycaemia, considering:

- endocrine and metabolic disorders
- toxic ingestion
- drug error

Seek **expert advice**

If patient is on insulin infusion then **stop insulin infusion**

**Recheck** BGL every five minutes

**Repeat** IV dextrose 10% 2 mL/kg as required

Delay regular insulin until hypoglycaemia has resolved, and consider lower dose

Seek **expert advice**

Investigations for **first presentation** of **isolated hypoglycaemia** in the non-diabetic:

- **take minimum of 6 mL of blood**, immediately to the laboratory on ice

  **blood**: one 3 mL lithium heparin tube, one 2 mL serum gel tube, two 0.5 mL fluoride oxalate tubes, Guthrie card, venous blood gas

  **for**: glucose, EUC, LFTs, free fatty acids, ketones, insulin, C-peptide, cortisol, growth hormone, lactate, pyruvate, amino acids, carnitine, ammonia, venous blood gas

- **urine** (first void after hypoglycaemia): glucose, ketones, reducing substances, organic acids, amino acids
PAEDIATRIC PAIN

ASSSESS PATIENT

Assess pain

Determine analgesia already given

Weigh patient or estimate using chart on next page

Monitor:

HR, RR, BP, oxygen saturations
pain score
level of sedation

NON-DRUG MANAGEMENT

Non-drug management:

positioning for comfort
immobilisation of injured limb
calm environment
explanation
give control to the patient wherever possible
empower parents
distraction and play

continued next page
MILD PAIN

For **mild pain:**

**PO paracetamol** 15 mg/kg Q4-6H (maximum 1 g/dose or 60 mg/kg/day)

**PO ibuprofen** 10 mg/kg Q6-8H (maximum 400 mg/dose or 40 mg/kg/day)

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Weight</th>
<th>PO paracetamol dose (15 mg/kg)</th>
<th>PO paracetamol syrup (240 mg/5 mL)</th>
<th>PO ibuprofen dose (10 mg/kg)</th>
<th>PO ibuprofen syrup (200 mg/5 mL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 months</td>
<td>6 kg</td>
<td>90 mg</td>
<td>1.9 mL</td>
<td>60 mg</td>
<td>1.5 mL</td>
</tr>
<tr>
<td>6 months</td>
<td>7.5 kg</td>
<td>110 mg</td>
<td>2.3 mL</td>
<td>75 mg</td>
<td>1.9 mL</td>
</tr>
<tr>
<td>1</td>
<td>10 kg</td>
<td>150 mg</td>
<td>3.1 mL</td>
<td>100 mg</td>
<td>2.5 mL</td>
</tr>
<tr>
<td>2</td>
<td>12 kg</td>
<td>180 mg</td>
<td>3.8 mL</td>
<td>120 mg</td>
<td>3 mL</td>
</tr>
<tr>
<td>3</td>
<td>14 kg</td>
<td>210 mg</td>
<td>4.4 mL</td>
<td>140 mg</td>
<td>3.5 mL</td>
</tr>
<tr>
<td>4</td>
<td>16 kg</td>
<td>240 mg</td>
<td>5 mL</td>
<td>160 mg</td>
<td>4 mL</td>
</tr>
<tr>
<td>5</td>
<td>18 kg</td>
<td>270 mg</td>
<td>5.6 mL</td>
<td>180 mg</td>
<td>4.5 mL</td>
</tr>
<tr>
<td>6</td>
<td>20 kg</td>
<td>300 mg</td>
<td>6.3 mL</td>
<td>200 mg</td>
<td>5 mL</td>
</tr>
<tr>
<td>7 - 8</td>
<td>25 kg</td>
<td>375 mg</td>
<td>7.8 mL</td>
<td>250 mg</td>
<td>6.3 mL</td>
</tr>
<tr>
<td>9 - 10</td>
<td>30 kg</td>
<td>450 mg</td>
<td>9.4 mL</td>
<td>300 mg</td>
<td>7.5 mL</td>
</tr>
<tr>
<td>11 - 12</td>
<td>40 kg</td>
<td>600 mg</td>
<td>12.5 mL</td>
<td>400 mg</td>
<td>10 mL</td>
</tr>
<tr>
<td>≥ 13</td>
<td>50 kg</td>
<td>1000 mg</td>
<td>20 mL</td>
<td>400 mg</td>
<td>10 mL</td>
</tr>
</tbody>
</table>

continued next page
For **moderate pain:**

**PO oxycodone** 0.1 mg/kg Q4-6H (max 1.2 mg/kg/day or 20 mg/day)

**PO paracetamol** 15 mg/kg Q4-6H (maximum 1 g/dose or 60 mg/kg/day)

**PO ibuprofen** 10 mg/kg Q6-8H (maximum 400 mg/dose or 40 mg/kg/day, see chart on previous page)

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Weight</th>
<th>PO oxycodone dose (0.1 mg/kg)</th>
<th>PO oxycodone syrup (5 mg/5 mL)</th>
<th>PO paracetamol dose (15 mg/kg)</th>
<th>PO paracetamol syrup (240 mg/5 mL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 months</td>
<td>6 kg</td>
<td>0.6 mg</td>
<td>0.6 mL</td>
<td>90 mg</td>
<td>1.9 mL</td>
</tr>
<tr>
<td>6 months</td>
<td>7.5 kg</td>
<td>0.75 mg</td>
<td>0.75 mL</td>
<td>110 mg</td>
<td>2.3 mL</td>
</tr>
<tr>
<td>1</td>
<td>10 kg</td>
<td>1 mg</td>
<td>1 mL</td>
<td>150 mg</td>
<td>3.1 mL</td>
</tr>
<tr>
<td>2</td>
<td>12 kg</td>
<td>1.2 mg</td>
<td>1.2 mL</td>
<td>180 mg</td>
<td>3.8 mL</td>
</tr>
<tr>
<td>3</td>
<td>14 kg</td>
<td>1.4 mg</td>
<td>1.4 mL</td>
<td>210 mg</td>
<td>4.4 mL</td>
</tr>
<tr>
<td>4</td>
<td>16 kg</td>
<td>1.6 mg</td>
<td>1.6 mL</td>
<td>240 mg</td>
<td>5 mL</td>
</tr>
<tr>
<td>5</td>
<td>18 kg</td>
<td>1.8 mg</td>
<td>1.8 mL</td>
<td>270 mg</td>
<td>5.6 mL</td>
</tr>
<tr>
<td>6</td>
<td>20 kg</td>
<td>2 mg</td>
<td>2.0 mL</td>
<td>300 mg</td>
<td>6.3 mL</td>
</tr>
<tr>
<td>7 - 8</td>
<td>25 kg</td>
<td>2.5 mg</td>
<td>2.5 mL</td>
<td>375 mg</td>
<td>7.8 mL</td>
</tr>
<tr>
<td>9 - 10</td>
<td>30 kg</td>
<td>3 mg</td>
<td>3 mL</td>
<td>450 mg</td>
<td>9.4 mL</td>
</tr>
<tr>
<td>11 - 12</td>
<td>40 kg</td>
<td>4 mg</td>
<td>4 mL</td>
<td>600 mg</td>
<td>12.5 mL</td>
</tr>
<tr>
<td>≥ 13</td>
<td>50 kg</td>
<td>5 mg</td>
<td>5 mL</td>
<td>1000 mg</td>
<td>20 mL</td>
</tr>
</tbody>
</table>

continued next page
For **severe pain without IV access**:  

**intranasal fentanyl** 1.5 micrograms/kg, repeat after 5 to 10 minutes (maximum 75 micrograms per dose or 4 micrograms/kg total)

**OR**

**PO oxycodone** 0.1 to 0.2 mg/kg Q4-6H (maximum 1.2 mg/kg/day or 20 mg/day)

**AND**

**PO paracetamol** and/or **PO ibuprofen** (see previous charts)

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Weight</th>
<th>Intranasal fentanyl dose (1.5 mcg/kg)</th>
<th>Intranasal fentanyl first dose volume*</th>
<th>Intranasal fentanyl second dose volume*</th>
<th>PO oxycodone dose (0.1 to 0.2 mg/kg)</th>
<th>PO oxycodone syrup (5 mg/5 mL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 months</td>
<td>6 kg</td>
<td>9 mcg</td>
<td>0.3 mL</td>
<td>0.2 mL</td>
<td>0.6 - 1.2 mg</td>
<td>0.6 - 1.2 mL</td>
</tr>
<tr>
<td>6 months</td>
<td>7.5 kg</td>
<td>11 mg</td>
<td>0.3 mL</td>
<td>0.2 mL</td>
<td>0.75 - 1.5 mg</td>
<td>0.75 - 1.5 mL</td>
</tr>
<tr>
<td>1</td>
<td>10 kg</td>
<td>15 mcg</td>
<td>0.4 mL</td>
<td>0.3 mL</td>
<td>1 - 2 mg</td>
<td>1 - 2 mL</td>
</tr>
<tr>
<td>2</td>
<td>12 kg</td>
<td>18 mcg</td>
<td>0.5 mL</td>
<td>0.4 mL</td>
<td>1.2 - 2.4 mg</td>
<td>1.2 - 2.4 mL</td>
</tr>
<tr>
<td>3</td>
<td>14 kg</td>
<td>21 mcg</td>
<td>0.5 mL</td>
<td>0.4 mL</td>
<td>1.4 - 2.8 mg</td>
<td>1.4 - 2.8 mL</td>
</tr>
<tr>
<td>4</td>
<td>16 kg</td>
<td>23 mcg</td>
<td>0.6 mL</td>
<td>0.5 mL</td>
<td>1.6 - 3.2 mg</td>
<td>1.6 - 3.2 mL</td>
</tr>
<tr>
<td>5</td>
<td>18 kg</td>
<td>27 mcg</td>
<td>0.6 mL</td>
<td>0.5 mL</td>
<td>1.8 - 3.6 mg</td>
<td>1.8 - 3.6 mL</td>
</tr>
<tr>
<td>6</td>
<td>20 kg</td>
<td>30 mcg</td>
<td>0.7 mL</td>
<td>0.6 mL</td>
<td>2 - 4 mg</td>
<td>2 - 4 mL</td>
</tr>
<tr>
<td>7 - 8</td>
<td>25 kg</td>
<td>38 mcg</td>
<td>0.9 mL</td>
<td>0.8 mL</td>
<td>2.5 - 5 mg</td>
<td>2.5 - 5 mL</td>
</tr>
<tr>
<td>9 - 10</td>
<td>30 kg</td>
<td>45 mcg</td>
<td>1 mL</td>
<td>0.9 mL</td>
<td>3 - 6 mg</td>
<td>3 - 6 mL</td>
</tr>
<tr>
<td>11 - 12</td>
<td>40 kg</td>
<td>60 mcg</td>
<td>1.3 mL</td>
<td>1.2 mL</td>
<td>4 - 8 mg</td>
<td>4 - 8 mL</td>
</tr>
<tr>
<td>≥ 13</td>
<td>50 kg</td>
<td>75 mcg</td>
<td>1.6 mL</td>
<td>1.5 mL</td>
<td>5 - 10 mg</td>
<td>5 - 10 mL</td>
</tr>
</tbody>
</table>

*Intranasal fentanyl volume uses fentanyl 100 mcg/2 mL and allows 0.1 mL for dead space in mucosal atomiser device.

**continued next page**
SEVERE PAIN WITH IV ACCESS

For severe pain with IV access:

**IV morphine** 0.1 to 0.2 mg/kg Q2-4H (maximum 10 mg/dose or 1.2 mg/kg/day)

**AND**

**PO paracetamol** and/or **PO ibuprofen** (see previous charts)

Continuous assessment and monitoring of oxygen saturations

Document observations every 15 minutes

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Weight</th>
<th>IV morphine (0.1 mg/kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 months</td>
<td>6 kg</td>
<td>0.6 mg</td>
</tr>
<tr>
<td>6 months</td>
<td>7.5 kg</td>
<td>0.75 mg</td>
</tr>
<tr>
<td>1</td>
<td>10 kg</td>
<td>1 mg</td>
</tr>
<tr>
<td>2</td>
<td>12 kg</td>
<td>1.2 mg</td>
</tr>
<tr>
<td>3</td>
<td>14 kg</td>
<td>1.4 mg</td>
</tr>
<tr>
<td>4</td>
<td>16 kg</td>
<td>1.6 mg</td>
</tr>
<tr>
<td>5</td>
<td>18 kg</td>
<td>1.8 mg</td>
</tr>
<tr>
<td>6</td>
<td>20 kg</td>
<td>2 mg</td>
</tr>
<tr>
<td>7 - 8</td>
<td>25 kg</td>
<td>2.5 mg</td>
</tr>
<tr>
<td>9 - 10</td>
<td>30 kg</td>
<td>3 mg</td>
</tr>
<tr>
<td>11 - 12</td>
<td>40 kg</td>
<td>4 mg</td>
</tr>
<tr>
<td>≥ 13</td>
<td>50 kg</td>
<td>5 mg</td>
</tr>
</tbody>
</table>

See treatment of opiate overdose on next page

continued next page
**OPIATE OVERDOSE**

Support **airway**

**Oxygen**

**Assist ventilation**

**IV naloxone 5 micrograms/kg** (see chart below)

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Weight</th>
<th>IV naloxone dose (5 micrograms/kg)</th>
<th>IV naloxone volume (0.4 mg/mL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 months</td>
<td>6 kg</td>
<td>0.03 mg</td>
<td>0.08 mL</td>
</tr>
<tr>
<td>6 months</td>
<td>7.5 kg</td>
<td>0.04 mg</td>
<td>0.1 mL</td>
</tr>
<tr>
<td>1</td>
<td>10 kg</td>
<td>0.05 mg</td>
<td>0.13 mL</td>
</tr>
<tr>
<td>2</td>
<td>12 kg</td>
<td>0.06 mg</td>
<td>0.15 mL</td>
</tr>
<tr>
<td>3</td>
<td>14 kg</td>
<td>0.07 mg</td>
<td>0.18 mL</td>
</tr>
<tr>
<td>4</td>
<td>16 kg</td>
<td>0.08 mg</td>
<td>0.2 mL</td>
</tr>
<tr>
<td>5</td>
<td>18 kg</td>
<td>0.09 mg</td>
<td>0.23 mL</td>
</tr>
<tr>
<td>6</td>
<td>20 kg</td>
<td>0.1 mg</td>
<td>0.25 mL</td>
</tr>
<tr>
<td>7 - 8</td>
<td>25 kg</td>
<td>0.13 mg</td>
<td>0.3 mL</td>
</tr>
<tr>
<td>9 - 10</td>
<td>30 kg</td>
<td>0.15 mg</td>
<td>0.4 mL</td>
</tr>
<tr>
<td>11 - 12</td>
<td>40 kg</td>
<td>0.2 mg</td>
<td>0.5 mL</td>
</tr>
<tr>
<td>≥ 13</td>
<td>50 kg</td>
<td>0.25 mg</td>
<td>0.6 mL</td>
</tr>
</tbody>
</table>

**Repeat IV naloxone** every 2 to 3 minutes as required

Naloxone has **short duration** of action so repeat doses or infusion may be needed.
CPR: 15 COMPRESSIONS : 2 BREATHS
100 TO 120 PER MINUTE
COMPRESSION DEPTH 1/3 OF CHEST
HAND ON LOWER HALF OF STERNUM
MINIMISE INTERRUPTIONS

CALL FOR HELP
INFORM TEAM
CRASH CART

START CPR

Attach defibrillator or monitor
Consider airway adjuncts (oro- or naso-pharyngeal airway, and if skilled LMA or ETT)
High-flow oxygen
Intravenous or intraosseous access

IV adrenaline 10 micrograms/kg followed by normal saline flush

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Weight</th>
<th>Adrenaline dose</th>
<th>Adrenaline volume 1:10,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 1</td>
<td>5 - 10 kg</td>
<td>50 - 100 mcg</td>
<td>0.5 - 1 mL</td>
</tr>
<tr>
<td>1 - 2</td>
<td>10 kg</td>
<td>100 mcg</td>
<td>1 mL</td>
</tr>
<tr>
<td>3 - 4</td>
<td>15 kg</td>
<td>150 mcg</td>
<td>1.5 mL</td>
</tr>
<tr>
<td>5 - 6</td>
<td>20 kg</td>
<td>200 mcg</td>
<td>2 mL</td>
</tr>
<tr>
<td>7 - 10</td>
<td>30 kg</td>
<td>300 mcg</td>
<td>3 mL</td>
</tr>
<tr>
<td>11 - 12</td>
<td>40 kg</td>
<td>400 mcg</td>
<td>4 mL</td>
</tr>
<tr>
<td>≥ 13</td>
<td>50 kg</td>
<td>500 mcg</td>
<td>5 mL</td>
</tr>
</tbody>
</table>

If only 1:1,000 adrenaline available then dilute to 10 mL with normal saline and dose as above

continued on page 57
### FIND AND TREAT CAUSE

**Obtain Bedside Bloods and Consider Cardiac Ultrasound**

If hypoxia give high-flow oxygen, check connections, check for bilateral breath sounds, suction endotracheal tube and reconfirm placement, consider CXR.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Treatment Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypovolaemia</td>
<td>Give IV normal saline 20 mL/kg and check haemoglobin</td>
</tr>
<tr>
<td>Hyperkalaemia</td>
<td>Give IV calcium gluconate 10% 0.7 mL/kg or IV calcium chloride 10% 0.2 mL/kg</td>
</tr>
<tr>
<td></td>
<td>Give IV insulin 0.1 units/kg with IV dextrose 10% 5 mL/kg</td>
</tr>
<tr>
<td></td>
<td>Give IV sodium bicarbonate 8.4% 1 mL/kg (maximum 50 mL)</td>
</tr>
<tr>
<td>Hypokalaemia</td>
<td>Give IV potassium chloride 1 mmol/mL 0.03 to 0.07 mL/kg (maximum 5 mL) slow injection and IV magnesium sulphate 50% 0.05 to 0.10 mL/kg bolus (maximum 2.5 mL)</td>
</tr>
<tr>
<td>Acidosis</td>
<td>Consider IV sodium bicarbonate 8.4% 1 mL/kg (maximum 50 mL)</td>
</tr>
<tr>
<td>Hypothermia</td>
<td>Use forced air blanket, warm IV fluids, raise room temperature</td>
</tr>
<tr>
<td>Hyperthermia</td>
<td>Consider sepsis, heat stroke, malignant hyperthermia, serotonin toxicity, and neuroleptic malignant syndrome (seek expert advice)</td>
</tr>
<tr>
<td>Hypocalcaemia</td>
<td>Give IV calcium gluconate 10% 0.7 mL/kg (maximum 20 mL) or IV calcium chloride 10% 0.2 mL/kg (maximum 10 mL)</td>
</tr>
<tr>
<td>Consider toxins</td>
<td>Including medications, infusions, ingestions, and medication error</td>
</tr>
<tr>
<td>Consider tension pneumothorax</td>
<td>Check for signs and perform emergency needle decompression or finger thoracostomy. Call for CXR but do not delay treatment.</td>
</tr>
<tr>
<td>Consider thrombosis</td>
<td>Including pulmonary embolus, myocardial infarct and stroke</td>
</tr>
<tr>
<td>Consider cardiac tamponade</td>
<td></td>
</tr>
</tbody>
</table>
Simultaneously **Find and Treat Cause** (facing page)

Waveform capnography

**Plan actions** before interrupting compressions

**CPR** 2 minutes

Look at the **clock**

If the rhythm is **shockable** (VF or pulseless VT) then **shock** using **4 J/kg**

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Weight</th>
<th>Shock</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 1</td>
<td>5 - 10kg</td>
<td>20 - 40 J</td>
</tr>
<tr>
<td>1 - 2</td>
<td>10 kg</td>
<td>40 J</td>
</tr>
<tr>
<td>3 - 4</td>
<td>15 kg</td>
<td>60 J</td>
</tr>
<tr>
<td>5 - 6</td>
<td>20 kg</td>
<td>80 J</td>
</tr>
<tr>
<td>7 - 10</td>
<td>30 kg</td>
<td>120 J</td>
</tr>
<tr>
<td>11 - 12</td>
<td>40 kg</td>
<td>160 J</td>
</tr>
<tr>
<td>≥ 13</td>
<td>50 kg</td>
<td>200 J</td>
</tr>
</tbody>
</table>

**CPR** 2 minutes

**Shockable?** then **shock**

**IV adrenaline 10 micrograms/kg**

**CPR** 2 minutes

**continued next page**
Shockable? then shock
After third shock give IV amiodarone 5 mg/kg in dextrose 5% 20 mL

CPR 2 minutes

Shockable? then shock

IV adrenaline 10 micrograms/kg
CPR 2 minutes

Shockable? then shock

CPR 2 minutes

Shockable? then shock

IV adrenaline 10 micrograms/kg
CPR 2 minutes

Shockable? then shock

CPR 2 minutes

Shockable? then shock

continued next page
IV adrenaline 10 micrograms/kg
CPR 2 minutes

Shockable? then shock
CPR 2 minutes

CPR now exceeds 20 minutes. Seek expert advice and consider stopping.

Post-resuscitation care:
Re-evaluate ABCDE and re-assess all tubes and lines
Cervical collar if required
Twelve lead ECG
CXR, IDC, nasogastric tube
Temperature probe in nasopharynx, oesophagus or bladder
Assess for injuries from resuscitation
Treat precipitating causes (consider antibiotics, seizure management)
Aim for normal sats and normal PaCO₂ unless specific conditions
Aim for normoglycaemia
Targeted temperature management aiming 32 to 37 °C
Psychological support for family and staff

Seek expert advice regarding ongoing care and transfer
Protect airway in recovery position (consider nasopharyngeal airway)
High-flow oxygen and suction

Attempt IV access
If IV access then take blood for FBC, EUC, CaMgPh, anticonvulsant levels, and culture

Check blood glucose (from IV or fingerprick). If blood glucose < 3.0 mmol/L then give IV dextrose 10% 2 mL/kg, followed by infusion of IV dextrose 10% at 5 mL/kg/hour, and check blood glucose again in 5 minutes.

Unless given pre-hospital, give:

**IV or IM midazolam 0.15 mg/kg** (see chart below, maximum 10 mg)

OR

**buccal or intranasal midazolam 0.3 mg/kg** (see chart below, maximum 10 mg)

OR

**IV diazepam 0.25 mg/kg** (maximum 10 mg, do not give IM diazepam)

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Weight</th>
<th>Midazolam IV/IM</th>
<th>Midazolam Buccal/Intranasal</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 1</td>
<td>5 - 10kg</td>
<td>0.75 - 1.5 mg</td>
<td>1.5 - 3 mg</td>
</tr>
<tr>
<td>1 - 2</td>
<td>10 kg</td>
<td>1.5 mg</td>
<td>3 mg</td>
</tr>
<tr>
<td>3 - 4</td>
<td>15 kg</td>
<td>2.25 mg</td>
<td>4.5 mg</td>
</tr>
<tr>
<td>5 - 6</td>
<td>20 kg</td>
<td>3 mg</td>
<td>6 mg</td>
</tr>
<tr>
<td>7 - 10</td>
<td>30 kg</td>
<td>4.5 mg</td>
<td>9 mg</td>
</tr>
<tr>
<td>11 - 12</td>
<td>40 kg</td>
<td>5 mg</td>
<td>10 mg</td>
</tr>
<tr>
<td>≥ 13</td>
<td>50 kg</td>
<td>7.5 mg</td>
<td>10 mg</td>
</tr>
</tbody>
</table>

continued next page
If still fitting after 5 minutes give:

**IV or IM midazolam 0.15 mg/kg** (see chart on previous page, maximum 10 mg)

**OR**

**buccal or intranasal midazolam 0.3 mg/kg** (see chart, maximum 10 mg)

**OR**

**IV diazepam 0.25 mg/kg** (maximum 10 mg)

If still fitting after 5 minutes give:

**IV or IO phenytoin 20 mg/kg** in normal saline 100 mL over 20 minutes (or IV/IO phenytoin 10 mg/kg if already on phenytoin) with ECG monitoring. Do not exceed 50 mg/min or 1 mg/kg/min, whichever is slower.

**OR**

**IV or IO levetiracetam 20 mg/kg** in normal saline 100 mL over 20 minutes

**OR**

**IV or IO phenobarbitone 20 mg/kg** (or IV/IO phenobarbitone 10 mg/kg if already on phenobarbitone)

Continuously monitor respirations, oxygen saturations, heart rate, blood pressure and ECG while fitting or unconscious

A child whose **conscious state is not improving** as expected after apparent termination of the seizure may be in **subclinical status** and require further treatment

**If seizures continue then seek expert advice**

**If seizures continue:**

consider **rapid sequence induction** with IV thiopentone 2 to 5 mg/kg

arrange **retrieval** or **PICU transfer**
CALL FOR HELP  INFORM TEAM  CRASH CART

Maintain **airway**
Assist **breathing** as necessary
High-flow **oxygen**

**If unstable** (hypotension or altered conscious state) and **without IV/IO access:**

- synchronous DC shock **1 J/kg** (see chart below)
- if unsuccessful then synchronous DC shock **2 J/kg**
- if unsuccessful then synchronous DC shock **2 J/kg** and consider IV **amiodarone 5 mg/kg** over 20 minutes
- seek **expert advice** and send **12-lead ECG**

### Age (years)  |  Weight  | Shock 1 J/kg  | Shock 2 J/kg  | Amiodarone
---|---|---|---|---
< 1  | 5 - 10kg  | 5 - 10 J  | 10 - 20 J  | 25 - 50 mg
1 - 2  | 10 kg  | 10 J  | 20 J  | 50 mg
3 - 4  | 15 kg  | 15 J  | 30 J  | 75 mg
5 - 6  | 20 kg  | 20 J  | 40 J  | 100 mg
7 - 10  | 30 kg  | 30 J  | 60 J  | 150 mg
11 - 12  | 40 kg  | 40 J  | 80 J  | 200 mg
≥ 13  | 50 kg  | 50 J  | 100 J  | 250 mg

**If stable** attempt **vagal manoeuvre:**

- infants: **cold stimulus** to the face (eg. washcloth soaked in ice water)
- children: **Valsalva** manoeuvre (eg. ask child to blow plunger out of syringe)
- do not use orbital pressure
- seek **expert advice** and send **12-lead ECG**

continued next page
If intravenous or intraosseous access:

**IV adenosine 100 micrograms/kg** (see chart below)

if unsuccessful after 2 minutes then **IV adenosine 200 micrograms/kg**

if unsuccessful after 2 minutes then **IV adenosine 300 micrograms/kg**

seek **expert advice** and send **12-lead ECG**

consider:

- IV adenosine 400 to 500 micrograms/kg
  (maximum in neonate 300 micrograms/kg, maximum in older child 12 mg)

  OR

- synchronous DC shock (may need procedural sedation)

  OR

- IV amiodarone 5 mg/kg over 20 to 60 minutes

  OR

- other anti-arrhythmic medication

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Weight</th>
<th>Adenosine 100 mcg/kg</th>
<th>Adenosine 200 mcg/kg</th>
<th>Adenosine 300 mcg/kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 1</td>
<td>5 - 10kg</td>
<td>0.5 - 1 mg</td>
<td>1 - 2 mg</td>
<td>1.5 - 3 mg</td>
</tr>
<tr>
<td>1 - 2</td>
<td>10 kg</td>
<td>1 mg</td>
<td>2 mg</td>
<td>3 mg</td>
</tr>
<tr>
<td>3 - 4</td>
<td>15 kg</td>
<td>1.5 mg</td>
<td>3 mg</td>
<td>4.5 mg</td>
</tr>
<tr>
<td>5 - 6</td>
<td>20 kg</td>
<td>2 mg</td>
<td>4 mg</td>
<td>6 mg</td>
</tr>
<tr>
<td>7 - 10</td>
<td>30 kg</td>
<td>3 mg</td>
<td>6 mg</td>
<td>9 mg</td>
</tr>
<tr>
<td>11 - 12</td>
<td>40 kg</td>
<td>4 mg</td>
<td>8 mg</td>
<td>12 mg</td>
</tr>
<tr>
<td>≥ 13</td>
<td>50 kg</td>
<td>5 mg</td>
<td>10 mg</td>
<td>12 mg</td>
</tr>
</tbody>
</table>

Check **electrolytes**

Refer to paediatric cardiologist
PAEDIATRIC TACHYCARDIA

> 160/MINUTE IF AGE < 2 YEARS
> 140/MINUTE IF AGE 2 TO 12 YEARS
> 100/MINUTE IF AGE > 12 YEARS

IF NO PULSE THEN GO TO PAGE 75 (PULSELESS VT)

CALL FOR HELP | INFORM TEAM | CRASH CART

Maintain airway
Assist breathing as necessary
High-flow oxygen
Attach oximetry, blood pressure monitor and cardiac monitor
**Intravenous** or **intraosseous** access
12-lead ECG if available (don't delay therapy)

Evaluate QRS duration where 1 mm (small square) on ECG is 0.04 seconds

If QRS > 0.09 s then this could be **ventricular tachycardia:**
ventricular rate usually > 120/minute and regular
P waves often not seen
T waves often opposite in polarity from QRS complex
consider underlying cause: electrolyte abnormality (hyperkalaemia, hypocalcaemia, hypomagnesaemia), congenital heart disease and surgery, myositis, cardiomyopathy, long QT syndrome, drug toxicity
or may be SVT with aberrant intraventricular conduction

If QRS > 0.09 s then assume VT until proven otherwise and go to page 72 (VT)

continued next page
If $\text{QRS} \leq 0.09 \text{ s}$ then is this **supraventricular tachycardia**?

- vague, nonspecific history
- history of abrupt rate changes
- infants: rate usually $\geq 220/\text{minute}$
- children: rate usually $\geq 180/\text{minute}$
- no variation in heart rate
- absent or abnormal P waves

**If supraventricular tachycardia then go to page 62**

If $\text{QRS} \leq 0.09 \text{ s}$ then is this **sinus tachycardia**?

- history consistent with known cause
- infants: rate usually $< 220/\text{minute}$
- children: rate usually $< 180/\text{minute}$
- normal P waves
- constant PR interval, variable R-R interval

**If sinus tachycardia then search for and treat cause:**

- consider **sepsis**:
  - check lactate
  - follow sepsis pathway
- consider **surgical emergency** (eg. ischaemic bowel):
  - check lactate
  - consider CXR, AXR and ultrasound
  - seek early advice from surgeons even if there are no abdominal signs

**Seek expert advice**
PAEDIATRIC VENTRICULAR FIBRILLATION

CPR: 15 COMPRESSIONS : 2 BREATHS
100 TO 120 PER MINUTE
COMPRESSION DEPTH 1/3 OF CHEST
HAND ON LOWER HALF OF STERNUM
MINIMISE INTERRUPTIONS

CALL FOR HELP INFORM TEAM CRASH CART

START CPR

Attach defibrillator or monitor

If the rhythm is shockable (VF or pulseless VT) then shock using 4 J/kg

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Weight</th>
<th>Shock</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 1</td>
<td>5 - 10kg</td>
<td>20 - 40 J</td>
</tr>
<tr>
<td>1 - 2</td>
<td>10 kg</td>
<td>40 J</td>
</tr>
<tr>
<td>3 - 4</td>
<td>15 kg</td>
<td>60 J</td>
</tr>
<tr>
<td>5 - 6</td>
<td>20 kg</td>
<td>80 J</td>
</tr>
<tr>
<td>7 - 10</td>
<td>30 kg</td>
<td>120 J</td>
</tr>
<tr>
<td>11 - 12</td>
<td>40 kg</td>
<td>160 J</td>
</tr>
<tr>
<td>≥ 13</td>
<td>50 kg</td>
<td>200 J</td>
</tr>
</tbody>
</table>

Consider airway adjuncts (oro- or naso-pharyngeal airway, and if skilled LMA or ETT)
High-flow oxygen
Intravenous or intraosseous access

continued on page 69
FIND AND TREAT CAUSE

OBTAIN BEDSIDE BLOODS AND CONSIDER CARDIAC ULTRASOUND

If hypoxia give high-flow oxygen, check connections, check for bilateral breath sounds, suction endotracheal tube and reconfirm placement, consider CXR

If hypovolaemia give IV normal saline 20 mL/kg and check haemoglobin

If hyperkalaemia:
  - give IV calcium gluconate 10% 0.7 mL/kg or IV calcium chloride 10% 0.2 mL/kg
  - give IV insulin 0.1 units/kg with IV dextrose 10% 5 mL/kg
  - give IV sodium bicarbonate 8.4% 1 mL/kg (maximum 50 mL)

If hypokalaemia give IV potassium chloride 1 mmol/mL 0.03 to 0.07 mL/kg (maximum 5 mL) slow injection and IV magnesium sulphate 50% 0.05 to 0.10 mL/kg bolus (maximum 2.5 mL)

If profound acidosis consider IV sodium bicarbonate 8.4% 1 mL/kg (maximum 50 mL)

If hypothermia use forced air blanket, warm IV fluids, raise room temperature

If hyperthermia consider sepsis, heat stroke, malignant hyperthermia, serotonin toxicity, and neuroleptic malignant syndrome (seek expert advice)

If hypocalcaemia give IV calcium gluconate 10% 0.7 mL/kg (maximum 20 mL) or IV calcium chloride 10% 0.2 mL/kg

Consider toxins including medications, infusions, ingestions, and medication error

Consider tension pneumothorax. Check for signs and perform emergency needle decompression or finger thoracostomy. Call for CXR but do not delay treatment.

Consider thrombosis including pulmonary embolus, myocardial infarct and stroke

Consider cardiac tamponade
Simultaneously Find and Treat Cause (facing page)

Plan actions before interrupting compressions

CPR 2 minutes
Look at the clock
Waveform capnography (end-tidal CO₂ monitoring)

Shockable? then shock

IV adrenaline 10 micrograms/kg followed by normal saline flush

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Weight</th>
<th>Adrenaline dose</th>
<th>Adrenaline volume 1:10,000</th>
</tr>
</thead>
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<td>&lt; 1</td>
<td>5 - 10 kg</td>
<td>50 - 100 mcg</td>
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<td>40 kg</td>
<td>400 mcg</td>
<td>4 mL</td>
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<tr>
<td>≥ 13</td>
<td>50 kg</td>
<td>500 mcg</td>
<td>5 mL</td>
</tr>
</tbody>
</table>

If only 1:1,000 adrenaline available then dilute to 10 mL with normal saline and dose as above

CPR 2 minutes

Shockable? then shock

After third shock give IV amiodarone 5 mg/kg in dextrose 5% 20 mL

continued next page
<table>
<thead>
<tr>
<th>Step</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CPR 2 minutes</td>
</tr>
<tr>
<td>2</td>
<td>Shockable? then shock</td>
</tr>
<tr>
<td>3</td>
<td>IV adrenaline 10 micrograms/kg</td>
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<td>4</td>
<td>CPR 2 minutes</td>
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</tr>
<tr>
<td>12</td>
<td>CPR 2 minutes</td>
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</table>

continued next page
Shockable? then shock

CPR 2 minutes

CPR now exceeds 20 minutes. Seek expert advice and consider stopping.

Post-resuscitation care:
Re-evaluate ABCDE and re-assess all tubes and lines
Cervical collar if required
Twelve lead ECG
CXR, IDC, nasogastric tube
Temperature probe in nasopharynx, oesophagus or bladder
Assess for injuries from resuscitation
Treat precipitating causes (consider antibiotics, seizure management)
Aim for normal sats and normal PaCO$_2$ unless specific conditions
Aim for normoglycaemia
Targeted temperature management aiming 32 to 37 °C
Psychological support for family and staff

Seek expert advice regarding ongoing care and transfer
Assess and support airway and breathing
High-flow oxygen
Attach oximetry, blood pressure monitor and cardiac monitor
Intravenous or intraosseous access
12-lead ECG if available (don’t delay therapy)

If pulse but compromised (hypotension, obtunded) then urgent cardioversion:
Give short-acting IV sedation as required. Be prepared to support airway.
Ensure the defibrillator is synchronised
Perform synchronised DC cardioversion 1 J/kg
(if fails to discharge then use asynchronous shock)
If no response then perform synchronised DC cardioversion 2 J/kg
If no response then give IV amiodarone 5 mg/kg in dextrose 5%
If no response then perform synchronised DC cardioversion 2 J/kg
Seek expert advice

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Weight</th>
<th>Shock 1 J/kg</th>
<th>Shock 2 J/kg</th>
<th>Amiodarone</th>
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<tbody>
<tr>
<td>&lt; 1</td>
<td>5 - 10kg</td>
<td>5 - 10 J</td>
<td>10 - 20 J</td>
<td>25 - 50 mg</td>
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<td>1 - 2</td>
<td>10 kg</td>
<td>10 J</td>
<td>20 J</td>
<td>50 mg</td>
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<td>3 - 4</td>
<td>15 kg</td>
<td>15 J</td>
<td>30 J</td>
<td>75 mg</td>
</tr>
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<td>20 J</td>
<td>40 J</td>
<td>100 mg</td>
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<td>60 J</td>
<td>150 mg</td>
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<td>11 - 12</td>
<td>40 kg</td>
<td>40 J</td>
<td>80 J</td>
<td>200 mg</td>
</tr>
<tr>
<td>≥ 13</td>
<td>50 kg</td>
<td>50 J</td>
<td>100 J</td>
<td>250 mg</td>
</tr>
</tbody>
</table>

continued next page
If **haemodynamically stable** then:

**IV amiodarone 5 mg/kg** (maximum 250 mg, see chart below) in dextrose 5% over 1 to 4 hours

Consider **synchronous DC shock**

Seek **expert advice** and **send 12-lead ECG**

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Weight</th>
<th>Shock 1 J/kg</th>
<th>Shock 2 J/kg</th>
<th>Amiodarone</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 1</td>
<td>5 - 10kg</td>
<td>5 - 10 J</td>
<td>10 - 20 J</td>
<td>25 - 50 mg</td>
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<td>10 J</td>
<td>20 J</td>
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<td>3 - 4</td>
<td>15 kg</td>
<td>15 J</td>
<td>30 J</td>
<td>75 mg</td>
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<td>40 J</td>
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<td>7 - 10</td>
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<td>≥ 13</td>
<td>50 kg</td>
<td>50 J</td>
<td>100 J</td>
<td>250 mg</td>
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</table>
PAEDIATRIC PULSELESS VENTRICULAR TACHYCARDIA

CPR: 15 COMPRESSIONS : 2 BREATHS
100 TO 120 PER MINUTE
COMPRESSION DEPTH 1/3 OF CHEST
HAND ON LOWER HALF OF STERNUM
MINIMISE INTERRUPTIONS

CALL FOR HELP  INFORM TEAM  CRASH CART

START CPR

Attach defibrillator or monitor

If the rhythm is shockable (VF or pulseless VT) then shock using 4 J/kg

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Weight</th>
<th>Shock</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 1</td>
<td>5 - 10kg</td>
<td>20 - 40 J</td>
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<tr>
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<td>10 kg</td>
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<tr>
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<td>60 J</td>
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<td>120 J</td>
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<tr>
<td>11 - 12</td>
<td>40 kg</td>
<td>160 J</td>
</tr>
<tr>
<td>≥ 13</td>
<td>50 kg</td>
<td>200 J</td>
</tr>
</tbody>
</table>

Consider airway adjuncts (oro- or naso-pharyngeal airway, and if skilled LMA or ETT)
High-flow oxygen
Intravenous or intraosseous access

continued on page 77
**FIND AND TREAT CAUSE**

**OBTAIEND BEDSIDE BLOODS AND CONSIDER CARDIAC ULTRASOUND**

If hypoxia give high-flow **oxygen**, check connections, check for bilateral breath sounds, suction endotracheal tube and reconfirm placement, consider **CXR**

If hypovolaemia give **IV normal saline** 20 mL/kg and check haemoglobin

If hyperkalaemia:
- give **IV calcium gluconate 10%** 0.7 mL/kg or **IV calcium chloride 10%** 0.2 mL/kg
- give **IV insulin** 0.1 units/kg with **IV dextrose 10%** 5 mL/kg
- give **IV sodium bicarbonate 8.4%** 1 mL/kg (maximum 50 mL)

If hypokalaemia give **IV potassium chloride 1 mmol/mL** 0.03 to 0.07 mL/kg (maximum 5 mL) slow injection and **IV magnesium sulphate 50%** 0.05 to 0.10 mL/kg bolus (maximum 2.5 mL)

If profound **acidosis** consider **IV sodium bicarbonate 8.4%** 1 mL/kg (maximum 50 mL)

If hypothermia use forced air blanket, **warm IV fluids**, raise room temperature

If hyperthermia consider sepsis, heat stroke, malignant hyperthermia, serotonin toxicity, and neuroleptic malignant syndrome (seek expert advice)

If hypocalcaemia give **IV calcium gluconate 10%** 0.7 mL/kg (maximum 20 mL) or **IV calcium chloride 10%** 0.2 mL/kg

Consider **toxins** including medications, infusions, ingestions, and medication error

Consider **tension pneumothorax**. Check for signs and perform emergency needle decompression or finger thoracostomy. Call for CXR but do not delay treatment.

Consider **thrombosis** including pulmonary embolus, myocardial infarct and stroke

Consider **cardiac tamponade**
Simultaneously **Find and Treat Cause** (facing page)

**Plan actions** before interrupting compressions

**CPR** 2 minutes

Look at the **clock**

Waveform capnography (end-tidal CO\(_2\) monitoring)

**Shockable? then shock**

**IV adrenaline 10 micrograms/kg** followed by normal saline flush

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Weight</th>
<th>Adrenaline dose</th>
<th>Adrenaline volume 1:10,000</th>
</tr>
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<tbody>
<tr>
<td>&lt; 1</td>
<td>5 - 10 kg</td>
<td>50 - 100 mcg</td>
<td>0.5 - 1 mL</td>
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<tr>
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If only 1:1,000 adrenaline available then dilute to 10 mL with normal saline and dose as above

**CPR** 2 minutes

**Shockable? then shock**

After third shock give **IV amiodarone 5 mg/kg** in dextrose 5% 20 mL

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<table>
<thead>
<tr>
<th>Step</th>
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<tbody>
<tr>
<td>1</td>
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continued next page
Shockable? then shock

CPR 2 minutes

CPR now exceeds 20 minutes. Seek expert advice and consider stopping.

Post-resuscitation care:
Re-evaluate ABCDE and re-assess all tubes and lines
Cervical collar if required
Twelve lead ECG
CXR, IDC, nasogastric tube
Temperature probe in nasopharynx, oesophagus or bladder
Assess for injuries from resuscitation
Treat precipitating causes (consider antibiotics, seizure management)
Aim for normal sats and normal PaCO$_2$ unless specific conditions
Aim for normoglycaemia
Targeted temperature management aiming 32 to 37 °C
Psychological support for family and staff

Seek expert advice regarding ongoing care and transfer
If newborn is **term gestation, breathing or crying**, and **good tone**, then:

- maintain normal temperature, wrap and give to mother
- ongoing evaluation of respiratory effort

If **not** term gestation, breathing or crying, or good tone, then:

- **maintain normal temperature** (resuscitation table with heater if available)
- ensure **open airway**
- **stimulate**

If **heart rate > 100** and **laboured breathing or persistent cyanosis**, then:

- ensure **open airway**
- monitor **oxygen saturations** on right hand
- consider **CPAP** (see Neopuff™ on page 82)

If **heart rate < 100**, **gasping** or **apnoea**, then for 30 seconds:

- **positive pressure ventilation**
- monitor **oxygen saturations** on right hand

If **heart rate < 100** then for 30 seconds:

- ensure **open airway**
- reduce **leaks**
- consider **increasing pressure and using oxygen**
- consider **laryngeal mask airway (LMA)** or if skilled **intubation**

continued next page
If heart rate < 60 then:

- add chest compressions (three compressions then a breath, at a rate of one compression every half a second)
- 100% oxygen
- LMA or intubation
- intravenous or intraosseous access (consider umbilical vein catheter)

If heart rate < 60 after a few minutes then:

- repeat IV adrenaline 10 to 30 micrograms/kg (0.1 to 0.3 mL/kg of 1:10,000 adrenaline)
- consider volume expansion (IV normal saline 10 mL/kg)
- seek expert advice

Gestation (weeks) | IV adrenaline (1:10,000) | IV normal saline
--- | --- | ---
23 - 26 | 0.1 mL | 7.5 mL
27 - 37 | 0.25 mL | 20 mL
38 - 43 | 0.5 mL | 35 mL

If heart rate < 60 after a few minutes then:

- repeat IV adrenaline 10 to 30 micrograms/kg (0.1 to 0.3 mL/kg of 1:10,000 adrenaline)
- consider volume expansion (IV normal saline 10 mL/kg)
- seek expert advice

Target pre-ductal (right hand) oxygen saturations after birth:

- 1 minute 60 - 70 %
- 2 minutes 65 - 85 %
- 3 minutes 70 - 90 %
- 4 minutes 75 - 90 %
- 5 minutes 80 - 90 %
- 10 minutes 85 - 90 %
**SETUP**

Neopuff does not have an “On” button

**Connect air outlet on wall** to **Gas Inlet** on Neopuff

Turn **air** at **wall outlet** to **10 L/min**

**Connect T-piece circuit** to **Gas Outlet** on Neopuff

Fit test lung onto T-piece (if no test lung then occlude open end of T-piece with palm of hand)

Set the **Positive End Expiratory Pressure (PEEP)**:

On the T-piece, **turn the little white (PEEP) cap** until the needle on the Neopuff points to **5 cmH\textsubscript{2}O**

Set the **Peak Inspiratory Pressure (PIP)**:

On the T-piece, **use your thumb to occlude** the **little white (PEEP) cap**

AND at the same time:

On the Neopuff, **turn the Peak Inspiratory Pressure (PIP) knob** until needle points to **30 cmH\textsubscript{2}O**

Neopuff is now set up
RESUSCITATION

USE WITH NEONATAL RESUSCITATION ON PAGE 80

Fit neonatal face mask onto T-piece

INSPIRATION: thumb on the little white PEEP cap for half a second ("breathe")

EXPIRATION: thumb off (count “two-three”)

REPEAT: aiming for ventilation rate of 40 to 60 per minute ("breathe-two-three")

Check the mask has a good seal, as shown by PEEP of 5 cmH₂O during expiration

If oxygen saturations are not improving despite effective ventilation then use higher concentration of oxygen

SEE NEONATAL RESUSCITATION ON PAGE 80
Emergency Protocols are a flight manual for the crashing patient.

In medicine competence is often measured by the ability to remember. Doctors have been taught to manage emergencies independently, by calmly reciting steps that may be stumbled over in a crisis managed by a team.

Cognitive aids, such as checklists and emergency manuals, have been frowned upon as “cookbook” medicine that somehow simplifies treatment – as if that is a bad thing in an emergency. Of course cognitive aids are no substitute for clinical acumen, good training, hard-won experience, and rehearsal with simulators. But perhaps the real opposition is to changing the image of the doctor in an emergency, away from the swashbuckling hero and towards a more human, more fallible, more integrated team member.

Pilots, military commanders and nuclear power plant operators use cognitive aids because:

- in a crisis memory fails, cognition is overloaded, “tunnel vision” develops, performance degrades, and distractions interrupt planned actions\(^1,2\)
- relevant literature can be difficult to find, poorly structured, and excessively detailed
- aviators have long demonstrated the safety benefits of a culture of teamwork engrained with cognitive aids and crew resource management techniques\(^3,4\)
- expertise requires repeated practice, and no-one is an expert in every emergency.

Using cognitive aids the doctor, like the pilot, still “flies the plane” and makes the big decisions. But cognitive aids improve performance, safety and satisfaction, which is why they have been widely adopted across industries managing time-critical emergencies. Good evidence supports cognitive aids in simulated medical emergencies.\(^5,6,7\) A trial from Harvard using intra-operative crisis checklists demonstrated a 73% reduction in critical errors, with 97% of participants wanting the checklists used if they were undergoing an operation.\(^8\) The adoption of cognitive aids in medicine is a cultural change whose time has come.

Emergency Protocols are integrated and improved guidelines from peak medical organisations. These protocols are linear and stepwise, rather than branching and looping, because sequential algorithms are simpler and safer in medical emergencies.\(^9\) Printed protocols are more accessible, user-friendly, familiar, robust and reliable than screen-based applications.

Emergency Protocols are standardised with common-sense definitions. A “difficult airway” is something that you predict. A “failed airway” is something that happens to you. The diagrams in the Ventilation protocol feature the ubiquitous Oxylog transport ventilator, the little orange workhorse of Australian retrieval medicine.

Emergency Protocols work best when doctors and nurses are familiar with the protocols and have trained with them in simulated emergencies.\(^10\) Assigning a reader is recommended\(^11\) as the reader can prompt the team and help avoid the task fixation common in medical emergencies.

Emergency Protocols are developed and tested by a team of doctors, nurses, graphic designers, a senior commercial pilot and ex-military test pilot, and human factors practitioners. These protocols are constantly updated as expert opinion evolves. New guidelines are parsed, refined, integrated and iteratively tested. Drug doses are presented as the amount and concentration of the commonly available formulation, minimising calculation and confusion in emergency drug administration. Protocol steps are practical, such as checking oxygen connections for the hypoxic patient. There is no extraneous information to wade through. In an emergency you don’t need to know the level of evidence . . . just what to do next.
The Trial of Emergency Medicine Protocols in Simulation Training (TEMPIST) is a large prospective randomised block-controlled simulator-based trial studying doctors and nurses managing simulated medical emergencies with and without Emergency Protocols. TEMPIST is underway at the University Centre for Rural Health in Lismore, NSW. Outcome measures are critical life-saving steps specific to each scenario, recorded on video and by high-fidelity manikin. Data collection has been completed. Preliminary analysis demonstrates a 54% decrease in critical errors when using Emergency Protocols, across a wide range of clinical scenarios and clinician seniority. Results will be published in a peer-reviewed journal and available at [www.emergencyprotocols.org.au](http://www.emergencyprotocols.org.au).

Emergency Protocols are used in Advanced Emergency Performance Training (ADEPT). The ADEPT course teaches high-level non-technical skills to doctors, nurses and allied health professionals. ADEPT features ex-military pilots and human factors professionals. Two innovative days optimise the participants skills in leadership, teamwork, communication, assertion, conflict management, self-awareness, situation awareness and decision-making. ADEPT is accredited for Continuing Professional Development points by the Australasian College of Emergency Medicine and the Australian College of Rural and Remote Medicine.

Emergency Protocols are endorsed by the Emergency Care Institute of the Agency for Clinical Innovation and by the Australian College of Rural and Remote Medicine.

References


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