



EMERGENCY PROTOCOLS



PAEDIATRIC

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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 2019, and should not be used after June 2021.

Author: Dean Robertson MBChB MBA DCH FACRRM
GP VMO, Emergency Department, Maclean District Hospital, NSW

Editor: Charlotte Hall BMed MSc GradCertClinEd FACEM
Emergency Physician and Medical Educator, North Coast NSW

Managing Editor: John Mackenzie MBChB DipMSM FACEM
Emergency Physician and Hyperbaric Medicine Consultant, Prince of Wales Hospital, NSW
Medical Project Officer, Emergency Care Institute, Agency for Clinical Innovation, NSW

Toxicology Editor: Lindsay Murray MBBS FACEM
Clinical Toxicologist and Emergency Physician, Lismore Base Hospital, NSW



Endorsed by the Emergency Care Institute of the Agency for Clinical Innovation and by the Australian College of Rural & Remote Medicine.

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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)

Emergency Care Institute (www.aci.health.nsw.gov.au/networks/eci)

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 June 2021

PAEDIATRIC AIRWAY

page 1 of 11

CALL FOR HELP



INFORM TEAM

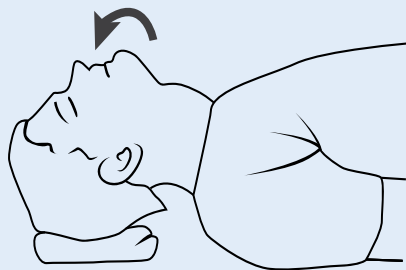


CRASH CART

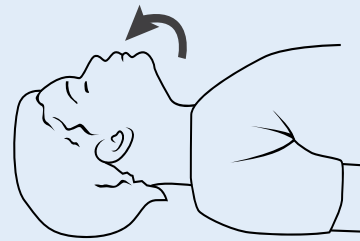
IF UNRESPONSIVE AND NEAR DEATH GO TO PAGE 12 (AIRWAY - CRASH)

Open and clear the airway:

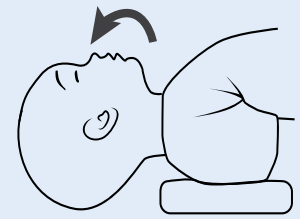
sniffing position (unless cervical spine injury)



older child



small child



infant

external auditory canal anterior to shoulder

infants may need a towel under the shoulders

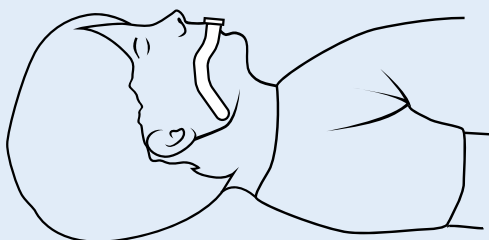
older children may need a towel under the head

chin lift

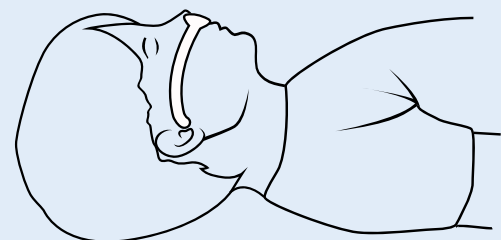
jaw thrust

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

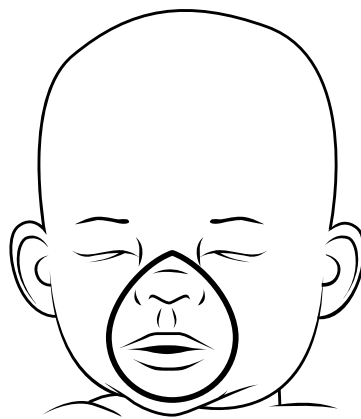


Nasopharyngeal size:
nostril to tragus of ear

continued next page

Bag-mask ventilate with 100% oxygen

Age	Mask size
newborn	00
neonate	0/1
infant	2
small child	3
large child	4
adult	5



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 14 (AIRWAY - FAILED)

continued next page

PRE-OXYGENATE

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

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

ESTIMATE WEIGHT AND ETT SIZE

Estimate weight using chart below or Broselow tape 

Age (years)	Weight	Cuffed ETT size (mm)	ETT length at lips (cm)	LMA size
birth	3 kg	3.0	9	1
3 months	6 kg	3.0	11	1.5
6 months	7.5 kg	3.0	12	1.5
1	10 kg	3.5	13	2
2	12 kg	3.5	13	2
3	14 kg	4.0	13.5	2
4	16 kg	4.0	14	2
5	18 kg	4.5	14.5	2
6	20 kg	4.5	15	2.5
7 - 8	25 kg	5.0	15.5	2.5
9 - 10	30 kg	5.5	16.5	3
11 - 12	40 kg	6.0	18	3
≥ 13	50 kg	7.0	18	3

Use equipment from **weight-based drawer** if available 


Choose ETT sizes using chart above 

IF PREDICTED DIFFICULT AIRWAY GO TO PAGE 13 (AIRWAY - DIFFICULT)

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

continued next page

INTUBATION DRUGS

Draw up **induction** drug: (see chart on next page) 


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: (see chart on next page) 

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

INTUBATION DRUGS (NEXT TWO PAGES)

PRE-INTUBATION CHECKLIST (FOLLOWING TWO PAGES)



PAEDIATRIC INTUBATION DRUGS



Prepare drugs
using instructions on facing page



Weigh patient
or estimate weight using this chart



Small volumes can be drawn up with
1 mL syringe attached via **three-way tap**

0.1

Give 0.1 mL/kg of each drug
eg. 24 kg child receives 2.4 mL of each drug

Flushes in 20 mL syringes

Age	Weight	Volume 0.1 mL/kg
33 weeks gestation	2 kg	0.2 mL
35 weeks gestation	2.5 kg	0.25 mL
37 weeks gestation	3 kg	0.3 mL
Term	3.5 kg	0.35 mL
2 weeks	4 kg	0.4 mL
4 weeks	4.5 kg	0.45 mL
6 weeks	5 kg	0.5 mL
2 months	5.5 kg	0.55 mL
3 months	6 kg	0.6 mL
5 months	7 kg	0.7 mL
6 months	8 kg	0.8 mL
9 months	9 kg	0.9 mL
12 months	10 kg	1 mL
18 months	11 kg	1.1 mL
2 years	12 kg	1.2 mL
2 ½ years	13 kg	1.3 mL
3 years	14 kg	1.4 mL
3 ½ years	15 kg	1.5 mL
4 years	16 kg	1.6 mL
4 ½ years	17 kg	1.7 mL
5 years	18 kg	1.8 mL
5 ½ years	19 kg	1.9 mL
6 years	20 kg	2 mL
6 ½ years	22 kg	2.2 mL
7 years	24 kg	2.4 mL
8 years	26 kg	2.6 mL
9 years	28 kg	2.8 mL
10 years	30 kg	3 mL
11 years	35 kg	3.5 mL
12 years	40 kg	4 mL
13 years	45 kg	4.5 mL
14 years	50 kg	5 mL



PAEDIATRIC INTUBATION DRUGS

	Dose/kg	Preparation	Concentration	Volume/kg
IV atropine	20 microg/kg	draw up 600 microg/1 mL vial into 3 mL syringe, dilute to 3 mL with saline	200 microg/mL	0.1 mL/kg
IV ketamine	2 mg/kg	draw up 200 mg/2 mL vial into 10 mL syringe, dilute to 10 mL with saline	20 mg/mL	0.1 mL/kg
IV suxamethonium	2 mg/kg	draw up 100 mg/2 mL vial into 5 mL syringe, dilute to 5 mL with saline	20 mg/mL	0.1 mL/kg
IV rocuronium	1 mg/kg	draw up 50 mg/5 mL vial into 5 mL syringe	10 mg/mL	0.1 mL/kg
IV midazolam	0.15 mg/kg	draw up 15 mg into 10 mL syringe, dilute to 10 mL with saline	1.5 mg/mL	0.1 mL/kg
IV morphine	0.1 mg/kg	draw up 10 mg/1 mL vial into 10 mL syringe, dilute to 10 mL with saline	1 mg/mL	0.1 mL/kg
IV fentanyl	1 microg/kg	draw up 100 microg/2 mL vial into 10 mL syringe, dilute to 10 mL with saline	10 microg/mL	0.1 mL/kg
IV vecuronium	0.1 mg/kg	add 10 mL water to 10 mg vial, draw up into 10 mL syringe	1 mg/mL	0.1 mL/kg



PRE-INTUBATION

TEAM

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)

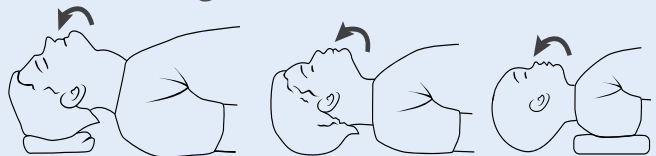
Anticipated **problems**?

Questions or **concerns**?

PATIENT

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 O₂ 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 O₂

Monitoring equipment:

end-tidal CO₂

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: (see previous pages)

ketamine 2 mg/kg

or **propofol** 3 mg/kg

or **thiopentone** 2 to 5 mg/kg

Paralysis drug: (see previous pages)

suxamethonium 2 mg/kg

or **rocuronium** 1.2 mg/kg

Vasopressor drug:

metaraminol 5 to 10 mcg/kg

Post-intubation drug infusion:

propofol

or **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 \geq 90%

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


Plan C: maintenance of oxygenation: **laryngeal mask airway**, three attempts, sats \geq 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 14 (AIRWAY - FAILED)

continued next page

If **successful intubation** then go to **Airway - Secure** (page 16) 

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 **successful intubation** then go to **Airway - Secure** (page 16) 

IF UNSUCCESSFUL THEN GO TO PAGE 14 (AIRWAY - FAILED)

PAEDIATRIC AIRWAY - CRASH

page 1 of 1

PATIENT UNRESPONSIVE AND NEAR DEATH

 CALL FOR HELP



INFORM TEAM



CRASH CART

Maintain **oxygenation**

Attempt intubation. If successful then go to **Airway - Secure** (page 16)

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

IF UNABLE TO VENTILATE THEN GO TO PAGE 14 (AIRWAY - FAILED)

IV **suxamethonium** 2 mg/kg

Attempt intubation. If successful then go to **Airway - Secure** (page 16)

Bag-mask ventilate with 100% oxygen

IF UNABLE TO VENTILATE THEN GO TO PAGE 14 (AIRWAY - FAILED)

Attempt intubation. If successful then go to **Airway - Secure** (page 16)

Bag-mask ventilate with 100% oxygen

GO TO PAGE 14 (AIRWAY - FAILED)

PAEDIATRIC AIRWAY - DIFFICULT

page 1 of 1

 CALL FOR HELP



INFORM TEAM



CRASH CART

If forced to act:

give induction and paralysis **drugs** (pages 6 & 7)

one best attempt by most experienced operator

if **successful** then go to **Airway - Secure** (page 16)

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

or **laryngeal mask airway**

or **intubation**

are predicted to be unsuccessful then use **awake technique** with:

direct laryngoscopy

or **video laryngoscopy**

or **intubating LMA**

or **fibreoptic scope**

or **blind intubation**

or **transtracheal airway**

} if **anaesthetist** and **equipment** available

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

If **successful intubation** then go to **Airway - Secure** (page 16)

IF UNSUCCESSFUL THEN GO TO NEXT PAGE (AIRWAY - FAILED)

PAEDIATRIC AIRWAY - FAILED

page 1 of 1

 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 16)

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)

PAEDIATRIC AIRWAY - NEEDLE CRICOTHYROIDOTOMY

page 1 of 1

 CALL FOR HELP



INFORM TEAM



CRASH CART

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)**

PAEDIATRIC AIRWAY - SECURE

page 1 of 1

Inflate **cuff** and **check cuff pressure**

Check tube placement:

end-tidal CO₂ (if using colourimeter then “go for gold” within six breaths)
auscultation

Secure tube

Record position at lips

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

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

Check portable **CXR**

Insert urinary **IDC**

Raise head of bed to 45°

If **complications** on the ventilator, check:

Dislodgement: check **end-tidal CO₂ 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

page 1 of 2

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

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

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

PAEDIATRIC ANAPHYLAXIS

page 2 of 2

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 \approx 0.1 micrograms/kg/min. Start infusion at 0.5 mL/h (\approx 0.05 mcg/kg/min) and titrate to a maximum of 10 mL/h (\approx 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

\geq 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

PAEDIATRIC ASTHMA

page 1 of 4

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)

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

Nebuliser mask with continuous salbutamol nebs:

age 0 to 5 years: **salbutamol 5 mg**

age ≥ 6 years: **salbutamol 10 mg** (two nebules given together)

continued next page

PAEDIATRIC ASTHMA

Aim for **oxygen saturations \geq 95%**



Add **nebulised ipratropium every 20 minutes for first hour** then **hourly**



age 0 to 5 years: **ipratropium 250 micrograms**

age \geq 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 \geq 6 years: **salbutamol 10 mg** (two nebules given together)

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



Age (years)	Weight	IV hydrocortisone 4 mg/kg
1 - 2	10 kg	40 mg
3 - 4	15 kg	60 mg
5 - 6	20 kg	80 mg
7 - 10	30 kg	120 mg
11 - 12	40 kg	160 mg
\geq 13	50 kg	200 mg



Seek expert advice

Continuous nebulised salbutamol and ipratropium



continued next page

PAEDIATRIC ASTHMA

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

Age (years)	Weight	IV magnesium dose (mg)	IV magnesium dose (mmol)	IV magnesium volume (49.3%) in 50 mL normal saline over 20 minutes
1 - 2	10 kg	500 mg	2 mmol	1 mL
3 - 4	15 kg	750 mg	3 mmol	1.5 mL
5 - 6	20 kg	1000 mg	4 mmol	2 mL
7 - 10	30 kg	1500 mg	6 mmol	3 mL
11 - 12	40 kg	2000 mg	8 mmol	4 mL
≥ 13	50 kg	2500 mg	10 mmol	5 mL

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.

Age (years)	Weight	IV salbutamol dose	IV salbutamol volume (5 mg in 5 mL) in 50 mL normal saline over 60 minutes
1 - 2	10 kg	3 mg	3 mL
3 - 4	15 kg	4.5 mg	4.5 mL
5 - 6	20 kg	6 mg	6 mL
7 - 10	30 kg	9 mg	9 mL
11 - 12	40 kg	12 mg	12 mL
≥ 13	50 kg	15 mg	15 mL

continued next page

PAEDIATRIC ASTHMA

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.

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

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

page 1 of 4



and
NO PULSE

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

Age (years)	Weight	Adrenaline dose	Adrenaline volume 1:10,000
< 1	5 - 10 kg	50 - 100 mcg	0.5 - 1 mL
1 - 2	10 kg	100 mcg	1 mL
3 - 4	15 kg	150 mcg	1.5 mL
5 - 6	20 kg	200 mcg	2 mL
7 - 10	30 kg	300 mcg	3 mL
11 - 12	40 kg	400 mcg	4 mL
≥ 13	50 kg	500 mcg	5 mL

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

continued on page 27

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 (maximum 10 mL)

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**


PAEDIATRIC ASYSTOLE

page 2 of 4


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** 

Age (years)	Weight	Shock
< 1	5 - 10kg	20 - 40 J
1 - 2	10 kg	40 J
3 - 4	15 kg	60 J
5 - 6	20 kg	80 J
7 - 10	30 kg	120 J
11 - 12	40 kg	160 J
≥ 13	50 kg	200 J

CPR 2 minutes 

Shockable? then **shock** 

IV adrenaline 10 micrograms/kg 

CPR 2 minutes

continued next page

PAEDIATRIC ASYSTOLE

page 3 of 4

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

page 4 of 4

IV adrenaline 10 micrograms/kg

CPR 2 minutes



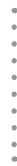
Shockable? then **shock**



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

page 1 of 2

< 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 57 (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

PAEDIATRIC BRADYCARDIA

If compromised and high vagal tone, continued:

Age (years)	Weight	Atropine dose
< 1	5 - 10kg	100 - 200 mcg
1 - 2	10 kg	200 mcg
3 - 4	15 kg	300 mcg
5 - 6	20 kg	400 mcg
7 - 10	30 kg	600 mcg
11 - 12	40 kg	600 mcg
≥ 13	50 kg	600 mcg

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

Age (years)	Weight	Adrenaline dose	Adrenaline volume 1:10,000
< 1	5 - 10kg	50 - 100 mcg	0.5 - 1 mL
1 - 2	10 kg	100 mcg	1 mL
3 - 4	15 kg	150 mcg	1.5 mL
5 - 6	20 kg	200 mcg	2 mL
7 - 10	30 kg	300 mcg	3 mL
11 - 12	40 kg	400 mcg	4 mL
≥ 13	50 kg	500 mcg	5 mL

If still compromised consider:

IV adrenaline infusion: adrenaline 0.3 mg/kg in 50 mL dextrose 5%, so that 1 mL/h \approx 0.1 micrograms/kg/min. Start infusion at 0.5 to 10 mL/h (\approx 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

page 1 of 10

Symptoms:	THIRST	Signs:	DEHYDRATION
	VOMITING		DEEP SIGHING RESPIRATIONS
	ABDOMINAL PAIN		SMELL OF KETONES ON BREATH
	WEAKNESS		LETHARGY
	CONFUSION		DROWSINESS
	POLYURIA		
	WEIGHTLOSS		

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](#)

PAEDIATRIC DIABETIC KETOACIDOSIS

page 2 of 10

ASSESSMENT

Disability assessed by **Glasgow Coma Scale (GCS)**

	Age < 4	Age ≥ 4
Eye Opening	Spontaneous 4	Spontaneous 4
	To voice 3	To voice 3
	To pain 2	To pain 2
	No response to pain 1	No response to pain 1
Verbal Response	Appropriate words or smiles, fixes, follows 5	Oriented 5
	Cries but consolable, less words than usual 4	Confused 4
	Persistently irritable 3	Inappropriate words 3
	Moans to pain 2	Incomprehensible sounds 2
	No response to pain 1	No response to pain 1
Motor Response	Spontaneous movements or obeys commands 6	Obeys commands 6
	Localises pain 5	Localises pain 5
	Withdraws from pain 4	Withdraws from pain 4
	Abnormal flexion 3	Abnormal flexion 3
	Abnormal extension 2	Abnormal extension 2
	No response to pain 1	No response to pain 1

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 43**)
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

PAEDIATRIC DIABETIC KETOACIDOSIS

page 4 of 10

EXCLUDE HYPEROSMOLAR HYPERGLYCAEMIC STATE (HHS)

Is this Hyperosmolar Hyperglycaemic State (HHS)?

osmolality > 320 mosmol/kg

AND

BGL > 30 mmol/L

AND

pH > 7.3 and $\text{HCO}_3^- > 15$ mmol/L

AND

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**:

pH < 7.3 to 7.2	Mild
pH < 7.2 to 7.1	Moderate
pH < 7.1	Severe

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)

continued next page

PAEDIATRIC DIABETIC KETOACIDOSIS

REHYDRATION RATE

Estimate % dehydration and use chart below for rehydration rate: 

CORRECTED SODIUM NORMAL (page 32) **HYPERNATRAEMIA or HYPEROSMOLALITY**


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

continued next page

PAEDIATRIC DIABETIC KETOACIDOSIS


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REHYDRATION FLUID


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


Serum potassium (mmol/L)	Rehydration fluid
> 5.5	IV sodium chloride 0.9% or PlasmaLyte 148 Recheck K in one hour
3.0 to 5.5	IV sodium chloride 0.9% with KCl 40 mmol/L or PlasmaLyte 148 with KCl 40 mmol/L
< 3.0	Monitor ECG and seek expert advice

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

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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**

Weight	Insulin in 50 mL normal saline	Starting rate (0.05 u/kg/h)
4 kg	10 units	1 mL/h
6 kg	15 units	1 mL/h
8 kg	20 units	1 mL/h
10 kg	25 units	1 mL/h
12 kg	30 units	1 mL/h
14 kg	35 units	1 mL/h
16 kg	40 units	1 mL/h
18 kg	45 units	1 mL/h
20 kg	50 units	1 mL/h
25 kg	65 units	1 mL/h
30 kg	75 units	1 mL/h
35 kg	90 units	1 mL/h
40 kg	100 units	1 mL/h
45 kg	115 units	1 mL/h
50 kg	125 units	1 mL/h
55 kg	140 units	1 mL/h
60 kg	150 units	1 mL/h
65 kg	165 units	1 mL/h
70 kg	175 units	1 mL/h

continued next page

PAEDIATRIC DIABETIC KETOACIDOSIS

page 8 of 10

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)

Start with	Remove	Add	Finish with
1000 mL sodium chloride 0.9%	50 mL	50 mL dextrose 50%	1000 mL sodium chloride 0.9% and dextrose 5%
1000 mL sodium chloride 0.45%	50 mL	50 mL dextrose 50%	1000 mL sodium chloride 0.45% and dextrose 5%
1000 mL sodium chloride 0.45%	100 mL	100 mL dextrose 50%	1000 mL sodium chloride 0.45% and dextrose 10%



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. hyperchloraemic acidosis, hypophosphataemia, hypomagnesaemia)

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

PAEDIATRIC HYPERKALAEMIA

page 1 of 3

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, spironolactone, beta-blocker, digoxin, NSAID)

Continuous cardiac monitoring and ECG:

the first manifestation may be **ventricular fibrillation**, or ECG changes may progress:

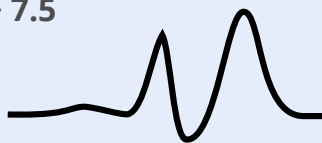
K > 6.5



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

TREATMENT

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**

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

continued next page

PAEDIATRIC HYPERKALAEMIA

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)

Age (years)	Weight	IV sodium bicarbonate 8.4% 1 mL/kg	PO or PR polystyrene sulfonate 1 g/kg
3 months	6 kg	6 mL	6 g
6 months	7.5 kg	7.5 mL	7.5 g
1	10 kg	10 mL	10 g
2	12 kg	12 mL	12 g
3	14 kg	14 mL	14 g
4	16 kg	16 mL	16 g
5	18 kg	18 mL	18 g
6	20 kg	20 mL	20 g
7 - 8	25 kg	25 mL	25 g
9 - 10	30 kg	30 mL	30 g
11 - 12	40 kg	40 mL	30 g
≥ 13	50 kg	50 mL	30 g

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



Seek expert advice

PAEDIATRIC HYPOGLYCAEMIA

page 1 of 2

BGL < 4 mmol/L in DIABETIC

BGL < 2.6 mmol/L in NON-DIABETIC

For investigation of **first presentation** of **isolated hypoglycaemia** see next page

If patient can **swallow safely**:

oral glucose 15 g or soft drink/juice 150 mL
then **two biscuits**

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

Age (years)	Weight	IV dextrose 10% 2 mL/kg
< 1	5 - 10 kg	10 to 20 mL
1 - 2	10 kg	20 mL
3 - 4	15 kg	30 mL
5 - 6	20 kg	40 mL
7 - 10	30 kg	60 mL
11 - 12	40 kg	80 mL
≥ 13	50 kg	100 mL

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

PAEDIATRIC HYPOGLYCAEMIA

page 2 of 2

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

ASSESS 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)

AND
OR

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

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

continued next page

MODERATE PAIN

For moderate pain:

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

AND

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

AND
OR

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

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

continued next page

SEVERE PAIN

IF IV ACCESS THEN GO TO 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)

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

continued next page

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

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

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

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)

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

Repeat IV naloxone every 2 to 3 minutes as required

Naloxone has **short duration** of action so repeat doses or infusion may be needed

PAEDIATRIC PULSELESS ELECTRICAL ACTIVITY



ANY RHYTHM

and

NO PULSE

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

Age (years)	Weight	Adrenaline dose	Adrenaline volume 1:10,000
< 1	5 - 10 kg	50 - 100 mcg	0.5 - 1 mL
1 - 2	10 kg	100 mcg	1 mL
3 - 4	15 kg	150 mcg	1.5 mL
5 - 6	20 kg	200 mcg	2 mL
7 - 10	30 kg	300 mcg	3 mL
11 - 12	40 kg	400 mcg	4 mL
≥ 13	50 kg	500 mcg	5 mL

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

continued on page 59

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 (maximum 10 mL)

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**

PAEDIATRIC PULSELESS ELECTRICAL ACTIVITY

page 2 of 4

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**

Age (years)	Weight	Shock
< 1	5 - 10kg	20 - 40 J
1 - 2	10 kg	40 J
3 - 4	15 kg	60 J
5 - 6	20 kg	80 J
7 - 10	30 kg	120 J
11 - 12	40 kg	160 J
≥ 13	50 kg	200 J

CPR 2 minutes

Shockable? then **shock**

IV adrenaline 10 micrograms/kg

CPR 2 minutes

continued next page

PAEDIATRIC

PULSELESS ELECTRICAL ACTIVITY page 3 of 4

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 PULSELESS ELECTRICAL ACTIVITY

page 4 of 4

IV adrenaline 10 micrograms/kg

CPR 2 minutes



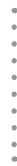
Shockable? then shock



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 STATUS EPILEPTICUS

page 1 of 2

 CALL FOR HELP



INFORM TEAM



CRASH CART

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)

Age (years)	Weight	Midazolam IV/IM	Midazolam Buccal/Intranasal
< 1	5 - 10kg	0.75 - 1.5 mg	1.5 - 3 mg
1 - 2	10 kg	1.5 mg	3 mg
3 - 4	15 kg	2.25 mg	4.5 mg
5 - 6	20 kg	3 mg	6 mg
7 - 10	30 kg	4.5 mg	9 mg
11 - 12	40 kg	5 mg	10 mg
≥ 13	50 kg	7.5 mg	10 mg

continued next page

PAEDIATRIC STATUS EPILEPTICUS

page 2 of 2

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**

PAEDIATRIC SUPRAVENTRICULAR TACHYCARDIA

page 1 of 2

 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

PAEDIATRIC SUPRAVENTRICULAR TACHYCARDIA

page 2 of 2

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

Age (years)	Weight	Adenosine 100 mcg/kg	Adenosine 200 mcg/kg	Adenosine 300 mcg/kg
< 1	5 - 10kg	0.5 - 1 mg	1 - 2 mg	1.5 - 3 mg
1 - 2	10 kg	1 mg	2 mg	3 mg
3 - 4	15 kg	1.5 mg	3 mg	4.5 mg
5 - 6	20 kg	2 mg	4 mg	6 mg
7 - 10	30 kg	3 mg	6 mg	9 mg
11 - 12	40 kg	4 mg	8 mg	12 mg
≥ 13	50 kg	5 mg	10 mg	12 mg

Check **electrolytes**

Refer to paediatric cardiologist

PAEDIATRIC TACHYCARDIA

page 1 of 2

- > 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 77 (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 74 (VT)

continued next page

If **QRS \leq 0.09 s** then is this **supraventricular tachycardia?** 

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

If supraventricular tachycardia then go to page 64

If **QRS \leq 0.09 s** then is this **sinus tachycardia?** 

- history consistent with known cause
- infants: rate usually $<$ 220/minute
- children: rate usually $<$ 180/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

page 1 of 4



and
NO PULSE

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**

Age (years)	Weight	Shock
< 1	5 - 10kg	20 - 40 J
1 - 2	10 kg	40 J
3 - 4	15 kg	60 J
5 - 6	20 kg	80 J
7 - 10	30 kg	120 J
11 - 12	40 kg	160 J
≥ 13	50 kg	200 J

Consider **airway** adjuncts (oro- or naso-pharyngeal airway, and if skilled LMA or ETT)

High-flow **oxygen**

Intravenous or **intraosseous** access

continued on page 71

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 (maximum 10 mL)

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**

PAEDIATRIC VENTRICULAR FIBRILLATION

page 2 of 4

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 

Age (years)	Weight	Adrenaline dose	Adrenaline volume 1:10,000
< 1	5 - 10 kg	50 - 100 mcg	0.5 - 1 mL
1 - 2	10 kg	100 mcg	1 mL
3 - 4	15 kg	150 mcg	1.5 mL
5 - 6	20 kg	200 mcg	2 mL
7 - 10	30 kg	300 mcg	3 mL
11 - 12	40 kg	400 mcg	4 mL
≥ 13	50 kg	500 mcg	5 mL

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

PAEDIATRIC VENTRICULAR FIBRILLATION

page 3 of 4

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**



IV adrenaline 10 micrograms/kg



CPR 2 minutes

continued next page

PAEDIATRIC VENTRICULAR FIBRILLATION

page 4 of 4

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 VENTRICULAR TACHYCARDIA

page 1 of 2

IF NO PULSE THEN GO TO PAGE 77 (PULSELESS VT)

CALL FOR HELP



INFORM TEAM



CRASH CART

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**

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

continued next page

PAEDIATRIC VENTRICULAR TACHYCARDIA

page 2 of 2

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**



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

PAEDIATRIC PULSELESS VENTRICULAR TACHYCARDIA



and
NO PULSE

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**

Age (years)	Weight	Shock
< 1	5 - 10kg	20 - 40 J
1 - 2	10 kg	40 J
3 - 4	15 kg	60 J
5 - 6	20 kg	80 J
7 - 10	30 kg	120 J
11 - 12	40 kg	160 J
≥ 13	50 kg	200 J

Consider **airway** adjuncts (oro- or naso-pharyngeal airway, and if skilled LMA or ETT)

High-flow **oxygen**

Intravenous or **intraosseous** access

continued on page 79

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 (maximum 10 mL)

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**

PAEDIATRIC PULSELESS VENTRICULAR TACHYCARDIA

page 2 of 4

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

Age (years)	Weight	Adrenaline dose	Adrenaline volume 1:10,000
< 1	5 - 10 kg	50 - 100 mcg	0.5 - 1 mL
1 - 2	10 kg	100 mcg	1 mL
3 - 4	15 kg	150 mcg	1.5 mL
5 - 6	20 kg	200 mcg	2 mL
7 - 10	30 kg	300 mcg	3 mL
11 - 12	40 kg	400 mcg	4 mL
≥ 13	50 kg	500 mcg	5 mL

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

PAEDIATRIC PULSELESS VENTRICULAR TACHYCARDIA

page 3 of 4

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**



IV adrenaline 10 micrograms/kg



CPR 2 minutes

continued next page

PAEDIATRIC PULSELESS VENTRICULAR TACHYCARDIA

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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

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 cmH₂O**



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 cmH₂O**

Neopuff is now set up

RESUSCITATION

USE WITH NEONATAL RESUSCITATION ON NEXT PAGE



GESTATION ≥ 35 WEEKS: USE AIR OUTLET 10 L/min
PIP 30 cmH₂O
PEEP 5 cmH₂O

GESTATION < 35 WEEKS: OXYGEN BLENDER FiO₂ 0.30
PIP 20 to 25 cmH₂O
PEEP 5 cmH₂O

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 NEXT PAGE

 **CALL FOR HELP**



INFORM TEAM



CRASH CART

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](#)

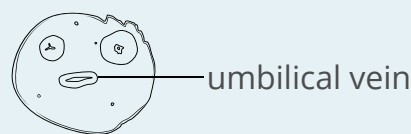
If **heart rate < 60** then:

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** then:

continue **chest compressions**

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)

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 %

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 recommended¹¹ 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.


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 of NSW Health and by the Australian College of Rural and Remote Medicine.

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EMERGENCY PROTOCOLS

Age	Weight
33 weeks gestation	2 kg
35 weeks gestation	2.5 kg
37 weeks gestation	3 kg
Term	3.5 kg
2 weeks	4 kg
4 weeks	4.5 kg
6 weeks	5 kg
2 months	5.5 kg
3 months	6 kg
5 months	7 kg
6 months	8 kg
9 months	9 kg
12 months	10 kg
18 months	11 kg
2 years	12 kg
2 ½ years	13 kg
3 years	14 kg
3 ½ years	15 kg
4 years	16 kg
4 ½ years	17 kg
5 years	18 kg
5 ½ years	19 kg
6 years	20 kg
6 ½ years	22 kg
7 years	24 kg
8 years	26 kg
9 years	28 kg
10 years	30 kg
11 years	35 kg
12 years	40 kg
13 years	45 kg
14 years	50 kg