Drugs for Paediatric Emergencies

Intravenous route is the preferred route. (Intraosseous if 90 seconds have elapsed or 3 failed attempts at intravenous access.) Drug doses should be administered over several minutes to avoid transient excessive blood levels (exceptions: adenosine, adrenaline, atropine, muscle relaxants). For the endotracheal route, generally give (or dilute in) 1-5 mL isotonic saline through a catheter inserted to the tip of the ET tube (to increase surface area of absorption).

Dosages should be individualised, taking into account the patient's age, weight, underlying illness, concurrently administered drugs, and known hypersensitivity.

The choice of drug for control of the airway should address two concerns:

1. Adequate sedation/analgesia for laryngoscopy
2. Appropriate selection of muscle relaxant, if indicated

For example, following a head injury ketamine therapy increases cerebral blood flow and intracranial pressure.

Combining drugs with different modes of action may be advantageous — e.g. benzodiazepine or narcotic to may prolong the effect and/or enable reduction in dose of ketamine or barbiturate required to sedate.

Airway equipment appropriate for patient size and age must be immediately available before a neuromuscular blocking agent is administered: appropriate sized face mask; a bag-mask-valve device for positive pressure ventilation; endotracheal tubes, oral airways; functioning laryngoscope blades; functioning laryngoscope handles; suction catheters; and suction apparatus. The patient should be fully monitored on a cardiac monitor, blood pressure readings, and pulse oximetry.

Nasogastric (orogastric) suction catheters

Choice of muscle relaxant depends on the circumstances. Succinylcholine remains the muscle relaxant of choice for the emergency control of the airway and is generally the muscle relaxant of choice for patients with full stomachs (most rapid onset, shortest duration).

Administration of succinylcholine should be preceded by atropine to prevent significant bradycardia. In greater than 5 year olds, a defasciculating dose of a non-depolarising relaxant (10% of intubating dose) 2-3 minutes before succinylcholine may prevent muscle fasciculations. Cricoid pressure is applied to prevent passive regurgitation during laryngoscopy and intubation.

If succinylcholine is contraindicated (history of malignant hyperthermia, muscular dystrophy, neuromuscular disease, neurologic denervation injury or crush injury) a non-depolarising muscle relaxant is indicated (note that they have a somewhat delayed onset and prolonged duration cf. to succinylcholine — although rocuronium is within 45 second to 1 minute, especially with high doses, is similar to that of succinylcholine).

Succinylcholine is the only neuromuscular blocking agent currently available that has been demonstrated to be effective after IM administration (4-5 mg/kg) when emergency control of the airway is required and there is no intravenous access.

ADENOSINE	**SVT**	C/I in heart transplant patients
	0.05 mg/kg rapid push followed by saline flush	Atropine C/I (antidote for profound bradycardia is aminophylline)
	→ 0.1 mg/kg (≤ 30 min)	
	→→ 0.15 mg/kg (max single dose = 12 mg)	
ADRENALINE	**Cardiac arrest or profound bradycardia, asystole, ventricular fibrillation, or pulseless electrical activity**	Subsequent doses 100 mcg/kg (0.1 mg/kg) IV q3-5 minutely
	10 mcg/kg (0.01 mg/kg) IVI	
	100 mcg/kg (0.1 mg/kg) ETT	
	If administered through an endotracheal tube, follow the dose with saline flush or dilute in isotonic saline flush (1 to 5 mL) based on patient size.	
	Anaphylaxis	Repeat the SC dose every 20 minutes while attempting IV access
	10 mcg/kg per dose SCI	
	Status asthmaticus, bronchospasm	Max single dose 300 mcg = 0.3 mL 1:1000 dilution
	10 mcg/kg per dose SCI	
	Continued shock after volume resuscitation	Start at lowest dose and titrate for desired clinical effect
	0.1-3.0 mcg/kg/min IV infusion	
	Laryngotracheobronchitis	Racemic epinephrine is not necessarily any better
	0-20kg: 2.5 mL in 2 mL N/S nebulised	
	20-40kg: 5.0 mL in 2 mL N/S nebulised	
	>40kg: 7.5 mL in 2 mL N/S nebulised	
ALBUTEROL	**Status asthmaticus**	0.02-0.03 mL/kg of 5 mg/mL solution with normal saline to make 3 mL total in nebuliser (max single dose 2.5 mg)
(salbutamol)	**Bronchospasm**	
	01-0.15 mg/kg nebulised	
	Repeat and dose adjust while desired clinical effect or symptomatic tachycardia.	
ATROPINE SULFATE	**Symptomatic bradycardia**	Min single dose 0.1 mg
	0.02-0.04 mg/kg IMI	Max single dose 0.5 mg (child); 1 mg (adolescent)
	0.02 mg/kg IVI	
	Dose may be repeated once	
	Oxygenation and ventilation are essential first manoeuvres in the treatment of symptomatic bradycardia. Adrenaline is the drug of choice if oxygen and adequate ventilation is not effective treatment of hypoxia and induced bradycardia.	
	Anticholinesterase poisoning	0.05 mg/kg IVI ± repeat for clinical effect
	To prevent succinylcholine-induced bradycardia	0.02 mg/kg IVI (0.02-0.04 mg/kg IMI just before or simultaneously with succinylcholine)

BICARBONATE, SODIUM	**Metabolic acidosis**	Not routinely used in cardiac arrest
	TCA overdose	
	1-2 mEq/kg IVI	
CALCIUM CHLORIDE	**Ionised hypocalcaemia**	Stop injection if symptomatic bradycardia occurs
	Hyperkalaemia	
	Hypermagnesaemia	
	Calcium-channel blocker toxicity	
	20 mg/kg (i.e. 0.2 mL/kg 10% $CaCl_2$)	
	Inject slowly and repeat as necessary for desired clinical effect	
CALCIUM GLUCONATE	Ionises as rapidly as the chloride salt and may be substituted using three times the dose of $CaCl_2$ (mg/kg)	Only in
	60 mg/kg (i.e. 0.6 mL/kg 10% gluconate)	
DEXAMETHASONE	**Emergency treatment of raised intracranial pressure due to brain tumour**	
	1-2 mg/kg IVI as loading dose	
	1 mg/kg/24-hour maintenance	
	Croup	
	0.6 (0.15) mg/kg IVI/IMI/PO, 1 dose/day	
	2 mg/kg/24-hour Prednisone	
DIAZEPAM	**Status epilepticus**	Do not give as IM injection
	0.1 mg/kg IVI q 2-min	(max 0.3 mg/kg, 10 mg/dose)
	0.5 mg/kg PR	(max 20 mg)
	There is an increased incidence of apnoea when combined with other sedative agents or when given rapidly. One must be prepared to provide respiratory support. Monitor oxygen saturation.	
DIPHENHYDRAMINE	Acute hypersensitivity reactions	
	Dystonic reactions	
	1-2 mg/kg IVI or IMI	(max dosage 50 mg)
	May cause sedation, especially if other sedative agents are being used. May cause hypotension.	
FENTANYL	**Pain**	
	0.5 – 2.0 mcg/kg IVI	Titrated in slowly over several minutes
	Repeat dose as necessary for clinical effect	
	Higher doses may be necessary if the patient is tolerant	
	There is an increased incidence of apnoea when combined with other sedative agents, particularly benzodiazepines. Be prepared to	

	administer naloxone. Monitor the patient's vital signs and oxygen saturation. Be prepared to provide respiratory support.	
FLUMAZENIL	**Benzodiazepine intoxication**	(up to 100 mcg/kg has been used) Max dose 1 mg
	5-10 mcg/kg	
	Duration of action is shorter than most clinically important benzodiazepines. Re-sedation may occur. May precipitate acute withdrawal in dependent patients; use drug with caution as its use may be associated with seizures. Patients who receive flumazenil should be continuously observed for re-sedation for at least 2 hours after the last dose of flumazenil	
GLUCAGON	**Hypoglycaemia due to insulin excess**	An attempt should be made to provide a simultaneous IVI glucose infusion
	Adult/adolescent: 0.5-1 mg SCI/IMI/IVI	
	Repeat every 20 min	
	Paediatric: 0.025 mg/kg SCI/IMI/IVI	
	Repeat every 20 min if needed for clinical effect	Total of 3 doses
	Beta-blocker or calcium channel blocker overdose	
	Adolescent: 2-3 mg followed by a 5 mg/hr infusion	
	Paediatric: 0.025-0.05 mg/kg followed by 0.07 mg/kg/hr infusion	
GLUCOSE	**Hypoglycaemia**	
	250-500 mg/kg IV infusion	2.5-5 ml/kg D10% 1-2 mL/kg D25% 0.5-1 mL/kg D50%
	Constant infusion of 10% Dextrose water at a rate of 100 mL/kg/24 hr (7 mg/kg/min)	
	Neonates should receive 10% to 12.5% glucose administered slowly.	
	Glucose levels should be determined before and during administration. If large volumes of dextrose are administered, include electrolytes to prevent hyponatraemia and hypokalaemia.	
HALOPERIDOL	**Psychosis with agitation**	
	0.1 mg/kg IMI/IVI	Max single dose 5 mg
	Repeat hourly as necessary	
	Hypotension and dystonic reactions may occur	
INSULIN, REGULAR	**Diabetic ketoacidosis**	
	0.25-0.5 Units/kg per dose	
	0.05-0.1 Units/kg/hr	
	Neonatal dose: 0.05 Units/kg/hr	

	Blood glucose levels should be closely monitored. Appropriate fluid and electrolyte therapy are required in treating diabetic ketoacidosis.	
	Hyperkalaemia	
	0.1 Units/kg with 400 mg/kg glucose	
	Ratio of 1 unit of insulin for every 4 g of glucose	
	Potassium levels in blood or serum should be moinitored	
LIGNOCAINE	**Ventricular arrhythmia**	Contraindicated in complete heart block and wide complex tachycardia due to accessory conduction pathways
	1 mg/kg IVI as single dose slowly	
	Repeat every 5-0 minutes to desired effect or until maximum dose of 3 mg/kg is given	
	20-50 mcg/kg/min IV infusion	Add 120 mg (6 mL of a 2.0% concentration) to 100 mL of 5%DW. Infusion of 1.0 to 2.5 mL/kg/h will deliver 20 to 50 mg/kg/min. A reduced infusion rate should be used in patients with a low cardiac output.
	1 mg/kg ETT	Follow the dose with saline flush or dilute in isotonic saline flush (1 to 5 mL) based on patient size.
	Excessive dosage may result in myocardial depression, hypotension, central excitation, and seizures	
	To attenuate airway reflexes before endotracheal intubation or airway manipulation in patients with elevated intracranial pressure	
	1 mg/kg IV as single dose 30 seconds before airway instrumentation	
MANNITOL	**Increased intracranial pressure**	A larger dose (0.5 g/kg given over 15 minutes) may be appropriate in an acute intracranial hypertensive crisis. In conjunction with mannitol, other measures to control intracranial pressure such as hyperventilation,
	0.25 g/kg given over a 15-min infusion	
	Rapid administration may cause hypotension, hyperosmolality, and elevated intracranial pressure.	
METHYLPREDNISOLONE	**Asthma / allergic reaction**	
	1-2 mg/kg IVI every 6 hours	
	Spinal cord injury	In 45 minutes begin a continuous infusion of 5-6 mg/kg/h for 23 hours.
	30 mg/kg IVI over 15 minutes	

		hours.
	Croup	
	1-2 mg/kg IVI, then 0.5 mg/kg q 6-8 hrs	
MIDAZOLAM	Adjunct for endotracheal intubation or for sedation / anxiolysis	
	0.05-0.2 mg/kg given over several minutes	
	There is an increased incidence of apnoea when combined with other sedative agents. Be prepared to provide respiratory support. Monitor oxygen saturation.	
MORPHINE SULFATE	**Pain, infundibular spasm ("Tet Spell")**	
	0.05-0.1 mg/kg IVI (slowly) or IMI	Higher dose may be necessary if patient is tolerant.
	Repeat dose as necessary for clinical effect	
	There is an increased incidence of apnoea when combined with other sedative agents, particularly benzodiazepines. Be prepared to administer naloxone. Monitor the patient's vital signs and oxygen saturation. Be prepared to provide respiratory support.	
NALOXONE	**Respiratory depression induced by opioid**	IM absorption may be erratic
	0.1 mg/kg IVI/IMI from birth until age 5 years or 20 kg weight, thereafter the minimum dose is 2 mg	This dosage is indicated for acute opiate intoxication. Titration to effect with lower initial doses (0.01 mg/kg or 10 mcg/kg) should be considered for other clinical situations, e.g., respiratory depression during pain management.
	Doses may be repeated as needed to maintain opiate reversal	
	May induce acute withdrawal in opioid dependency. Patients who receive naloxone should be continuously observed for re-narcotization for at least 2 hours after the last dose of naloxone	
OXYGEN	**Hypoxaemia and/or respiratory depression**	
	Carbon monoxide poisoning	
	Shock	
	100% by non-rebreather mask initially or endotracheal tube; wean as tolerated	
	The administer of supplemental oxygen should be considered during EVERY paediatric emergency.	
PROCAINAMIDE	**Wide complex tachycardia**	
	Start at 3-6 mg/kg over 5 minutes not to exceed 100 mg to a titrated maximum of 15 mg/kg/loading dose	If 50% QRS widening or hypotension occurs during

	Maintenance dose, 20 to 80 mg/kg/min (0.02 to 0.08 mg/kg/min); maximum, 2 g/24 h	loading dose, the remainder of the loading dose is held, and the maintenance dose is delayed until these signs have resolved
PROPRANOLOL	**Infundibular spasm ("Tet Spell")**	
	0.01-0.02 mg/kg per dose infused over 10 minutes in 5% dextrose in water	Oxygen should be administered first.
	Maximum initial dose 1 mg	Morphine is also an effective treatment for infundibular spasms. Phenylephrine is another adjunct for reversal of infundibular spasm. Use C/I in CHF. Avoid in patients with a h/o bronchospasm.
ROCURONIUM	**Neuromuscular blockade to facilitate mechanical ventilation**	This drug does not alter the level of consciousness or provide analgesia or amnesia
	Emergency intubation	Alternative to succinylcholine for rapid intubation when succinylcholine is C/I. Duration of block is generally 30 to 45 minutes and is dose-dependent. Satisfactory conditions for endotracheal intubation will generally occur 45 to 60 seconds after administration.
	0.8-1.2 mg/kg	
	Ventilatory support is necessary. Personnel with skills in airway management must be present and prepared to respond when this agent is administered. Age-appropriate equipment for suctioning, oxygenation, intubation, and ventilation should be immediately available.	
SUCCINYLCHOLINE	**Neuromuscular blockade for emergency intubation or treatment of laryngospasm**	Contraindicated with previous history of malignant hyperthermia, severe burns, spinal cord injury, neuromuscular disease, or myopathies. When these contraindications exist use a non-depolarizing

		muscle relaxant such as rocuronium. Despite reports of acute rhabdomyolysis, hyperkalaemia, and cardiac arrest with succinylcholine, this agent remains the drug of choice when immediate securing of an airway is indicated
	1-2 mg/kg IVI	
	Atropine, 0.02 mg/kg (minimum dose, 0.1 mg), should be combined with or precede succinylcholine to prevent bradycardia or asystole. Satisfactory conditions for endotracheal intubation generally occur 30 - 45 seconds after IV administration and 3 - 5 minutes after IM administration.	
	4-5 mg/kg IMI	If cardiac arrest occurs immediately after administration of succinylcholine, hyperkalaemia must be suspected and treatment for this condition initiated. Hyperkalaemia is especially likely to be responsible for cardiac arrest occurring in male children 8 years of age or younger.
	Ventilatory support is necessary. Personnel with skills in airway management must be present and prepared to respond when this agent is administered. Age-appropriate equipment for suctioning, oxygenation, intubation, and ventilation should be immediately available.	
THIOPENTAL	**Adjunct to intubation**	
	4-6 mg/kg IVI	IM administration leads to tissue necrosis.
	A lower dose may be used if other sedatives/narcotics have been administered.	
	Be prepared to provide respiratory support. Monitor oxygen saturation. High doses are associated with hypotension and apnoea. Use with caution in patients with cardiac compromise or hypovolemia.	
	Control of intracranial hypertension	
	1-2 mg/kg, repeated as necessary	
VECURONIUM	**Neuromuscular blockade to facilitate mechanical ventilation**	This drug does not alter the level of consciousness or provide analgesia or amnesia
	Emergency intubation	
	0.1 mg/kg IVI	This agent may be used for emergency intubation when

		succinylcholine is contraindicated. Satisfactory conditions for endotracheal intubation generally occur 1.5 to 2.0 minutes after administration
	Ventilatory support is necessary. Personnel with skills in airway management must be present and prepared to respond when this agent is administered. Age-appropriate equipment for suctioning, oxygenation, intubation, and ventilation should be immediately available.	