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Emergency drugs in general practice

This review article discusses available drugs for the initial management of medical emergencies in general practice.

Table 1. General principles in the management of medical emergencies

- Danger, response, airway, breathing, circulation (and compressions) – DRABC
- Activate a crisis resource management plan
 - get help (eg. other practice staff, ambulance professionals via '000', bystanders)
 - assign roles (including leader, scribe, and timekeeper)
 - facilitate teamwork
- Some history is better than no history
 - any drugs or allergies?
 - any 'not for resuscitation orders'? (Ideally sighted, and on standardised forms)
 - if available – ask relatives, check medical records
- Give oxygen (8 L/min) via Hudson mask (via bag-valve-mask system in cardiac arrest)
- Intravenous drugs are generally given over 2–5 minutes (but as a 'push' with saline flush in cardiac arrest)
- Continuous assessment and management until stable
- Observe patient once stable (especially if sedative drugs have been administered)
- Be willing to consult with an emergency department for advice and patient transfer
- Practise safe sharps management, and follow infection control procedures
- Take detailed notes, and transcribe these to the patient's medical record at the earliest opportunity. Keep copies of any transfer of care letters
- Arrange debriefing as appropriate for the patient (or relatives), and for those involved in managing the emergency

■ **General practitioners need the knowledge, skills, drugs and equipment for managing medical emergencies. Clinics need treatment rooms and doctor's bags that enable emergencies to be managed onsite and offsite respectively. Rural medical generalists may provide more advanced emergency management in their local hospitals. In managing emergencies, GPs may be working with paramedics, therefore it helps to be familiar with their skills and with the drugs they carry. General principles that apply in managing medical emergencies are described in Table 1. Relevant contraindications should be checked before administering any of the drugs described below (Table 2).**

Life threatening medical emergencies

Cardiac arrest

Current guidelines¹ emphasise the importance of cardiac compressions, and prompt defibrillation for ventricular fibrillation (VF) or pulseless ventricular tachycardia (VT). Adrenaline is given every 3 minutes intravenously (IV) until return of spontaneous circulation (ROSC):

- adult dosage: 1 mg with a saline flush (10–20 mL)
- paediatric dosage: 0.01 mg/kg (10 µg/kg) (Table 3) with a saline flush (up to 5 mL).

During cardiopulmonary resuscitation, the following drugs may be considered:

- VF or VT: lignocaine 1 mg/kg
- asystole or severe bradycardia: atropine 1.2–3.0 mg (adult); 20 µg/kg (child)

In the hospital setting amiodarone is the first line drug for treating ventricular arrhythmias. Following ROSC, blood pressure (BP) and adequate perfusion should be maintained. This may require IV adrenaline (Table 4).

Anaphylaxis²

- Adrenaline is given every 5 minutes intramuscularly (IM) (anterolateral thigh) until clinical features have improved. Up to 10 doses may be given:
 - adult dosage: 0.5 mg
 - paediatric dosage: 0.01 mg/kg (10 µg/kg) (Table 3)
 - in adults, if there is a poor response, consider glucagon 1–2 mg IV over 5 minutes
 - consider IV adrenaline if shock persists after two IM doses; use with extreme caution (Table 4)

- Oxygen (8 L/min)
- Normal saline (20 mL/kg) is given for hypotension
- Hydrocortisone 250 mg (or 4 mg/kg), single dose IV.

Potentially life threatening emergencies

Asthma and bronchospasm³

Critical or severe (any of: talking in words, unable to talk, SpO₂ <90%, agitated, confused, drowsy, maximal accessory muscle use and recession).

Adult:

- oxygen, at least 8 L/min to maintain SpO₂ >94%
- nebulised salbutamol 10 mg driven by oxygen, at least 8 L/min every 15 minutes
- nebulised ipratropium 500 µg 2 hourly
- hydrocortisone 250 mg (or 4 mg/kg) IV

Paediatric:

- oxygen at least 8 L/min to maintain SpO₂ >94%
- nebulised salbutamol (5 mg/2.5 mL) driven by oxygen, at least 8 L/min, continuous

- ipratropium 20 µg/dose metered dose inhaler (MDI) via spacer, 2–4 puffs every 20 minutes in first hour
- hydrocortisone 4 mg/kg IV.

If there is no response to inhaled salbutamol, then salbutamol should be given IV as a bolus (250 µg for adults, 5 µg/kg over 10 minutes for children) followed by an infusion. This may not be practical in most general practice settings. Consider IV adrenaline in extremis (Table 4).

Mild/moderate

Adult:

- oxygen at least 8L/min to maintain SpO₂ >94%
- salbutamol 100 µg/dose MDI via spacer, 10–20 puffs (4–6 tidal breaths per puff) every 1–4 hours, or salbutamol 5–10 mg nebulised, driven by oxygen every 1–4 hours
- ipratropium 20 µg/dose MDI via spacer, six puffs every 2 hours, OR ipratropium 500 µg nebulised, driven by oxygen every 2 hours (ipratropium is optional)
- prednisolone 50 mg orally

Table 2. Emergency drugs: presentation, contraindications, and potential adverse reactions (in emergency use)

Drug presentation	Contraindications (other than known allergy)	Adverse reactions
Adrenaline: 1 mg/1 mL (1:1000)	Nil in cardiac arrest and anaphylaxis	Arrhythmia; myocardial and cerebrovascular ischaemia
Atropine: 600 µg/1 mL	Nil in cardiac arrest or hypotensive bradycardia	Tachycardia, confusion, nausea
ADT: 0.5 mL vial	Children <8 years of age	Local: pain, swelling Systemic: fever, malaise
Benztropine: 2 mg/2 mL	Children <3 years of age	Tachycardia, confusion
Benzylpenicillin powder: 600 mg or 3 g	Nil	Nil
Dexamethasone: 4 mg/1 mL	Nil in emergency	Rare with single dose
Diazepam: 10 mg/2 mL	Cardiorespiratory failure Central nervous system (CNS) depression	Drowsiness, confusion, respiratory depression
Dihydroergotamine: 1 mg/1 mL	Hemiplegic migraine Use of sumatriptan	Vasospasm syndromes (rare)
Frusemide: 20 mg/2 mL	Sulfonamide allergy	Nil
Glucagon: 1 mg/1 mL	Nil	Nil
GTN spray: 400 µg/dose	Cardiogenic shock Systolic blood pressure <100 mmHg Use of phosphodiesterase type 5 (PDE5) inhibitors	Headache, hypotension
Haloperidol: 5 mg/1 mL	Cardiovascular collapse CNS depression	Dystonia, confusion, hypotension
Hydrocortisone: 100 mg or 250 mg/2 mL	Nil in emergency	Rare with single dose
Lignocaine: 100 mg/5 mL	Nil	Lightheadedness, nausea, agitation
Metoclopramide: 10 mg/2 mL	Acute complete bowel obstruction	Dystonic reactions (~1%, more common in children)
Morphine sulphate: 15 mg or 30 mg/1 mL	Respiratory or CNS depression	Sedation, nausea, vomiting
Naloxone Min-I-Jet: 0.8 mg/2.0 mL or 2 mg/5 mL	Nil	Nil
Prochlorperazine: 12.5 mg in 1.0 mL	Circulatory collapse CNS depression	Drowsiness

Table 2. Emergency drugs: presentation, contraindications, and potential adverse reactions (in emergency use) continued

Drug presentation	Contraindications (other than known allergy)	Adverse reactions
Salbutamol: MDI: 100 µg/dose Nebuliser: 2.5 mg or 5.0 mg/2.5 mL	Nil	Tachycardia, tremor
Tramadol: 100 mg/2 mL	Children, MAOIs, respiratory or CNS depression; caution with SSRI drugs	Nausea, vomiting, dizziness
Verapamil: 5 mg/2 mL	Cardiogenic shock, heart block, hypotension, broad complex SVT, use of beta blocker drugs	Nausea, heart block, bradycardia, hypotension
Aspirin*#: 300 mg tablet	Active haemorrhage, active gastrointestinal ulcer; caution in asthma	Dyspepsia
Ceftriaxone*#: 2 g powder	Nil	Nil
Diclofenac*: tablets: 50 mg suppositories: 100 mg	Active gastrointestinal ulcer or haemorrhage; caution in: renal impairment, anticoagulation, asthma	Nausea, dyspepsia
Glucose*# 50% (500 mg/mL): 50 mL	Diabetic coma	Phlebitis
Ipratropium bromide*#: MDI: 20 µg/dose Nebuliser: 500 µg/1 mL	Nil	Nil
Ketorolac*: 10 mg/1 mL	Active gastrointestinal ulcer or haemorrhage; caution in: renal impairment, anticoagulation, asthma	Nausea, dyspepsia
Midazolam*#: 5 mg in 1 mL (or 15 mg in 3 mL)	Cardiorespiratory failure CNS depression	Drowsiness, confusion, respiratory depression
Olanzapine*: 5 mg wafer or tablet	Nil	Hypotension
Sumatriptan*: tablets: 50 mg, 100 mg injection: 6.0 mg in 0.5 mL	Ischaemic heart disease Cerebrovascular disease Ergotamine <24 hour ago Caution: taking SSRI, SNRI	Transient flushing, dizziness, tightness in chest or throat, increased BP
Syntometrine* 1 mL (oxytocin 5 intra-uterine (IU) plus ergometrine 500 µg)	Threatened abortion Severe hypertension	Hypertension Headache Nausea

* Not supplied under PBS emergency drug (doctor's bag) items # Drugs are carried by MICA paramedics in Victoria
MAOI = monoamine oxidase inhibitor, SSRI = selective serotonin reuptake inhibitor, SNRI = selective noradrenaline reuptake inhibitor

Paediatric:

- oxygen at least 8 L/min to maintain SpO₂ >94%
- salbutamol 100 µg/dose MDI via spacer, 4–6 tidal breaths per puff, repeat after 20 minutes for two further doses if not improved
 - over 6 years of age: 12 puffs
 - 6 years of age or under: 6 puffs

And

- prednisolone 1 mg/kg orally.

Acute exacerbation of chronic obstructive pulmonary disease⁴

Treat as acute asthma, with the following exceptions:

- controlled oxygen therapy to reduce the risk of inducing hyperoxic hypercapnia. In practice, oxygen at 2 L/min via nasal prongs is indicated to achieve oxygen saturation of 90–93%
- nebulised bronchodilators should be driven with high flow air, not oxygen
- start antibiotics for clinical signs of infection (eg. oral doxycycline).

Acute coronary syndrome⁵

- Oxygen 8 L/min
- Aspirin 300 mg orally
- Glycerol trinitrate (GTN) spray, 1 dose repeated after 5 minutes if no improvement
- Morphine 2.5 mg IV every 5 minutes as required, titrated to analgesic effect (maximum of 15 mg).

All patients with acute coronary syndrome (ACS) should be stabilised and transferred to hospital as soon as possible.

Fibrinolysis (for ACS with ST elevation or new left bundle branch block) in an out-of-hospital setting is controversial. Patients who present to a rural hospital less than 12 hours from symptom onset may be considered for fibrinolysis if percutaneous coronary intervention is not possible within 1–2 hours. A cardiologist should be consulted.

Severe upper airway obstruction

- Nebulised adrenaline (1 mg in 1 mL ampoules):

- adult dosage: 5 mL
- paediatric dosage: 0.5 mL/kg (maximum dose: 5.0 mL); dilute to 5.0 mL if necessary.

Acute pulmonary oedema

- Oxygen 8 L/min – patient must be sitting up
- GTN spray, one dose, repeat every 5 minutes as required
- Frusemide 20 mg IV (consider 40 mg in patients currently taking frusemide)
- Consider morphine 2.5 mg IV.

Arrhythmias

Adults

- Cardiac monitoring is essential.
- Supraventricular tachycardia (SVT): consider verapamil 5 mg IV over 1 minute if symptomatic and if vagal manoeuvres have failed
- Bradycardia and ventricular arrhythmias – as described under ‘cardiac arrest’.

Adenosine by rapid IV bolus (6 mg then 12 mg if required) is now the drug of first choice for converting SVT, and GPs may consider this. It is potentially safer than verapamil, which may result in VF if given to treat VT which has been misdiagnosed as broad complex SVT.

Hypovolaemia

- Normal saline IV
- Adult dosage: 500 mL–1L bolus then infusion to maintain circulation
- Paediatric dosage: 20 mL/kg bolus then infusion to maintain circulation.

Postpartum haemorrhage and incomplete abortion

- Syntometrine 1 mL IM.

Hypoglycaemia

- Glucagon IV, IM, or SC
 - adult (and children over 8 years of age) dosage: 1 mg
 - children 8 years or under dosage: 0.5 mg

And/or:

- Glucose 50% IV at 3 mL/min via large vein
 - adult and paediatric dosage: 20–50 mL (depending on response).

Convulsive status (convulsion for longer than 10 minutes)

- Oxygen 8 L/min
- Diazepam
 - adult dosage: 5–10 mg IV or 10–20 mg per rectum (PR) (insert nozzle of syringe PR, can dilute with 5 mL of saline)
 - paediatric dosage: (Table 3)

Or

- Midazolam (dose can be repeated after 15 minutes if there is persistent or recurrent convulsion)
 - adult dosage: 5–10 mg IM or 2.5–5.0 mg IV
 - paediatric dosage: 0.2 mg/kg IM or 0.1 mg/kg IV.

Opioid induced respiratory depression

- Oxygen 8 L/min
- Naloxone
 - adult dosage:
 - titrated IV bolus (preferred): 0.1 mg at 1–2 minute intervals
 - IM (if no IV access): 0.4 mg, repeat every 3 minutes as required (to a maximum of 10 mg)
 - paediatric dosage: 10 µg/kg IM initially; second dose 100 µg/kg if required.⁶

Titration reduces the risk of precipitating withdrawal symptoms. Patients should be observed for re-narcotisation; naloxone infusion may be required.

Meningitis and/or meningococcaemia (suspected)

- Benzylpenicillin, preferably IV but IM acceptable
 - adult dosage: 1.2 g
 - paediatric dosage:
 - age <1 year: 300 mg
 - age 1–9 years: 600 mg
 - age >9 years: 1.2 g

Table 3. Paediatric dosage chart for adrenaline and diazepam

Approximate age	Approximate weight (kg)*	Adrenaline 1 mg/1mL 0.01 mL/kg [†]	Adrenaline 1 mg/10 mL 0.1 mL/kg [†]	Diazepam IV 10 mg/2 mL 0.04 mL/kg	Diazepam PR 10 mg/2 mL 0.10 mL/kg
6 months	8	0.05 mL	0.5 mL	0.2–0.3 mL	0.5–0.8 mL
1–2 years	10	0.10 mL	1.0 mL	0.4 mL	1.0 mL
2–3 years	15	0.15 mL	1.5 mL	0.6 mL	1.5 mL
4–6 years	20	0.20 mL	2.0 mL	0.8 mL	2.0 mL
7–8 years	25	0.25 mL	2.5 mL	1.0 mL	2.5 mL
9–10 years	30	0.30 mL	3.0 mL	1.2 mL	3.0 mL [‡]
11–12 years	35	0.35 mL	3.5 mL	1.4 mL	3.0 mL [‡]
>12 years	40	0.40 mL	4.0 mL	1.6 mL	3.0 mL [‡]

Note: A useful approximation for a child's weight is: 9 + (age x 2) kg

[†] = 0.01 mg/kg (10 µg/kg)

[‡] = maximum recommended dosage

- Ceftriaxone (if known allergy to penicillin)
 - adult dosage: 2 g IV or IM
 - paediatric dosage: 50 mg/kg IV or IM (maximum 2 g)
- Dexamethasone (0.15 mg/kg IV (maximum 10 mg)) may also be administered on specialist advice.

Septicaemia (suspected)

- Ceftriaxone
 - adult dosage: 2 g IV or IM
 - paediatric dosage: 50 mg/kg IV or IM (maximum 2 g).

Nonlife threatening emergencies

Nausea and vomiting

Adults:

- metoclopramide 10 mg, IV, IM or SC
- prochlorperazine 12.5 mg IM is effective for nausea and vomiting associated with vertigo, related to vestibular system disorders.

Metoclopramide has a higher risk of dystonic reactions in children than in adults, and its use in children should be avoided. Metoclopramide has no place in the management of a child with gastroenteritis.

Severe acute pain

- Pethidine has no place in the management of pain due to its high potential for dependence and its neurotoxic metabolites
- Consider and exclude drug seeking behaviour before administering opioids.

In most contexts, severe pain can be treated with:

- morphine (preferably IV, but can be given IM or SC)
 - adult dosage: 2.5–5.0 mg, titrate to analgesic effect every 5 minutes up to a maximum of 15 mg
 - paediatric dosage: 0.1 mg/kg (avoid in infants)
- consider an antiemetic

Or (for moderate pain in adults):

- Tramadol 50–100 mg slow IV or IM.

Migraine (adult)

- Aspirin 900 mg orally
- Metoclopramide 10 mg IV
- Normal saline 1 L IV over 1–4 hours
- Alternatives to aspirin:
 - dihydroergotamine 1 mg IM
 - diclofenac 50–100 mg orally or PR
 - sumatriptan 50–100 mg orally.

Ureteric colic and biliary colic

Nonsteroidal anti-inflammatory drug (NSAID), eg. diclofenac 100 mg PR or ketorolac 10 mg IM.

Painful wounds

Consider using plain lignocaine by infiltration, topical application (eg. eyes, ears) or ring block.

Table 4. Intravenous adrenaline in low cardiac output states and life threatening asthma

- Ambulance clinical practice guidelines describe the use of diluted incremental doses of IV adrenaline every 2 minutes as required to maintain blood pressure and perfusion
- Initial doses 10 µg. If there is inadequate response, doses are increased to 50 µg and then if necessary to 100 µg
- For 10 µg doses, add adrenaline 1 mg to a 1 L bag of normal saline to give a solution of adrenaline 1 µg/mL. Ensure that the bag is labelled. Withdraw 10 mL for each dose
- For 50 µg and 100 µg doses, add an adrenaline 1 mg/mL 1 mL ampoule to 9 mL of normal saline to give a solution of adrenaline 100 µg/mL. Ensure that the syringe is labelled. Add the required volume of this solution (0.5 mL or 1.0 mL) to a syringe with 10 mL of normal saline to give the diluted dose of adrenaline
- An infusion of normal saline should be running when adrenaline is used intravenously
- IV adrenaline should only be used with extreme caution. Cardiac monitoring is essential

Palliative care emergencies

Seidel et al⁷ have written a review on the use of doctor's bag drugs in the management of these emergencies.

Psychiatric emergencies (adults)

Acute psychosis, mania, severe agitation, severe anxiety or panic attack, delirium (pending diagnosis and definitive treatment):

- diazepam 5–20 mg orally, or
- olanzapine 5 mg orally, or
- midazolam 2.5–10.0 mg IM or 2.5–5.0 mg IV every 20 minutes as required (especially for drug induced states), or
- haloperidol 2.5–5.0 mg IM or IV.

With severe disturbance, IV access will be impossible.

Dystonic drug reaction:

- benztropine IV or IM
 - adult dosage: 1–2 mg
 - paediatric dosage: 0.02 mg/kg.

Contaminated wounds

Cleaning and debridement is the principal management.

Adult diphtheria and tetanus (ADT) 0.5 mL IM should be given if:

- tetanus prone wound, if more than 5 years since last dose of tetanus toxoid
- any wound, if more than 10 years since last dose of tetanus toxoid
- uncertainty that primary course has been completed.

Emergency drugs provided under the PBS

General practitioners can submit a monthly order form to a pharmacist for the supply of Pharmaceutical Benefits Scheme (PBS) doctor's bag drugs at no cost. Alternative drugs may be preferable for managing some emergencies.

- Chlorpromazine may cause hypotension; should be used with extreme caution

- Midazolam is more versatile than diazepam. It can be used to manage convulsions and agitated states, and, unlike diazepam, can be given IM, buccally and intranasally. It can be given IV at half the IM dose
- Dihydroergotamine is less effective than sumatriptan for relieving the symptoms of migraine
- Haloperidol may cause significant dystonic reactions. Midazolam is preferable for managing severe agitated states⁸
- Promethazine has no place in the management of anaphylaxis as it may cause hypotension and vasodilatation. Oral nonsedating antihistamines are preferable for managing acute urticaria⁹
- Current emergency management guidelines do not include the use of either procaine penicillin or terbutaline.

Emergency drugs not provided under the PBS

Doctors may obtain these as private items – at their own expense – by submitting a written order to a pharmacist. In addition to the non-PBS items listed in *Table 2*, the following should be considered:

- oral drugs: analgesics, antibiotics, prednisolone, diazepam
- normal saline, 1 L bags
- normal saline and water for injection.

Oxygen

Oxygen is essential for managing emergencies and its availability is a requirement for general practice accreditation. Oxygen cylinders can be hired and refilled from a medical gas supplier (eg. BOC). A size C cylinder (490 L) will last for 55 minutes at 8 L/min.

The following are required to administer oxygen: adult and paediatric Hudson masks and nebuliser masks, nasal prongs, airways, and a bag-valve-mask breathing system (eg. Air Viva 3).

Equipment for managing emergencies

Appropriate supplies of IV infusion sets, cannulas, syringes, and needles are required. General practitioners should consider the following items for their practices:

- an automated external defibrillator (AED) with monitor and manual override. Although a defibrillator is not a requirement for practice accreditation, its absence may put a practice at clinical and medicolegal risk
- pulse oximeter
- portable packs to enable equipment to be taken for use offsite.

Equipment for the doctor's bag is discussed in detail by Hiranek et al.¹⁰

Managing emergency drugs in general practice

Drugs must be stored in a locked cupboard or a locked bag at less than 25°C. ADT and syntometrine are stored in a refrigerator. Schedule 8 drugs (opioids) must be stored in a locked, fixed, steel safe; although ampoules may be put in a locked bag for use away from the clinic.

All emergency drugs should be logged in a book or spreadsheet that includes date received, date administered, recipient, and expiry date. Systems should be in place for checking drug stocks and expiry dates, and for auditing the log.

A separate book is required to log Schedule 8 drugs received and used. A Schedule 8 drug record book is available from The Royal Australian College of General Practitioners at www.racgp.org.au/publications/recordkeeping.

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References

1. Adult cardiorespiratory arrest flow chart. Australian Resuscitation Council. Available at www.resus.org.au/public/arc_adult_cardiorespiratory_arrest.pdf [Accessed 19 December 2007].
2. Emergency management of anaphylaxis in the community. Australian Prescriber 2007;30:115. Available at www.australianprescriber.com/upload/pdf/articles/913.pdf [Accessed 19 December 2007].
3. National Asthma Council. Emergency management of asthma. Available at www.nationalasthma.org.au/html/emergency/print/EMAC.pdf [Accessed 19 December 2007].
4. McKenzie DK, Abramson M, Crockett AJ, et al, The COPD-X Plan. Australian and New Zealand guidelines for the management of chronic obstructive pulmonary disease, 2007.
5. National Heart Foundation. Algorithm for the management of acute coronary syndrome. Available at www.heartfoundation.com.au/downloads/NHF_ACS_chart0506.pdf [Accessed 19 December 2007].
6. Clark SFJ, Dargan PI, Jones AL. Naloxone in opioid poisoning: walking the tightrope. *Emerg Med J* 2005;22:612–6.
7. Seidel R, Sanderson C, Mitchell G, Currow DC. Until the chemist opens – palliation from the doctor's bag. *Aust Fam Physician* 2006;35:225–31.
8. Pharmaceutical Benefits Scheme: Doctors bag emergency drugs. Available at www.pbs.gov.au/html/healthpro/browseby/doctorsbag [Accessed 19 December 2007].
9. Brown SGA, Mullins RJ, Gold MS. Anaphylaxis: diagnosis and management. *Med J Aust* 2006;185:283–9.
10. Hiranek N, O'Shea C, Lee C, Speechly C, Cavanagh K. What's in the doctor's bag? *Aust Fam Physician* 2004;33:714–20.