Executive summary of recommendations
Details of recommendations can be found in the main text at the pages indicated.

Principles of management of acute poisoning – resuscitating the poisoned patient

**GPP** In a critically poisoned patient, measures beyond standard resuscitative protocol like those listed above need to be implemented and a specialist experienced in poisoning management should be consulted (pg 55).

**D** Prolonged resuscitation should be attempted in drug-induced cardiac arrest (pg 55).

Grade D, Level 3
Titrated doses of naloxone, together with bag-valve-mask ventilation, should be administered for suspected opioid-induced coma, prior to intubation for respiratory insufficiency (pg 56).

Grade C, Level 2+

In bradycardia due to calcium channel or beta-blocker toxicity that is refractory to conventional vasopressor therapy, intravenous calcium, glucagon or insulin should be used (pg 57).

Grade D, Level 3

Patients with actual or potential life threatening cardiac arrhythmia, hyperkalaemia or rapidly progressive toxicity from digoxin poisoning should be treated with digoxin-specific antibodies (pg 57).

Grade B, Level 2++

Titrated doses of benzodiazepine should be given in hyperadrenergic-induced tachycardia states resulting from poisoning (pg 57).

Grade B, Level 1+

Non-selective beta-blockers, like propranolol, should be avoided in stimulant toxicity as unopposed alpha agonism may worsen accompanying hypertension (pg 57).

Grade D, Level 3

Physostigmine should be considered for treating tachycardia resulting from pure anticholinergic poisoning (pg 58).

Grade D, Level 3

Lidocaine is the drug of choice for most ventricular arrhythmias due to drug toxicity (pg 58).

GPP

Sodium bicarbonate should be used in impaired conduction defect caused by sodium channel blocking agents such as tricyclic antidepressants (pg 58).

Grade C, Level 2+

Titrated doses of benzodiazepine can be used to treat hypertension associated with drug-induced hyperadrenergic states (pg 59).

Grade B, Level 1+

High dose vasopressor therapy for hypotension caused by poisoning needs to be titrated to response and complications (pg 59).

Grade D, Level 3
**D** Calcium chloride or gluconate can be given for calcium-channel blocker overdose (pg 59).

  Grade D, Level 3

**D** Glucagon can be given for beta-blocker and calcium-channel blocker overdose (pg 59).

  Grade D, Level 3

**D** High dose insulin euglycaemia therapy (HIE) is efficacious for use during calcium-channel and beta-blocker overdose (pg 60).

  Grade D, Level 3

**D** Life support with circulatory assist device, such as intra-aortic balloon pump and bypass circuits (example: extracorporeal life support system) should be considered in severe refractory hypotension that is unresponsive to maximal medical therapy. Deployment of these devices should be preplanned in advance (pg 60).

  Grade D, Level 3

**GPP** For poisoned patients presenting with depressed conscious level due to unspecified drugs, the following treatment should be considered: naloxone, glucose, oxygen and thiamine (pg 60).

  GPP

**B** Routine toxicology screen for poisoning agents in the blood and urine or other body fluids is not advised (pg 60).

  Grade B, Level 1-

**D** Checking serum paracetamol level should be considered, especially in a situation of parasuicide where the history may not be forthcoming. Paracetamol is the most common drug involved in parasuicides locally and is readily amenable to treatment with antidotes (pg 61).

  Grade D, Level 4

**D** Patients, who ingested drugs that are of sustained-release formulation; have a prolonged half-life; or active metabolites that have prolonged effects, should be observed for a longer period of time (pg 61).

  Grade D, Level 4
Decontamination after poisoning

Single dose activated charcoal

**C** Single dose activated charcoal is indicated as a gastric decontaminant agent if a patient has ingested a potentially toxic amount of a poison up to 1 hour following ingestion (pg 62).

*Grade C, Level 2+

**GPP** The recommended dose for activated charcoal is as follows (pg 63):
- Children up to 1 year of age: 10-25 g or 0.5 – 1 g/kg.
- Children from 1 to 12 years of age: 25 to 50 g or 0.5 to 1 g/kg.
- Adolescents and adults: 25 to 100 g.

**C** Activated charcoal can be used with additives like orange juice, chocolate syrup and cola to improve its palatability. However use of these additives may decrease activated charcoal’s adsorptive properties (pg 64).

*Grade C, Level 2-

**C** Use of activated charcoal with cathartics does not improve outcome of gastric decontamination compared to activated charcoal alone (pg 64).

*Grade C, Level 2-

**D** Use of activated charcoal with other forms of gastric emptying (e.g. gastric lavage) may be indicated in specific types of poisoning where the poison is seriously life-threatening; the dose ingested is of a massive amount; the poison is in a sustained-release preparation; the poison slows gastrointestinal motility (pg 65).

*Grade D, Level 3

**C** Use of activated charcoal should not be used at home as first aid because its benefit has not been proven (pg 65).

*Grade C, Level 2+

Gastric lavage

**C** Gastric lavage should not be employed routinely, if ever, in the management of poisoned patients. In certain cases where the procedure is of attractive theoretical benefit (e.g. recent ingestion of a very toxic substance), the substantial risks should be weighed carefully against the sparse evidence that the procedure is of any benefit (pg 65).

*Grade C, Level 2+
**Ipecac**

**C** Ipecac has no proven acute role in gastrointestinal contamination management as there is insufficient data to support or exclude its administration soon after poisons ingestion (pg 68).

*Grade C, Level 2+

**B** Use of ipecac as a first aid measure at home has not been proven to be beneficial (pg 69).

*Grade B, Level 2++

**Cathartics**

**C** The administration of a cathartic alone has **no** role in the management of the poisoned patient and is **not** recommended as a method of gut decontamination (pg 69).

*Grade C, Level 2+

**C** Based on available data, the routine use of a cathartic in combination with activated charcoal is not endorsed (pg 70).

*Grade C, Level 2+

**GPP** If a cathartic is used, it should be limited to a single dose in order to minimize adverse effects of the cathartic (pg 70).

*GPP

**Whole bowel irrigation**

**C** Whole bowel irrigation (WBI) should not be used routinely in the management of the poisoned patient (pg 71).

*Grade C, Level 2+

**C** The concurrent administration of activated charcoal and WBI may decrease the effectiveness of the charcoal (pg 73).

*Grade C, Level 2-

**C** WBI should be considered for potentially toxic ingestions of sustained-release or enteric-coated drugs particularly for those patients presenting greater than two hours after drug ingestion and there is a lack of other options for gastrointestinal decontamination (e.g. substantial amounts of iron/ingestion of illicit packets of drugs) (pg 73).

*Grade C, Level 2+
C WBI is contraindicated in patients with bowel obstruction, perforation, ileus, and in patients with hemodynamic instability or compromised unprotected airways. It should be used cautiously in debilitated patients or in patients with medical conditions that may be further compromised by its use (pg 74).

Grade C, Level 2+

Poisons management at home

C Ipecac should no longer be used routinely as a home treatment strategy (pg 74).

Grade C, Level 2+

C It is premature to recommend the administration of activated charcoal in the home (pg 74).

Grade C, Level 2-

GPP The first action for a caregiver of a child who may have ingested a toxic substance is to consult with a doctor (pg 74).

GPP

Enhancing the elimination of toxic substances from the body

Multiple-dose activated charcoal (MDAC)

D Based on experimental and clinical studies, multiple-dose activated charcoal should be considered only if a patient has ingested a life-threatening amount of carbamazepine, dapsone, phenobarbital, quinine or theophylline (pg 75).

Grade D, Level 3

D Volunteer studies have demonstrated that multiple-dose activated charcoal increases the elimination of amitriptyline, dextropropoxyphene, digoxin, disopyramide, nadolol, phenylbutazone, phenytoin, piroxicam, and sotalol. There is insufficient clinical data to support or exclude the use of this therapy. The use of multiple-dose charcoal in salicylate poisoning is controversial (pg 75).

Grade D, Level 4

D Co-Administration of a cathartic to MDAC is unproven. Cathartics should not be administered to young children because of the propensity of laxatives to cause fluid and electrolyte imbalance (pg 75).

Grade D, Level 4
Multiple-dose activated charcoal is administered orally. If appropriate, it may be given via a nasogastric tube. An antiemetic may be given intravenously, if vomiting, to ensure compliance. Smaller, more frequent doses of charcoal may be tried to prevent regurgitation. The optimum dose of charcoal is unknown but it is recommended that after an initial dose of 50–100 g to an adult, activated charcoal should be administered at a rate of not less than 12.5 g/h or equivalent. Lower doses (10–25 g) of activated charcoal may be employed in children less than 5 years of age as usually, they have ingested smaller overdoses and their gut lumen capacity is smaller (pg 75).

Multi-Dose Activated Charcoal should be discontinued if there is significant clinical improvement or serum drug concentrations have fallen to nontoxic levels (pg 76).

Urinary pH manipulation

Urine alkalisation increases the urine elimination of salicylate, chlorpropamide, 2,4-dichlorophenoxyacetic acid (herbicide), diflunisal, fluoride, mecoprop (herbicide), methotrexate and phenobarbital. High urine flow (approximately 600 mL/h) and urine alkalisation should also be considered in patients with severe 2,4-dichlorophenoxyacetic acid and mecoprop poisoning (pg 76).

Volume overload may complicate therapy in patients with pre-existing cardiac disease. Significant pre-existing heart disease is a relative contraindication. Urinary pH manipulation is contraindicated in patients with established or incipient renal failure, pulmonary oedema and cerebral oedema (pg 77).

Hypokalemia is the most common complication. Alkalotic tetany occurs occasionally, but hypocalcaemia is rare. There is no evidence to suggest that relatively short-duration alkalemia poses a risk to life in normal individuals or in those with coronary and cerebral arterial disease (pg 77).

Urinary acidification (urine pH < 5.5) with ammonium chloride or ascorbic acid was historically used to treat intoxications with weak bases such as amphetamines, quinidine or phencyclidine. However, this practice has been abandoned, as efficacy has not been established and iatrogenic toxicity (severe acidosis) can occur (pg 77).
D Discontinue urine alkalinisation when plasma salicylate concentrations fall below 350 mg/L in an adult or 250 mg/L in a child (pg 78).

**Extracorporeal techniques**

GPP Extracorporeal techniques are considered if the patient is critically ill and the blood level of a poison is in the known lethal range or associated with serious consequences (pg 79).

**Antidotes**

GPP Consider using specific antidotes in a timely manner when clinically indicated. Certain antidotes have been shown to improve survival and patient outcomes in poisonings and drug overdoses (pg 80).

GPP Indications for the use of antidotes in children are generally the same as for adults. Certain antidotes have been shown to improve survival and outcomes in paediatric poisonings and drug overdoses (pg 80).

GPP Do not withhold antidotes for pregnant women who had experienced poisonings and drug overdoses, especially if the symptoms are life-threatening or severe (pg 81).

GPP Institutions that manage acute poisoning and drug overdoses should adequately stock the appropriate antidotes (pg 83).

**Analgesics**

*Non-steroidal anti-inflammatory drugs (NSAID) poisoning (excluding salicylates)*

Definition:

D Symptomatic patients irrespective of reported dose ingested (pg 84).

**Grade D, Level 4**
Ingestions of less than 100 mg/kg of most NSAIDs (except mefenamic acid and phenylbutazone) are unlikely to cause any significant toxicity. Massive ingestions with severe symptomology are seen with ingestions greater than 400 mg/kg (pg 85).

**Grade C, Level 2++**

Refer to Emergency Department / Hospital for further evaluation and management if (pg 85):
- Patient is symptomatic (irrespective of dose).
- If toxic dose is consumed (see above).
- Suspected non-accidental ingestion (irrespective of dose).
- Poor home support (lives alone, inability of caregivers to monitor).

**Grade D, Level 4**

Activated charcoal should be given within 1 hour of ingestion (pg 86).

**Grade B, Level 1+**

Aspiration risk, including mental status and the ability to protect the airway, must be assessed in all patients before any attempts to administer activated charcoal (pg 86).

**Grade D, Level 4**

Supportive treatment and a brief period of observation are usually all that is necessary in most cases of non-steroidal anti-inflammatory drug (NSAID) overdose, with the exception of mefenamic acid and phenylbutazone (pg 86).

**Grade D, Level 4**

If more than 6 hours had passed since the suspected toxic ingestion and the patient is clinically well, the patient does not require further evaluation for toxicity (except for mefenamic acid and phenylbutazone).

In mefenamic acid and phenylbutazone poisoning, a 24-hour post ingestion observation is advised due to the increased risk in complications (pg 87).

**Grade D, Level 3**

Seizures secondary to NSAIDs toxicity can be effectively treated with benzodiazepines (pg 87).

**Grade C, Level 2++**

NSAID levels correlate poorly with symptoms and are not usually clinically useful (pg 87).

**Grade B, Level 2+**
Routine measurement of renal function is not indicated in patients with minor, asymptomatic ingestions. In symptomatic patients or those with significant toxic ingestion, measurement of baseline renal function and electrolytes should be done (pg 87).

**Opioids**

Refer to Emergency Department / Hospital for the following groups of patients (pg 88):

- All patients with suicidal intent, intentional abuse, or in cases in which a malicious intent is suspected (e.g. child abuse or neglect).
- All symptomatic patients.
- Patients who are suspected of ingesting toxic amounts of opioid.
- Patients with poor home support (e.g. lives alone, inability for caregivers to monitor).

Capillary glucose: to exclude hypoglycaemia.
Electrocardiogram (ECG): should be obtained when the patient is suspected of methadone/propoxyphene overdose; or when co-ingestion with other substances which may cause cardiovascular complications, such as cocaine or antidepressants is suspected (e.g. if intended self-harm is suspected).
Other investigations:
- In the setting of suspected prolonged immobilization: serum creatine phosphokinase concentration should be obtained to exclude rhabdomyolysis.
- Serum creatinine and electrolytes: depending on clinical circumstances
- Targeted blood toxicology: In any overdose scenario in which the opioid is formulated with paracetamol or self-harm is suspected, serum paracetamol concentration should be obtained.
- Urine toxicologic screens should not be routinely obtained. Opioids are detectable in the urine for only two to four days after use. A positive test may indicate recent use but not current intoxication, or may even represent a false positive. Conversely, many opioids, especially the synthetic drugs, will produce false-negative results in many commonly available urine screens.

Initial management should focus on support of the patient’s airway and breathing. While pulse-oximetry is useful in monitoring oxygenation, its usefulness may be limited if supplemental oxygen is given. Capnography if available may be useful for monitoring the ventilatory effort of opioid-poisoned patients.
C Patients with respiratory insufficiency should be supported with bag mask ventilation and 100% oxygen to correct respiratory acidosis before or while the opioid antagonist is administered (pg 92).

Grade C, Level 2++

B For suspected pulmonary oedema, oxygen and positive pressure ventilation may be required (pg 92).

Grade B, Level 1+

B Activated charcoal (1 g/kg, maximum of 50 g) can be given to patients who have ingested within 1 hour of overdose, if the airway is first assessed and protected, as needed, prior to the procedure (pg 92).

Grade B, Level 1+

D In Lomotil (diphenoxylate and atropine) poisoning, gastric lavage within 2 hours of overdose and multi-dose activated charcoal should be considered (pg 92).

Grade D, Level 3

D In body packing with leakage and overdose, whole body bowel irrigation can be considered if airway is protected (pg 92).

Grade D, Level 3

Salicylate poisoning

Refer to emergency department / hospital referral for further evaluation and management:

D All symptomatic patients should be referred to an emergency department regardless of dose ingested (e.g. haematemesis, tachypnoea, hyperpnoea, dyspnoea, tinnitus, deafness, lethargy, seizures, unexplained lethargy or confusion) (pg 100).

Grade D, Level 3

D All patients with known or suspected suicidal intent or non-accidental ingestion (e.g. child abuse) irrespective of amount ingested (pg 100).

Grade D, Level 4

D If asymptomatic and had suspected toxic ingestion (pg 100):
  - Acute ingestion of aspirin or equivalent exceeding 150 mg/kg or 6.5 g, whichever is less.
  - Ingestion of oil of wintergreen (98% methyl salicylate) if:
    - Under 6 years of age: greater than a lick or taste.
    - Patients 6 years of age or older: > 4 mL.

Grade D, Level 3
If the accidental ingestion occurred >12 hours (24 hours for enteric-coated tablets) and the patient is asymptomatic, no further evaluation is required (pg 100).

**Grade C, Level 2+**

*Mucocutaneous and ocular salicylate exposure*

For asymptomatic patients with dermal exposures to methyl salicylate or salicylic acid, the skin should be thoroughly washed with soap and water and the patient can be observed for symptoms (pg 101).

**Grade D, Level 3**

For patients with an ocular exposure of methyl salicylate or salicylic acid, the eye(s) should be irrigated with room temperature tap water for 15 minutes. If after irrigation the patient is having pain, decreased visual acuity or persistent irritation, refer to an ophthalmologist (pg 101).

**Grade D, Level 4**

*Management of salicylate poisoning*

Intubation of the salicylate-poisoned patient can be detrimental and should be avoided unless necessary (pg 101).

**Grade D, Level 3**

If intubation and mechanical ventilation is necessary for severe obtundation, hypotension, hypoventilation or severe metabolic acidosis, ensure appropriately high minute ventilation and maintain alkalemia (via serial blood gas analysis) with serum pH 7.50-7.55 (pg 101).

**Grade D, Level 4**

Consider haemodialysis for patients who require intubation (pg 102).

**Grade D, Level 4**

Pulmonary oedema and acute lung injury may occur and should be treated with oxygen and if available, non-invasive ventilation. Intubation and mechanical ventilation with positive end-expiratory pressure (PEEP) may be necessary, but should be avoided if possible (pg 102).

**Grade D, Level 3**

Intravenous fluids should be administered as necessary to replace insensible fluid losses from hyperpyrexia, vomiting, diaphoresis, and elevated metabolic rate (pg 102).

**Grade D, Level 4**
D There should be judicious administration of fluids in the presence of suspected pulmonary oedema or cerebral oedema (pg 102).

Grade D, Level 4

D All patients with salicylate poisoning with altered mental status should be given supplemental glucose, regardless of serum glucose levels (pg 102).

Grade D, Level 4

D Supplemental potassium should be given to maintain serum potassium 4–4.5 mmol/L, unless renal failure is present (pg 102).

Grade D, Level 4

D Gastrointestinal decontamination with activated charcoal can be considered in patients with significant acute salicylate overdose irrespective of the suspected time of ingestion (pg 103).

Grade D, Level 2+

D Multi-dose activated charcoal should be considered in massive salicylate ingestions every 4 hours for 24 hours in a dose of 1 g/kg (maximum 50 g) until symptoms have resolved and plasma salicylate concentration is < 30 mg/dL (pg 103).

Grade D, Level 2+

B Enhanced salicylate elimination via urine alkalinisation with sodium bicarbonate is an essential component in the management of the salicylate-poisoned patient (pg 103).

Grade B, Level 1+

D Alkalemia from respiratory alkalosis is not a contraindication to sodium bicarbonate therapy (pg 103).

Grade D, Level 3

C Haemodialysis is the definitive treatment to prevent and treat salicylate induced end-organ injury (pg 103).

Grade C, Level 2++

D Early consultation to the relevant specialists may be required in severe salicylate poisoning (pg 104).

Grade D, Level 4
The indications for haemodialysis are primarily clinical and include (pg 104):

- Severe acidosis or hypotension refractory to optimal supportive care (regardless of absolute serum aspirin concentration).
- Evidence of end-organ injury (i.e. seizures, rhabdomyolysis, pulmonary oedema).
- Renal failure.
- Plasma salicylate concentration > 100 mg/dL (> 7.2 mmol/L) in the setting of acute ingestion; or plasma salicylate concentration > 60 mg/dL (> 4.3 mmol/L) in the setting of chronic salicylate use.
- Haemodialysis should be considered for patients who require mechanical ventilation, unless that indication for mechanical ventilation is respiratory depression secondary to a co-ingestant.

Grade C, Level 2++

A salicylate level and blood gas should be drawn 2-3 hourly until both the plasma salicylate level is falling and the acid-base status is stable or improving for two consecutive readings (pg 104).

Grade D, Level 4

Check urea and electrolytes every 3-4 hours. The serum potassium should be kept in the range 4 to 4.5 mmol/L (pg 104).

Grade D, Level 4

**Paracetamol poisoning**

*Toxic ingestion*

**Definition:**

- Symptomatic: e.g. repeated vomiting, abdominal tenderness in the right upper quadrant or mental status changes (pg 107).

Grade D, Level 4

- If unknown dose, assume toxic ingestion (pg 107).

Grade D, Level 4

**Acute single dose poisoning:**

- 200 mg/kg or more; or 10 g (whichever is less) (pg 107).
  - Both paediatric and adults.

Grade C, Level 2++
**Repeated supratherapeutic ingestion (>24 hours staggered dose) (pg 107):**

- In children (< 6 years) or high risk group: 4 g or more than 100 mg/kg/day (whichever is less).
- In children (> than 6 years old) or adults: 6 g or 150 mg/kg/day (whichever is less).

*Grade D, Level 4*

**Sustained-release preparations**

- In a single acute ingestion, if more than 200 mg/kg or 10 g (whichever is less) has been ingested, N-acetylcysteine treatment should be started immediately (pg 108).

*Grade C, Level 2++*

- In all cases, serum paracetamol levels should be taken at 4 hours or more post-ingestion (as with standard preparations) and repeated 4 hours later. If either level is above the normogram line, N-acetylcysteine should be commenced or continued. N-acetylcysteine may be discontinued if both levels fall below the normogram line (pg 108).

*Grade C, Level 2++*

**Management of paracetamol poisoning**

- Presence of hypoglycaemia may be secondary to hepatic failure and intensive care monitoring is required (pg 109).

*Grade D, Level 4*

- **Prehospital**
  
  - Activated charcoal (1 g/kg, up to 50 g) can be considered if available, patient is alert and co-operative, a toxic dose of acetaminophen has been taken and fewer than 2 hours have elapsed since the ingestion (pg 110).

*Grade B, Level 1+

- Gastrointestinal decontamination could be particularly important if N-acetylcysteine cannot be administered within 8 hours of ingestion (pg 110).

*Grade D, Level 4*

- **ED/Hospital Management**

  - Activated charcoal (1 g/kg, up to 50 g) can be given if less than 2 hours (pg 110).

*Grade B, Level 1+

- May have a role in sustained-release preparations even after 2 hours of ingestion (pg 110).

*Grade D, Level 4*
Limited studies available but charcoal haemoperfusion may be considered in severe paracetamol poisoning in the intensive care setting, after consultation with the relevant specialists (pg 110).

Grade D, Level 3

N-acetylcysteine is the antidote of choice for paracetamol poisoning and should be administered to all patients judged to be at risk of developing hepatotoxicity after paracetamol overdose (pg 110).

Grade A, Level 1+

When risk assessment indicates that N-acetylcysteine is required, it is administered as a three-stage infusion, totalling 300 mg/kg over 20–21 hours (pg 111).

Grade C, Level 2++

If hepatic injury is suspected after the three infusion stages, N-acetylcysteine is continued at the rate of the last infusion stage (100 mg/kg each 16 hours or 150 mg/kg/24 hours) until there is clinical and biochemical evidence of improvement (pg 111).

Grade C, Level 2++

N-acetylcysteine reduces mortality if commenced late in patients with established paracetamol-induced fulminant hepatic failure. In this setting, N-acetylcysteine reduces inotrope requirements, decreases cerebral oedema and increases the rate of survival by about 30% (pg 111).

Grade B, Level 2++

Anaphylactoid reactions manifested by rash, wheeze or mild hypotension occur in 5–30% of patients during the first two N-acetylcysteine infusions. Management is supportive, with temporary halting or slowing of the infusion, and administration of antihistamines (IV promethazine 0.2 mg/kg, up to 10 mg) (pg 112).

Grade D, Level 3

The occurrence of an anaphylactoid reaction does not preclude the use of N-acetylcysteine on another occasion, if indicated (pg 112).

Grade D, Level 3

Methionine can be considered as an alternative antidote for paracetamol poisoning, especially in the setting of known allergy to N-acetylcysteine (pg 112).

Grade B, Level 1+
Management of non-accidental toxic ingestions

Grade D, Level 4

Admission is recommended, irrespective of levels for non-accidental ingestion. Serum levels must be tested. Multi-drug poisoning should be considered (pg 112).

ED/hospital management of accidental ingestions

Acute single dose toxic ingestion

Asymptomatic patients

Grade B, Level 1+

B If < 2 hours: Gastrointestinal decontamination via activated charcoal (1 g/kg, up to 50 g) for co-operative and alert patients (pg 113).

Grade C, Level 2++

C If 4-8 hours: Measure paracetamol levels (at or after 4 hours post ingestion) (pg 113).

- Plot paracetamol level on normogram.
- Start IV N-acetylcysteine if over normogram at 150 mg/L (1000 μmol/L) at 4 hours (line of possible hepatotoxicity).

Symptomatic patients (clinical or biochemical)

Grade D, Level 3

D Start IV N-Acetylcysteine without waiting for levels (even < 8 hours) (pg 113).

- Obtain paracetamol levels, ALT/AST, full blood count (platelet), INR or PT, urea and creatinine, electrolytes, glucose and arterial blood gas.
- If symptomatic and paracetamol levels are below the normogram, consider toxic co-ingestions.
Repeated Supratherapeutic Toxic Ingestion

D Commence IV N-Acetylcysteine (do not wait for levels) (pg 113).
• Obtain paracetamol and ALT/AST levels as soon as possible.
• If paracetamol < 10 mg/L and ALT/AST normal, stop infusion of NAC.
• Obtain INR or PT, urea and creatinine, electrolytes, glucose and arterial blood gas (if bicarbonate abnormal) at admission.
• Repeat ALT/AST and serum paracetamol levels at 8-12 hours.
• If ALT/AST normal or static and paracetamol < 10 mg/L, stop infusion of NAC.
• If abnormal, continue IV NAC and repeat ALT/AST 12 hourly and other investigations as indicated.

Grade D, Level 2+

Unknown time of ingestion

D Start IV N-acetylcysteine. Investigations and management are similar to supratherapeutic repeated dose ingestion (pg 114).

Grade D, Level 4

Severe paracetamol poisoning

C Metabolic (pg 115):
• Metabolic acidosis (pH < 7.3 or bicarbonate < 18) despite rehydration.
• Hypoglycaemia.
• Hypotension despite adequate fluid resuscitation.

CNS:
• Encephalopathy or signs of raised intracranial pressure.

Liver Function / Coagulopathy:
• INR > 2.0 at or before 48 hours or > 3.5 at or before 72 hours:
  – Consider measuring INR every 12 hourly.
  – Peak elevation occurs around 72 – 96 hours.
  – LFTs are not good markers of hepatocyte death.

Renal:
• Renal impairment (creatinine > 200 μmol/L):
  – Monitor urine output.
  – Daily urea, electrolytes and serum creatinine.
  – Consider haemodialysis if > 400 μmol/L.

Resuscitation and intensive care monitoring required.

Grade C, Level 2++
Consider referrals to liver transplant hepatologists and transferring to tertiary intensive care units with a liver transplant unit in Singapore (pg 115).

Grade D, Level 4

Consider liver transplantation if (pg 115):
- Arterial pH < 7.3 or arterial lactate > 3.0 mmol/L after adequate fluid resuscitation. OR
- If all three of the following occur in a 24-hour period:
  - Creatinine > 300 μmol/L.
  - PT > 100 (INR > 6.5).
  - Grade III / IV encephalopathy.

Strongly consider transplantation if:
- Arterial lactate > 3.5 mmol/L after early fluid resuscitation.

Grade C, Level 2++

Antihistamines / Anticholinergics

Referral for ED / hospital management

All patients with suicidal intent, intentional abuse or in cases in which a malicious intent is suspected (e.g. child abuse or neglect) should be referred to an emergency department (pg 121).

Grade D, Level 4

All symptomatic patients should be referred to an emergency department (pg 121).

Grade D, Level 4

Poor home support (lives alone, inability of caregivers to monitor) (pg 121).

Grade D, Level 4

Patients who are suspected of ingesting toxic amounts of anticholinergics should be referred to an emergency department or further management (pg 121).

Grade D, Level 4

Investigations

Capillary glucose should be done in any patient presenting with altered conscious status (pg 121).

Grade D, Level 4
Cardiac monitoring and ECG: it is crucial that patients suspected of having anticholinergic toxicity have an ECG to allow detection of QTc interval prolongation or frank arrhythmias. This can occur with overdose of tricyclic antidepressants, certain phenothiazines (e.g. mesoridazine and thoridazine), diphenhydramine and other agents with anticholinergic properties (pg 121).

Grade D, Level 3

Urine analysis/microscopy and serum creatinine kinase: rhabdomyolysis in anticholinergic toxicity can occur secondary to prolonged seizures or may be atraumatic in doxylamine and diphenhydramine poisoning (pg 122).

Grade D, Level 3

Serum drug levels of anticholinergic agents are not helpful or readily available in the clinical setting; the diagnosis of anticholinergic toxicity is based on clinical findings and less often the result of a diagnostic/therapeutic trial of physostigmine (pg 122).

Grade D, Level 2+

Management

Patients should have intravenous access, supplemental oxygen, cardiac monitoring and continuous pulse oximetry (pg 122).

Grade D, Level 3

Patients with severe anticholinergic toxicity and/or treated with physostigmine should be monitored in an intensive care unit for observation (pg 122).

Grade D, Level 3

(1) Gastric lavage:

May be considered in patients with history of significant overdosing and potential for high morbidity as gastric emptying may be delayed (pg 123).

Grade D, Level 3

(2) Activated charcoal:

If the patient’s mental status is intact and ingestion of an anticholinergic agent is likely, activated charcoal (1 g/kg; maximum 50 g) should be given (pg 123).

Grade D, Level 2+

Physostigmine

The main management for most patients with cholinergic toxicity is supportive care alone, but some literature report benefit in selected patients (pg 124).

Grade D, Level 3
Physostigmine may be indicated when patients manifest isolated moderate to severe agitation/delirium secondary to anticholinergic toxicity (pg 124).

Grade C, Level 2+

Physostigmine should not be given if a condition other than a purely anticholinergic poisoning is suspected (e.g. tricyclic antidepressant overdose) as it is associated with cardiac adverse events and deaths (pg 124).

Grade D, Level 3

Before physostigmine is given, the patient should be placed on a cardiac monitor; and atropine and resuscitative equipment should be available (pg 124).

Grade D, Level 3

Physostigmine may be superior to benzodiazepines in the management of agitation and delirium due to anticholinergic toxicity in selected patients (pg 124).

Grade D, Level 2+

Diagnostic trial in patients presenting with agitation and delirium with suggestive history which may avoid the use of many invasive and radiological investigations (pg 124).

Grade D, Level 2+

Psychotropics

Benzodiazepines

Qualitative screening of urine or blood is not recommended. Screening rarely influences treatment decisions because of long turnaround time, lack of available or reliable tests, poor correlation clinically and may not alter emergency treatment options. However urine and blood screening may support evidence of exposure (pg 129).

Grade D, Level 3

Monitor arterial blood gas if there is respiratory depression. Obtain serum electrolytes, glucose, BUN levels. Useful tests to exclude other causes of respiratory depression and predict severity of respiratory depression (pg 129).

GPP

Diagnosis is usually based on a history of ingestion. Specific serum levels may confirm diagnosis. Urine and blood screens are also available (pg 130).

Grade D, Level 3
Although flumazenil may be effective to reverse coma from suspected drug poisoning in patients presenting to the emergency department, its routine use is not recommended. Routine use of flumazenil is not recommended as benzodiazepine overdose is seldom fatal and flumazenil has side effects (pg 130).

Grade A, Level 1+

Flumazenil is not recommended in patients with epilepsy, benzodiazepine dependence or suspected multi-agent overdoses. Co-ingested substances, such as heterocyclic antidepressants, are known to produce seizures (pg 130).

Grade A, Level 1+

**Selective serotonin reuptake inhibitor (SSRI)**

Asymptomatic patients or those with mild effects following isolated unintentional acute SSRI ingestions of up to five times an initial adult therapeutic dose can be observed at home with instructions to seek medical attention if symptoms develop. The therapeutic index is wide and overdoses up to 5 times the therapeutic doses may be tolerated without serious toxicity (pg 133).

Grade D, Level 4

For patients already on an SSRI, those with ingestion of up to five times their own single daily therapeutic dose can be observed at home with instructions to seek medical attention if symptoms develop (pg 133).

Grade D, Level 4

**GPP** (pg 134)

- Monitor arterial blood gas if there is respiratory depression.
- Monitor serum electrolytes, glucose, BUN.
- Useful tests to exclude other causes of respiratory depression and predict severity of respiratory depression.

**GPP** Cardiac monitoring is recommended in symptomatic cases. Some drugs can prolong QT and in overdoses, arrhythmias need to be excluded (pg 134).

**GPP**

Use intravenous benzodiazepines for seizures, and external cooling measures for hyperthermia (>104°F or >40°C) seen with SSRI-induced serotonin syndrome. Institute emergency and supportive measures as they occur (pg 134).

Grade D, Level 4
Sodium bicarbonate may be used for QRS widening in patients with cardiac conduction abnormalities after SSRI poisoning. This reverses the sodium channel-dependent membrane depressant effects and may correct the cardiac conduction abnormalities (pg 134).

\textbf{Grade D, Level 4}

**GPP** Provide IV fluids and maintenance of the airway and ventilation if required. Institute emergency and supportive measures as required clinically (pg 135).

**GPP** Inotropic agents should be started for hypotension not responding to fluid resuscitation. Institute emergency and supportive measures as they occur (pg 135).

**D** Cyproheptadine may be considered for suspected serotonin syndrome refractory to standard treatment measures. Cyproheptadine is a histamine H\textsubscript{1} blocker which antagonises serotonin receptors. Anecdotal case reports have shown improved clinical symptoms with its use (pg 135).

\textbf{Grade D, Level 3}

**D** Chlorpromazine may be considered for suspected serotonin syndrome refractory to standard treatment measures. Chlorpromazine is a serotonin receptor antagonist neuroleptic. Anecdotal case reports have shown improved clinical symptoms with its use (pg 135).

\textbf{Grade D, Level 3}

**D** Dantrolene may be considered for suspected serotonin syndrome refractory to standard treatment measures. Dantrolene relaxes skeletal muscles and prevents hyperthermia. Anecdotal case reports have shown improved clinical symptoms with its use (pg 135).

\textbf{Grade D, Level 3}

In the absence of an established toxic dose, the presence of more than mild clinical effects (vomiting, somnolence, mydriasis, diaphoresis, including those consistent with serotonin syndrome) should be used as an indication for emergency department referral, regardless of the dose reportedly ingested.

Patients who have unintentional SSRI ingestions and are asymptomatic may stay at home with poison centre follow-up. A patient suspected of a significant overdose is at risk of serious toxicity and serotonin syndrome (pg 136).

\textbf{Grade D, Level 3}
**Antipsychotics**

B Clinical manifestations of atypical antipsychotic toxicity generally include varying degrees of central nervous system depression (drowsiness), agitation, anticholinergic effects, pupillary changes, seizures, hypotension or hypertension, and cardiac conduction abnormalities (prolongation of the QTc and QRS intervals). Clozapine has been shown to cause agranulocytosis in 1–2% of patients after 1 year of therapy. Morbidity usually results from cardiotoxicity (hypotension, ventricular arrhythmias or conduction delay); or neurotoxicity (respiratory depression, coma, seizures or delirium) (pg 138).

Grade B, Level 1-

D Patients with stated or suspected self-harm should be referred to an emergency department immediately. This is regardless of the dose reported (pg 139).

Grade D, Level 4

C Asymptomatic patients without evidence of attempted self-harm are unlikely to develop symptoms if the time since ingestion is greater than 6 hours. They do not need referral into hospital (pg 139).

Grade C, Level 3

D All patients (12 years of age or older) who are naïve to atypical antipsychotic medications, and are experiencing no more than mild drowsiness can be observed at home, unless they have ingested more than five times the initial adult dose of the antipsychotic medication (i.e. if they ingested more than aripiprazole 50 mg, clozapine 62.5 mg, olanzapine 25 mg, quetiapine 125 mg, risperidone 5 mg, ziprasidone 100 mg) (pg 139).

Grade D, Level 4

D If a patient on chronic atypical antipsychotic therapy ingested more than 5 times their current single dose (not daily dose), they should be referred to the emergency department (pg 139).

Grade D, Level 3

D Ipecac syrup should be avoided due to insufficient evidence of its effectiveness. (Olanzapine, ziprasidone) (pg 139).

Grade D, Level 3

D Decontaminate with activated charcoal. Consider attempting gastric lavage if ingestion was within a few hours since anticholinergic action slows GI transit. (Olanzapine, quetiapine) (pg 139).

Grade D, Level 3
Hypotension should be treated with IV crystalloid infusions. If vasopressors are required, norepinephrine or phenylephrine is preferred. Agents with beta-agonist activity (dopamine, epinephrine) may worsen vasodilatory effects (hypotension) and should be avoided. Hypotension is due to atypical antipsychotic-induced alpha blockade (pg 140).

Grade D, Level 3

For drug-induced dystonia in the adult, give IV benztropine 1-2 mg or diphenhydramine 50 mg IV/IM over 2 minutes. For that in the child, give diphenhydramine 1 mg/kg/dose IV over 2 minutes (maximum 5 mg/kg/day or 50 mg/m²/day) (pg 140).

Grade D, Level 3

Perform continuous cardiac monitoring. Monitor antimuscarinic effects, and check creatine kinase (CK) levels in patients with prolonged agitation, excessive rigidity or coma. In patients with neurologic symptoms, monitor for respiratory depression (pulse oximetry and/or ABGs) (pg 140).

Grade D, Level 3

Haemodialysis, haemoperfusion, forced diuresis and exchange transfusion are unlikely to be useful following overdose, because of the relatively large volume of distribution and high degree of protein binding. (Ziprasidone, clozapine) (pg 140).

Grade D, Level 3

Treat seizures with IV benzodiazepines (pg 140).

Grade D, Level 3

Neuroleptic Malignant Syndrome should be treated with oral or parenteral dantrolene (pg 141).

Grade C, Level 2+

All patients less than 12 years of age who are naïve to atypical antipsychotics, and are experiencing no more than mild drowsiness (lightly sedated and can be aroused with speaking voice or light touch) can be observed at home. However, refer if they have ingested more than four times the initial adult dose; or a dose that is equal to or more than the lowest reported acute dose that resulted in moderate toxicity, whichever dose is smaller (i.e. aripiprazole 15 mg; clozapine 50 mg; olanzapine 10 mg; quetiapine 100 mg; risperidone 1 mg; or ziprasidone 80 mg) (pg 141).

Grade C, Level 3
Clinical manifestations of typical antipsychotics poisoning generally include neuroleptic malignant syndrome, rigidity, dystonia, fever and widened QRS interval (pg 141).

Grade C, Level 2+

The primary treatment of cardiotoxicity is plasma alkalinisation with sodium bicarbonate and hyperventilation (pg 141).

Grade D, Level 4

Patients with altered mental state or persistent tachycardia despite intravenous fluids should be closely monitored. Benzodiazepines or physostigmine could be administered to manage tachycardia (pg 142).

GPP

Tricyclic Antidepressants (TCAs)

Consider referral to a hospital emergency department if ingested either of the following amounts (whichever is lower) (pg 146):
- An amount that exceeds the usual maximum single therapeutic dose;
- An amount equal to or greater than the lowest reported toxic dose
  - For amitriptyline, clomipramine, doxepin and imipramine: 5 mg/kg.
  - For nortriptyline and trimipramine: 2.5 mg/kg.

This recommendation applies both to patients who are naïve to the specific drug and to patients currently taking TCAs. For patients currently on TCAs, the extra doses should be added to the daily dose taken for comparison to the threshold doses stated above.

Grade C, Level 2+

For unintentional poisonings, asymptomatic patients do not need referral to an emergency department facility if more than 6 hours have elapsed since the ingestion of the TCA. These patients are unlikely to develop symptoms (pg 146).

Grade C, Level 2+

ECG readings are recommended over serum TCA drug level to predict seizure and arrhythmia (pg 147).

Grade B, Level 1+

Gastric lavage may be considered for massive ingestions, up to 2-4 hours post-ingestion in potentially toxic TCA overdoses. Gastric emptying time may be delayed due to anticholinergic effects of the TCAs (pg 149).

Grade D, Level 3
**D** Activated charcoal may be used for gastric decontamination. However, the routine use of multiple-dose activated charcoal is not recommended. Activated charcoal slurry 1 g/kg may be administered as soon as possible after a potentially toxic ingestion in a healthcare setting (due to the risk of aspiration), as TCAs are known to undergo enterohepatic recirculation. Administration of subsequent doses should be considered in patients with serious toxicity, because of the possibility of desorption of TCA from charcoal. It should also be considered in patients who ingest modified-release formulations (pg 149).

*Grade D, Level 3*

**GPP** Haemodialysis and haemoperfusion may be considered in patients with very severe TCA poisoning. Due to the very large volume of distribution and high protein binding of TCAs, haemodialysis and haemoperfusion are not as effective in enhancing drug removal (pg 149).

**C** Sodium bicarbonate is the mainstay of therapy in TCA overdose. Bolus doses of 1-2 mEq/kg should be given to achieve and maintain a QRS width of 100 milliseconds or less. In patients with dysrhythmia, serum pH should be maintained at 7.45 to 7.55. Other causes of widened QRS should be considered if the patient fails to respond to sufficient doses of sodium bicarbonate therapy (pg 149).

*Grade C, Level 2-

**GPP** Use of physostigmine as an antiarrhythmic is not recommended. In the setting of TCA overdose, it has been associated with the development of seizures and fatal dysrhythmias (pg 149).

**GPP** Avoid antiarrhythmic drugs from class Ia (quinidine, procainamide, disopyramide), class Ic (flecainide), class II, and class III (bretylium, amiodarone). These agents may prolong depolarisation, QTc interval and predispose to arrhythmias. The correction of hypotension, hypoxia and acidosis will reduce the cardiotoxic effects of tricyclics. Ventricular arrhythmias refractory to sodium bicarbonate may require treatment with lidocaine, magnesium sulphate, or both (pg 150).

**GPP** Hypotension refractory to fluid resuscitation and sodium bicarbonate may require vasopressor support (norepinephrine, phenylephrine). Inotrope support (dopamine) may not be as effective (pg 150).

*Grade D, Level 3*
**GPP** For TCA-associated convulsions, benzodiazepines are recommended. The efficacy of phenytoin is not proven (pg 150).

**GPP** Flumazenil is not recommended in patients who have co-ingested TCA and benzodiazepines (pg 150).

**D** Symptoms of TCA toxicity generally present within 2 hours of ingestion. All patients with suspected significant cyclic antidepressant exposure should undergo cardiac monitoring for a minimum of 6-8 hours. Major complications (such as seizures and arrhythmias) typically occur in the first 6 hours after ingestion. Monitoring in symptomatic patients should continue until the ECG findings have been normal for 12-24 hours. Patients may be discharged then if there are no signs of toxicity and no significant ECG abnormalities (QRS < 100 milliseconds) (pg 150).

*Grade D, Level 3*

**C** While serum TCA levels may be used to confirm suspected poisoning, the levels do not correlate with toxic effects and are not predictive. ECG is recommended over serum TCA levels to predict seizure and arrhythmia risk (pg 151).

*Grade C, Level 2+

**Organophosphates (OP)**

**GPP** The diagnosis of anticholinesterase poisoning is made by a combination of suspected exposure to a pesticide / insecticide and clinical signs and symptoms of a cholinergic crisis. Acetylcholinesterase levels, if available, should be used as supporting evidence of such poisonings (pg 153).

**GPP** The management of Intermediate Syndrome (IMS) involves prompt recognition of the condition and the institution of good supportive care, including ventilatory support as appropriate (pg 157).

**GPP** (pg 160)
- Resuscitation should proceed according to standard BCLS/ACLS protocols as indicated in all patients.
- The risk of secondary poisoning of health care workers from handling contaminated patients and property is of concern. However, the likelihood of
severe poisoning is reportedly low. We recommend the use of simple protective measures: use of universal precautions, properly ventilated care areas and proper containment measures (including removal and containment of contaminated items & clothing) and prompt decontamination of patients as needed.

GPP

D (pg 161)
- Skin exposure would require irrigation of the skin with copious amounts of water and liberal use of soap. It is important for health care workers to wear appropriate protective gear before removing contaminated clothing and items from patients.

- Eye exposure should be irrigated with copious amount of normal saline. In all cases refer to ophthalmologist for further management. The routine use of atropine eye drops for relief of ocular symptoms is not recommended.

- General recommendations for gastric decontamination from oral exposure should be followed.

Grade D, Level 3

C Muscarinic antagonist: Atropine or glycopyrronium bromide (pg 162). Atropine use reverses the cholinergic effects. In particular, aim to dry bronchial secretions and reverse bronchospasm and to facilitate ventilation and oxygenation. Glycopyrronium bromide can be an alternative for peripheral symptoms.

Grade C, Level 2+

A Pralidoxime should be used with caution for OP poisoning. It should be given in consultation with a clinical toxicologist or an expert in the care of poisoned patients (pg 166).

Grade A, Level 1+

C Benzodiazepines are recommended to control seizures and agitation in patients poisoned by organophosphorus compounds (pg 168).

Grade C, Level 2-

B The routine use of serum alkalinization using sodium bicarbonate is currently not recommended (pg 169).

Grade B, Level 1-

C Charcoal haemoperfusion or haemodialysis or haemofiltration are not recommended for managing poisonings with OP (pg 169).

Grade C, Level 2-
• There should be adequate fluid resuscitation and correction of acid-base and electrolyte disturbances as is deemed appropriate.
• Patients with OP poisoning tend to be fluid depleted due to the excessive sweating, gastrointestinal and urinary loss.
• There is no evidence that aggressive fluid resuscitation in patients with bronchorrhoea is dangerous provided atropine is also given simultaneously to dry the lung secretions.

**GPP** (pg 169)

**GPP** (pg 170)

• For accidental exposures in the workplace, it is important to remove the victim from further exposure and take measures to investigate and mitigate the source of exposure.
• It is mandatory to report occupational toxic exposure to Ministry of Manpower – Refer to Annex D: Resources for industrial chemical exposure.

**Industrial chemicals** (Hydrofluoric acid only)

**GPP** Dermal and ocular decontamination should be immediately performed using water or saline. The clothes should be removed and the exposed area washed by copious irrigation for at least 30 minutes (pg 175).

**D** Dialysis could be used for patients with severe systemic fluoride poisoning to lower F- and potassium levels (pg 175).

Grade D, Level 3

**D** Apply calcium gluconate gel 2.5% liberally over the exposed dermal area and rub. Allow it to remain in place for a minimum of 30 minutes. Reapply gel every 4-6 hours (pg 176).

Grade D, Level 3

**D** Burns involving the fingers can be treated by placing the hands and gel in tight-fitting impervious gloves. Continue for at least 15 minutes after relief of pain (pg 176).

Grade D, Level 3

**D** Perform subcutaneous infiltration of calcium gluconate by injecting 0.3-0.5 mL/cm² of 5% calcium gluconate with a 27G to 30G needle when local gel application
therapy fails, the site has sufficient tissue space and is not amenable for regional perfusion therapy (e.g. the thigh) (pg 176).

Grade D, Level 3

D Use the Bier block method for intravenous regional application of 2.5% calcium gluconate. A volume of 40 mL of 2.5% solution calcium gluconate is given via the regional intravenous anaesthesia route after the pressure cuff is inflated. The cuff is left inflated for about 20 minutes (pg 176).

Grade D, Level 3

D If intravenous regional perfusion therapy fails to relieve pain, intra-arterial application of 2.5% calcium gluconate should be tried. Usually the brachial or radial artery is cannulated depending on the site of injury and about 40 mL of 2-2.5% calcium gluconate is infused over 4 hours. May repeat cycle 4 hours later. About 1 – 3 cycles may be needed (pg 176).

Grade D, Level 3

D Administer bronchodilators for victims with bronchospasm together with parenteral corticosteroids as part of supportive treatment for respiratory irritation. Nebulisation using 1 mL of 10% calcium gluconate and 3 mL of normal saline (2.5% calcium gluconate) has been advocated. It has been shown that there are minimal side-effects when used at that concentration (pg 177).

Grade D, Level 3

D Do not use calcium gluconate gel for eyes and do not irrigate with calcium salts. If pain persists after irrigation, consider administration of 1% calcium gluconate eye drops every 2 – 3 hours for several days (pg 177).

Grade D, Level 3

A Treat hypocalcaemia using intravenous 10% calcium gluconate infusions with doses of 0.1 to 0.2 mL/kg up to 10 mL. Infusions can be repeated until serum calcium, ECG, or till symptoms improve. Calcium levels should be checked hourly (pg 178).

Grade A, Level 1+

Caustics and detergents

B Patients with suicidal ingestion or are persistently symptomatic after caustic ingestion should be referred for further investigations. Suicidal ingestion, ingestion of concentrated acid or alkaline, or persistent symptoms predicts severe injury to the aerodigestive tract (pg 182).

Grade B, Level 2+
Assessment of severity of corrosive injuries should not be based on degree of oropharyngeal burns. The degree of oropharyngeal burns does not predict upper digestive tract injuries or stricture formation (pg 182).

Assess degree of injury in both adult and children with a flexible oesophageal-gastro-duodenoscope (OGD). The extent and depth of acute oesophageal and gastric injury are found to accurately predict stricture formation. OGD is the instrument of choice and it has been shown that it can be safely performed up to 48 hours after caustic ingestion (pg 182).

Perform contrast imaging studies with water-soluble contrast if OGD cannot be completed (pg 183).

Skin exposure should be irrigated with a copious amount of water. Eye exposure should be irrigated with a copious amount of normal saline. In all cases of eye exposure, promptly refer to an ophthalmologist (pg 184).

Gastric decontamination and activated charcoal are not recommended. Dilution with milk and water may be attempted in patients who are able to tolerate fluid. Neutralization of caustics is contraindicated (pg 185).

To reduce stricture formation, the following treatments may be considered - bowel rest, proton pump inhibitor, intravenous antibiotics and intravenous steroids (pg 185).

Bites and stings

Snakebites

Ensure that the snake is no longer a threat before instituting first aid. Keep calm. Do not attempt to incise the bite wound or suck the venom out. Transport to hospital as soon as possible (pg 187).
Bind the crepe bandage firmly around the entire bitten limb, as tightly as for a sprained ankle. It should be loose enough to allow a finger to be easily slipped between its layers, and not occlude the peripheral pulse. Include a rigid splint or sling to avoid any muscular contraction of the bitten limb. Avoid tight tourniquets that may occlude circulation. Movement or muscular contraction increases absorption of venom into the bloodstream and lymphatics (pg 187).

Grade D, Level 3

In clinically significant envenoming, compression bandages should not be released until the patient is under medical care in hospital, resuscitation facilities are available and antivenom treatment has been started (pg 187).

Grade D, Level 3

PIB is not recommended in cases of viper bites. PIB may increase the danger of local necrotic effects of viper venom (pg 187).

Grade D, Level 3

The pressure immobilisation may be removed if the clinical examination is normal and clinically insignificant envenoming is suspected. Re-evaluate 1-2 hours later with laboratory tests. If laboratory tests are normal, repeat at least twice (pg 188).

Grade D, Level 4

Observe all cases of probable venomous snake bite for at least 12 hours, after the bite or after removal of PIB. Monitor vital signs, limb circulation, wound infection, including urine for output and myoglobinuria. Monitor for an increase in girth and leading edge of oedema (pg 189).

Grade D, Level 4

Secure airway and assist ventilation if required. Treat shock, renal failure, myoglobinuria or haemoglobinuria. Correct coagulopathy (pg 189).

Grade D, Level 4

In systemic envenoming, an appropriate antivenom is indicated. Antivenom therapy should be repeated after 1-2 hours, if there is persistent or recurrent coagulopathy or bleeding or deteriorating neurotoxic or cardiovascular signs along with full supportive treatment. Antivenom may reverse systemic envenoming even when this had been present for several days. Antivenom is effective in reversing signs of local envenoming only if it is given within the first few hours after the bite (pg 189).

Grade D, Level 4
**D** Signs of local envenoming that indicate antivenom therapy include rapid extension of swelling (within a few hours of bites), local swelling involving more than half of the bitten limb, swelling after bites on the digits, enlarged tender lymph node draining the bitten limb (pg 189).

*Grade D, Level 4*

**D** Administer antivenom intravenously. Local or intramuscular administration of antivenom is not recommended. The initial dose of antivenom is usually empirical. Children are given exactly the same dose of antivenom as adults (pg 190).

*Grade D, Level 4*

**B** Pre-treatment with subcutaneous epinephrine [0.25 mL (1:1000)], reduces acute adverse reactions to antivenom. Patients with high-risk of developing allergic reaction may be pre-treated *empirically* with subcutaneous epinephrine, intravenous antihistamines (both anti-\(H_1\) and anti-\(H_2\)) and corticosteroid (pg 190).

*Grade B, Level 1+

**D** In asthmatic patients, prophylactic use of an inhaled adrenergic \(\beta_2\) agonist may reduce the risk of bronchospasms (pg 190).

*Grade D, Level 4*

**D** Skin Tests for antivenom hypersensitivity are not recommended as skin tests are not predictive and may delay treatment and can themselves be sensitizing (pg 190).

*Grade D, Level 4*

**D** Rarely, compartmental syndrome could develop despite aggressive antivenom therapy, and if so, an orthopaedic referral is needed. The compartment pressure should be measured before resorting to fasciotomy (pg 190).

*Grade D, Level 4*

**D** Fluorescent staining and slit lamp examination should be performed to diagnose corneal ulceration. Topical antimicrobials (tetracycline or chloramphenicol) should be applied to prevent endophthalmitis or blinding corneal opacities. Use a dressing pad to close the eye (pg 191).

*Grade D, Level 4*

**D** Stingers should be removed by forceps or scraping with care to avoid breaking the venomous sac as soon as possible (pg 194).

*Grade D, Level 3*
**Bees and wasps stings**

**GPP** Treatment is symptomatic. Oral or injectable antihistamines may be used to reduce itching and swelling. Cool compress (ice should not be placed directly on the skin), elevations to limit oedema and local wound care have been recommended. Patients with severe symptoms, including airway, cardiovascular, or pulmonary compromise, or persistent symptoms should receive a short course of corticosteroids (pg 194).

**D** In cases of anaphylactic reaction, epinephrine should be given and repeated after 5 minutes in the absence of clinical improvement (pg 195).

*Grade D, Level 4*

**D** Patients with multiple stings may warrant extended observation at least 24 hours after envenomation, with close monitoring of serum chemistries, haemoglobin, myoglobin and creatinine phosphokinase (pg 195).

(Healthy adults with > 50 stings, the elderly and in those with underlying medical problems and > 1 sting per kg in children)

*Grade D, Level 3*

**D** When there is severe systemic reaction of massive envenomation, careful monitoring for: rhabdomyolysis, thrombocytopenia, cardiac arrhythmias, renal failure and possible dialysis should be instituted (pg 195).

*Grade D, Level 3*

**D** In cases of corneal bee stings, pain relief should be provided. An urgent referral to the ophthalmologist should be done to rule out infection, uveitis and inflammatory glaucoma. Broad-spectrum topical antibiotics could be given to prevent secondary infection. Surgical removal of the embedded stinger is controversial (pg 195).

*Grade D, Level 3*

**GPP** Individuals who are aware they are allergic to stings should be advised to carry epinephrine auto injector (pg 195).

**GPP** Immunotherapy is indicated in adults and children who had life threatening reactions to bee or wasp stings including cardiovascular and respiratory symptoms, provided that either skin test or serum IgE is positive (pg 195).
Marine Envenomation

**D** Resuscitate and manage cardiorespiratory arrest (from stonefish, stingray, jellyfish, blue-ringed octopus envenomation) (pg 198).
  - Treat anaphylaxis, if present.
  - Tetrodotoxin envenoming or neurotoxicity from jelly fish stings will require intubation and ventilation, if respiratory paralysis occurs.
  - Treat any major haemorrhage.

  Grade D, Level 4

**D** Administer analgesics, including local anaesthetics where indicated (pg 198).
  - Update the tetanus immunisation status.
  - Relevant radiological investigations, surgical removal of foreign material and surgical debridement may be required to address the local lesion.

  Grade D, Level 4

**D** Secondary infection, chronic ulcer and osteomyelitis can occur. Prophylactic antibiotic should be given in contaminated wounds (pg 198).

  Grade D, Level 4

**B** First aid for stingray and stonefish stings is hot, non-scalding (not higher than 45°C) water immersion as the venom is heat labile (pg 198).

  Grade B, Level 2++

**A** Hot water immersion may be useful for pain relief following jellyfish stings after the tentacles have been removed (pg 198).

  Grade A, Level 1-