Poisoning — an overview of treatment

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Poisoning, either accidental or intentional, is a common cause of attendance at accident and emergency departments. This article describes the general management of poisoned patients the role of the pharmacist

Poisoning is a common cause of attendance at accident and emergency departments and resulted in over 100,000 admissions to hospital in England in 2004/05.[1] Over 65 per cent of enquiries to poisons units involve drugs.[2]

The treatment of a poisoned patient will depend on a variety of factors, such as the identity of the poison involved (if this is known) and the timing and extent of its absorption. Some sources of information on the toxicity of agents and how to manage incidences of poisoning are set out in Panel 1(p8).

General treatment

The mainstay of management for poisoned patients is providing symptomatic and supportive care. Antidotes for specific poisoning agents will also be used where appropriate. As for any seriously ill patient, a systematic and thorough approach to treatment is required, including the following aspects of care:

- Initial "ABC" (airway, breathing, circulation) assessment and resuscitation if necessary
- A secondary survey for infection or trauma (of the head and cervical spine if a patient's mental status is abnormal) and metabolic derangements
- Supportive care with continuous assessment and monitoring
- Case-specific management such as preventing further absorption, using antidotes or enhancing the elimination of the toxic agent

Because of the serious nature of some poisonings, early treatment and supportive care may often proceed rapidly without extensive investigations being carried out or an apparent diagnosis being made. Attention must be given to assessing a patient's vital signs and to providing immediate treatment of life-threatening conditions such as hypotension, hypertension, bradycardia, tachycardia, cardiac arrhythmias, hyperthermia, hypothermia and respiratory depression.

Arrhythmias and conduction defects require cardiac monitoring and prompt treatment. Arterial blood gas measurements can be useful to assess ventilation and oxygenation and also to identify metabolic derangements (eg, metabolic acidosis caused by toxic alcohols such as ethylene glycol or in salicylate poisoning). Where appropriate, blood samples should be sent for a full blood count, and to measure hepatic and renal function, electrolytes and blood glucose (relevant if a patient has collapsed or is confused). Additionally, in suicidal patients, it is prudent to check plasma concentrations of paracetamol, as well as those of other medicines suggested by the patient's drug history (eg, salicylate, iron, lithium, digoxin).[3]

After resuscitation and stabilisation, attention can turn to identifying the agents ingested using data from the history and physical examination. Although it is unlikely that a single abnormality detected on examination will help differentiate poisoning from other causes of illness, or indicate a specific toxin, a cluster of symptoms and signs in the same patient, known as a toxidrome, may be of considerable value in helping to identity a toxic agent. For example, an opioid toxidrome is characterised by impaired consciousness and, although a number of agents are associated with depressed consciousness, when this symptom is coupled with pinpoint pupils, hypotension and respiratory depression, opioid poisoning is the most likely cause. The anticholinergic toxidrome (found with poisoning from drugs such as tricyclic antidepressants and antihistamines) includes tachycardia, dilated pupils, dry, warm skin, dry mucous membranes and urinary retention. Conversely, the cholinergic toxidrome, found after exposure to organophosphate and carbamate insecticides or nerve agents, includes salivation, lacrimation, urinary and faecal incontinence, emesis, abdominal pain, diaphoresis and small pupils. Assessing patients symptoms in the light of known toxidromes can therefore

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Panel 1: Some sources of information about poisons

- Poisons unit — such as the Guy's and St Thomas' Poisons Unit on 0870 243 2241
- TOXBASE — an internet database, available at **www.spib.axl.co.uk**

help identify the likely toxic agent and its subsequent effects, whether evident or expected.

Gut decontamination There is no evidence that inducing vomiting with syrup of ipecachuana[4] (or "ipecac") or performing a gastric lavage (ie, stomach washout),[5] has any impact on the outcome of a poisoning.

Activated charcoal (AC) acts by adsorbing ingested substances and preventing their absorption from the gut into the systemic circulation. It is generally most effective if administered within one, or perhaps two, hours of ingestion.[6] For overdoses of drugs that enter the enterohepatic circulation, such as carbamazepine, phenobarbitone, theophylline, quinine or dapsone, multiple doses of activated charcoal (MDAC) may be used, provided a patient's bowel sounds are present.[7] MDAC has also been used for overdoses of sustained release preparations. The main risk with AC is aspiration if a patient has an unprotected airway. If this occurs, administration of AC via a nasogastric tube, after the patient has been intubated, is indicated.

The usual dose of AC is 50g in adults and 1g/kg body weight for children under 12 years. When using MDAC, these doses are repeated four hourly, although smaller doses may be given more frequently if necessary. There are a variety of AC preparations available, including a sweetened version, but unfortunately none is able to prevent AC being a particularly unpleasant substance to drink. This makes its use, especially in paediatrics, difficult. It is best to avoid mixing AC with food, such as ice cream, to try to improve its palatability as this can reduce its adsorbent capacity.[8] AC has a good adsorptive capacity for most drugs and chemicals, except for metals (eg, iron and lithium), alcohols (eg, ethanol, methanol and ethylene glycol), acids or alkalis.

Whole bowel irrigation (WBI) may be indicated where there has been ingestion of high doses of medicines such as iron or lithium tablets (which, as mentioned above, are not bound by AC), sustained release preparations or when treating "bodypackers" (ie, those who swallow illicit drugs for smuggling purposes). WBI involves the oral administration of polyethylene glycol until the rectal effluent is clear.[9] In the UK, the only suitable product is Klean-Prep. The adult dose is 1.5-2L/hr, usually continued for two to six hours. In children aged six to 12 years old the dose is 1L/hr and in those nine months to six years old 500ml/hr. Klean-Prep can be made more palatable by chilling it. Administration via a nasogastric tube may be necessary.

Enhanced elimination of toxins Severely poisoned patients are likely to require methods to increase the elimination of the toxin from the body. These will generally take place in an intensive care unit.

Urinary alkalinisation with sodium bicarbonate can increase the elimination of weak acids because it prevents the ionised drug being reabsorbed in the renal tubules. It is most commonly used in patients with moderate to severe aspirin poisoning.[10] In adults, the dose of sodium bicarbonate used is usually 1L of isotonic fluid (ie, 1.26 per cent or 1.4 per cent) given intravenously over four hours. Alternatively, 50ml boluses of hypertonic (8.4 per cent) sodium bicarbonate can be given, but this should ideally be administered via a central line, given the irritant nature of this preparation. In practice, a combination of the two regimens is often necessary to achieve adequate urinary alkalinisation. The bicarbonate dose, regimen and dose-timing should be titrated to

Panel 2: Core aspects of safe medicine use

Core aspect	Outcome	Examples of how to achieve outcome
Patient information	Reduction of unintentional overdoses	■ Ensure patients understand the dose of medicines and the maximum daily dose, especially for certain analgesics ■ Advise patients to review the contents of their home medicines cupboards
Product storage	Safe use and storage of medicines	■ Advise patients to dispose of expired and unused medicines via their community pharmacy
	Reduced domestic poisoning	■ Advise patients about the safe storage of medicines and hazardous substances (eg, caustics) — keep out of reach of children and in original containers ■ Use child-resistant packs (eg, reducing methadone overdose in children) ■ Reinforce warnings to store medicines prone to harmful degradation in the refrigerator (eg, some liquid antibiotics)
Clinical pharmacy	An accurate drug history and appropriate treatment of overdose	■ Ensure prompt identification of tablets and constituent ingredients
	Safe and effective use of drugs with a narrow therapeutic index	■ Avoid gentamicin toxicity by increasing dosing intervals for patients with renal failure
Strategic planning	Co-ordination of antidote stocks	■ Review antidotes held for chemical, biological, radiological and nuclear incidents
	Major incident plan incorporates antidotes	■ Ensure effective departmental planning, including patient group directions
Product changes	Reduction in the number and complexity of overdoses	■ Reduction of paracetamol pack sizes ■ Co-proxamol withdrawn from UK market
Quality control	Removal of counterfeit or contaminated products	■ Identify and remove from supply chain (eg, counterfeit atorvasatin and oseltamivir)
	Ensure quality of imported products	■ Assess unlicensed medicines before use

Panel 3: Case studies of unintentional self poisoning

- **Case 1** A 23-year-old woman presented with strange movements in her right arm. She was diagnosed with an unintentional overdose of prochlorperazine and treated with oral procyclidine. She had visited the accident and emergency department the previous day with vertigo had been prescribed prochlorperazine 5mg three times a day. She thought that the tablets "must not be very good as they were really small" so took 15 tablets during the day.
- **Case 2** A 45-year-old man was admitted with back pain and an unintentional overdose of paracetamol. He was treated with intravenous N-acetylcysteine and non-paracetamol-based analgesics. He had visited his GP with back pain and been prescribed co-dydramol (and diclofenac). He was already taking paracetamol preparations at home, which he continued taking with co-dydramol — he took a total of 22 500mg paracetamol tablets and 16 co-dydramol tablets over a two-day period.

achieve a urine pH of 7.5–8.5. The urine pH should be checked at least hourly and patients should also have their blood gases monitored regularly to ensure that systemic alkalinisation is not occurring. It is also important to monitor the serum potassium concentration closely and titrate potassium replacement accordingly — hypokalaemia will make it difficult to achieve alkalinisation. Once alkalinisation is achieved, the serum potassium is likely to fall in response to an increase in urinary potassium excretion.

Extracorporeal procedures such as haemodialysis and haemoperfusion are only used in patients who have been severely poisoned with a limited subset of drugs and chemicals — treatment of such patients should always be discussed with a poisons unit. Haemodialysis may be required in patients with severe aspirin, lithium, ethylene glycol or methanol poisoning. There are limited data on the use of haemofiltration as a method for toxin removal in the poisoned patient, but it may be required in patients with renal failure or a severe metabolic acidosis. Charcoal haemoperfusion may be used in patients with severe theophylline or carbamazepine poisoning, although drug clearance is similar to that with MDAC and so haemoperfusion is generally reserved for patients with life-threatening toxicity.

Antidotes Antidotes will be discussed in more detail in the next article in this special feature (p10). Some general aspects of antidote use include the importance of documenting a patients' weight to ensure that a correct dose is used for dose-adjusted treatments such as N-acetylcysteine for paracetamol poisoning. Studies have shown that clinicians are poor at estimating patient's body weight.[11] A chart is available to support health care staff in the prescribing and administration of N-acetylcysteine.[12]

In addition, prescriptions for antidotes should be written using generic names, which helps avoid errors such as Parvolex (acetylcysteine) being read as Pabrinex (thiamine).

Role of pharmacists

Pharmacists have a key role in ensuring the timely availability of any antidote that might be indicated and giving advice on treatment regimens and possible complications. Guidelines have recently been produced by the British Association of Emergency Medicine (BAEM) and the Guy's and St Thomas' Poisons Unit, which group the availability of antidotes by the urgency of clinical need.[13] The antidotes held at each health care facility should be assessed to ensure that stock levels are appropriate when taking into account the epidemiology of poisoning in their local area. Regular expiry date checks should be carried out. The "Rarely used medicines" database run by London, Eastern and South East Specialist Pharmacy Services is a resource supporting pharmacy staff to obtain medicines quickly and easily, including antidotes, that are only stocked in small numbers of trusts across the area.[14] There is also scope strategically to plan and rationalise antidote availability at a national level.

Pharmacists working in emergency care need to be familiar with the management of common poisonings such as those caused by overdoses of paracetamol, antidepressants and hypnotics (eg, benzodiazepines). Key aspects of good patient management include:

- Establishing a patient's drug history from his or her medical notes, or from the patient (if appropriate), including over-the-counter medicines
- Ensuring the appropriate prescribing of, and availability of, antidotes
- Providing patient information
- Supporting the continuity of medicine supply on discharge, where appropriate

Assisting medical teams in identifying the constituent ingredients of poisonous products and unidentified medicines is another main role for pharmacists. The TICTAC database is a useful resource for the latter.[15]

Importantly, pharmacists have a key role in preventing unintentional drug poisoning. Panel 2 (p8) shows the core aspects of safe medicine use that should be adhered to help prevent poisoning. Case studies highlighting the need to provide clear patient information on the safe and appropriate use of medicines are set out in Panel 3.

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