Emergency management of poisoning in Hong Kong

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The emergency management of poisoning is important in reducing the risk of mortality and morbidity in poisoned patients. This article reviews the Hong Kong system of prehospital and emergency care of poisoning, with reference to recent advances in this field. Administering activated charcoal is recommended for the gastro-intestinal decontamination of most poisons, unless doing so is contra-indicated. Gastric lavage should be considered only in life-threatening cases of poisoning that present within the first hour. Newer antidotes that are available in Hong Kong accident and emergency departments include hydroxocobalamin, stonefish and snake antevenenes, digoxin-specific antibodies, esmolol hydrochloride, and octreotide. The 'golden hour' concept of gastro-intestinal decontamination is advocated and ways to ensure that decontamination is performed within the 'golden hour' are suggested.

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Introduction

Poisoning is a somewhat neglected area in clinical medicine in Hong Kong. It is not a subspecialty in most clinical units and the standard of managing poisoned patients is highly variable. With the shift of emphasis in the management of poisoning from in-patient care to early decontamination and initial stabilisation, emergency physicians are taking a more active role in the care of poisoned patients. In this article, the emergency management of poisoned patients in Hong Kong is reviewed, with reference to recent updates in the literature and the different practices elsewhere.

Prehospital management

The emergency management of poisoning starts from the scene of the event, where early induction of vomiting can remove a significant portion of the ingested poison. It is not clear, however, whether early or late induction of vomiting influences the outcome. In countries where poisons information centres are accessible to the public, people are advised to keep some ipecacuanha (Ipecac Syrup USP or Paediatric Ipecacuanha Emetic Mixture BP) at home. If poisons are ingested, the poisons information centre can be called for advice prior to inducing vomiting with ipecacuanha. This practice has been shown to reduce visits to emergency departments for paediatric[1] and other poisonings. In Hong Kong, The Drug and Poisons Information Bureau at the Prince of Wales Hospital provides a 24-hour advice service that is staffed by the Division of Clinical Pharmacology of The Chinese University of Hong Kong. Because of the limited resources, however, it mainly takes calls from health care workers and is generally not accessible to the public.[2]

When the toxic agent ingested is not known, it is not advisable to induce vomiting by the gag reflex or with chemical agents. If the toxic agent is a corrosive, vomiting will inflict a second insult on the upper gastro-intestinal tract. Furthermore, aspiration of vomit in patients with decreasing consciousness can be fatal. The most useful and simple advice for the on-site treatment of poisoning is as follows: (1) to irrigate external chemical burns with plenty of water; (2) if corrosives have been ingested, to drink a cup of water or milk, which may dilute the corrosive and reduce tissue damage, provided the patient can protect his or her own airway; and (3) to immerse stings from stonefish or other deep-sea fish in hot water (at 45°C) for 30 to 60 minutes to help inactivate the toxin and decrease the severity of the symptoms.[3]

When a poisoned patient calls an ambulance, the ambulance personnel should have a chance to administer early decontamination and antidotal treatment.

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Studies have been done on the prehospital use of activated charcoal, naloxone, and hypertonic glucose (dextrose monohydrate) by paramedics, and they have yielded encouraging results.[4-7] Crockett et al[4] in their pilot study of the prehospital use of activated charcoal, showed that the time for activated charcoal administration could be shortened by 45 minutes compared with when it is given in hospital. Hoffman et al[6] demonstrated that it is safe to use naloxone empirically in paramedic treatment protocols for patients with an acute loss of consciousness.

In Hong Kong, emergency medical assistants II (EMA II) have been trained to give antidotes of oxygen for carbon monoxide poisoning, glucose 10% for hypoglycaemia, and naloxone for narcotic overdose. The majority of ambulance personnel, however, are not trained to the level of EMA II, and only 25% of the emergency calls are attended by EMA II. With regard to the optimal position for transporting a poisoned patient to the hospital, Vance et al[8] have recommend the left lateral decubitus position, because this position is associated with the lowest initial absorption of toxin. This position also offers advantages in preventing aspiration and enhancing oropharyngeal drainage.

Management of poisoning in the accident and emergency department

After arriving at the accident and emergency (A&E) department, all significantly poisoned patients are triaged as being in a critical or emergency condition,[9] depending on whether they are unstable or not. This practice will ensure that the patients can be seen almost immediately for stabilisation and consideration of early gut decontamination. The mainstay of the management of poisoning is supportive—that is, care of the airway and the maintenance of breathing and the blood circulation. Toxic symptoms such as convulsion and arrhythmia should be watched for, as their onset can be quite sudden. If the patient's history and the results of the physical examination support toxic ingestion, gut decontamination should be considered.

Gut decontamination

Much controversy remains regarding the roles of gastric lavage,[10-13] emesis,[14-17] activated charcoal,[18,19] whole-bowel irrigation,[20,21] and the use of cathartics[22] in decontaminating the gut. In view of this, the American Academy of Clinical Toxicology and European Association of Poisons Centres and Clinical Toxicologists have published position statements of various gut decontamination methods.[23] These position statements are systematically developed clinical guidelines based on high-quality research evidence, and are summarised in Table 1. They are well accepted by the rest of the world, being endorsed by the Canadian Association of Poison Control Centers and the American Board of Applied Toxicology.

In Hong Kong, gastric lavage is still commonly practised, sometimes for even minor poisoning, and it has been associated with a number of fatalities.[24] It is based on these position statements and other literature that the Coordinating Committee in A&E Services of Hong Kong developed their protocol on gastrointestinal decontamination.[25] This protocol advocates activated charcoal as the treatment of choice for most poisons, except substances such as metals, alcohol, cyanide, acids, and alkalis, which are not adsorbable by charcoal. Although charcoal should be given within 1 hour of ingestion of the poison, the protocol recommends giving the drug within the first few hours in

Table 1. Summary of position statements published by the American Academy of Clinical Toxicology and European Association of Poison Centres and Clinical Toxicologists[23]

Treatment	Indications
Gastric lavage	Should not be considered unless a patient has ingested a potentially life-threatening amount of a poison and the procedure can be undertaken within 60 minutes of ingestion
Activated charcoal	May be considered if a patient has ingested a potentially toxic amount of a poison (known to be adsorbed by charcoal) up to 1 hour previously; there are insufficient data to support or exclude its use after 1 hour of ingestion
Ipecacuanha	Its routine administration in the emergency department should be abandoned; there are insufficient data to support or exclude its administration soon after ingestion of poison
Whole-bowel irrigation	May be considered for potentially toxic ingestion of sustained-release or enteric-coated drugs; there are insufficient data to support or exclude the use of whole-bowel irrigation for potentially toxic ingestion of iron, lead, zinc, or packets of illicit drugs
Cathartics	The administration of a cathartic alone has no role in the treatment of a poisoned patient and is not recommended as a method of gut decontamination

Gastric lavage procedure

(1) Get informed consent from the patient or a relative for the procedure
(2) For the conscious patient, make sure he or she understands the procedure and agrees to cooperate; lignocaine spray should be applied to the oropharynx to avoid excessive gagging
(3) For drowsy patients with loss of gag reflex, protect the airway needs with endotracheal intubation
(4) Have the suction ready to remove regurgitated gastric content
(5) Monitor all patients by using pulse oximetry; monitor cardiac function in patients in whom arrhythmia is likely to develop
(6) Lay the patient in the left lateral position on a trolley
(7) Raise the foot of the trolley by approximately 20 cm
(8) Measure the distance of tubing from the mouth to the epigastrium and the mark level with a piece of adhesive tape
(9) Lubricate and pass down the gastric tube orally; a mouth gag can be used to prevent patient from biting on the tube
(10) Confirm the correct placement of the tube in the stomach by aspirating fluid out or injecting air with the 50 mL syringe, while auscultating over the epigastrium
(12) Siphon off the gastric contents before lavage and save a specimen for toxicological analysis if necessary
(13) Small aliquots of lavage fluid should be repeatedly introduced by gravity by using a funnel about 2 feet higher than the level of the patient; the recommended volume of each aliquot is 200 mL for adults and 10 mL/kg for children
(14) The lavage should continue until 3 L of clear return are obtained; lavage can be stopped when a total of 3 L of lavage fluid is used and the return is clear

view of its safety profile and ease of administration. As there have been case reports of fatal aspiration, however, an unprotected airway is a contra-indication for the administration of activated charcoal. On the other hand, the use of gastric lavage is now limited to life-threatening ingestions that present within 1 hour. Even then, clinical benefit has not been confirmed in controlled studies.[23] To reduce the morbidity of the procedure, certain contra-indications should be noted; they include an unprotected airway, an uncooperative patient, and the ingestion of corrosives or petroleum products. Furthermore, the proper method of gastric lavage is important in minimising the risk of pulmonary aspiration and oesophageal rupture (Box). The routine use of ipecacuanha or cathartics in the A&E department is not recommended. Whole bowel irrigation can be considered for potentially toxic ingestion of sustained-release or enteric coated drugs.

New antidotes

In certain poisonings, the early use of a specific antidote can reduce the risk of mortality and morbidity in the patient. Some antidotes, however, are very expensive and have adverse side effects. Hence, these antidotes should be used in only severe poisonings and according to strict indications, when the benefits outweigh the adverse effects and costs. Useful antidotes that are available in public hospitals in Hong Kong are listed in Table 2. Only the newly introduced ones are discussed below.

Hydroxocobalamin

Hydroxocobalamin was introduced to the hospitals of the Hospital Authority after an incidence of cyanide poisoning, when hypotension developed in one of the patients; conventional antidote treatment with sodium

Table 2. Antidotes available in major public hospitals in Hong Kong

Poison	Antidote/s
Anticholinesterase (insecticide)	Atropine; pralidoxime mesylate
Arsenic, mercury, lead, gold	Dimercaprol
Benzodiazepines	Flumazenil
β-Blockers	Glucagon
Calcium-channel blockers	Calcium chloride
Carbon monoxide	100% oxygen
Coumarins	Vitamin K_1; fresh frozen plasma
Cyanide	Hydroxocobalamin
Digoxin	Digitalis-specific antibodies
Insulin, oral hypoglycaemic agents	Glucose 50%; octreotide
Iron	Deferoxamine mesilate (desferrioxamine mesylate)
Opioids	Naloxone hydrochloride
Oxidising agents	Methylene blue
Paracetamol	Acetylcysteine
Paraquat	Fuller's earth; activated charcoal
Snake venom	Antevenene for bamboo snake, Russell's viper, Chinese cobra, king cobra, and banded krait
Stonefish venom	Stonefish antevenene
Sympathomimetics	Propranolol hydrochloride; esmolol hydrochloride
Tricyclic antidepressants	Sodium bicarbonate

nitrite was thus contra-indicated.[26] Hydroxocobalamin is the synthetic form of vitamin B_{12}, which works by sequestering cyanide from plasma-cyanide to give non-toxic cyanocobalamin. The adverse effects are minimal—namely, brown coloration of body fluids, nausea, and vomiting. Hypertension and muscle spasms may also be observed. The initial dose is 5 g of reconstituted solution given over 30 minutes Subsequent doses, if the severity of poisoning so indicates, should be given more slowly over 2 hours.

Stonefish antevenene

The stonefish is a coral fish that has venom glands on its 13 dorsal spines. As stonefish are becoming increasingly popular in seafood restaurants, poisonous stingings of kitchen staff and fishmongers are increasingly common. The venom is one of the most potent toxins known and causes immediate intense pain, numbness, and swelling. Systemic effects include delirium, convulsion, hypotension, arrhythmia, and pulmonary oedema. Emergency management includes immersion in hot water (at 45°C) to inactivate the toxin and the administration of potent analgesics. Stonefish antevenene, recently stocked in the A&E department of most public hospitals, is indicated if pain and oedema is severe or when there is systemic manifestation. One ampoule of 2000 units should be given for the injury from one or two spines. Because the antevenene is prepared from horse serum, anaphylaxis and delayed serum sickness may develop.

Snake antevenenes

Some snake antevenenes are available in Hong Kong and the Coordinating Committee in A&E Services has published a protocol for the management of snake bites,[27] which includes the indications and precautions for the proper use of antivenenes. The majority of snake bites in Hong Kong are by bamboo snakes (*Trimeresurus albolabris*). Most of these bites are mild and do not require antevenene.[28] However, when antevenene is used, precautions need to be taken regarding anaphylaxis and serum sickness. There is evidence that monovalent antevenene is better than polyvalent antevenene.[29] Furthermore, imported antevenenes that are specific for species overseas may not be as good as those manufactured locally, due to venom variability within individual species.[29]

Digoxin-specific antibodies

Digoxin-specific antigen-binding fragments are indicated for life-threatening arrhythmia or hyperkalaemia caused by intoxication by cardiac glycosides. Improvement of symptoms occurs within 30 minutes of injection and peaks at 4 hours. Because the antibodies are produced in sheep, patients need to be monitored for anaphylaxis and serum sickness.

Esmolol hydrochloride

Esmolol hydrochloride is a short-acting cardioselective beta-adrenoceptor blocking drug that has no sympathomimetic activity. This drug is useful for controlling hypertension and tachyarrhythmia due to excessive sympathomimetic activity following an overdose of a central nervous system stimulant. Given in an infusion, esmolol is better than propranolol, because its half-life of only 9 minutes allows rapid titration of the therapeutic effect. Contra-indications include hypotension, bradycardia, and a history of asthma.

Octreotide

Octreotide is a synthetic polypeptide that antagonises pancreatic insulin release. It is indicated for the treatment of sulphonylurea-induced hypoglycaemia if the blood glucose level cannot be maintained by intravenously infusing glucose 10%.

New antidotes that are not available in Hong Kong

Botulism or botulinum antitoxin was developed from equine-derived antibodies against the toxin of *Clostridium botulinum*. It is used to treat clinical botulism to prevent the progression of neurological complications. Succimer (2,3-dimercaptosuccinic acid) is a chelating agent that is used to treat lead, mercury, and arsenic poisoning; it is the water-soluble analogue of dimercaprol and can be taken orally. Fomepizole (4-methypyrazole) is a potent competitive inhibitor of alcohol dehydrogenase and prevents the formation of toxic metabolites following methanol and ethylene glycol poisoning; it is preferred to ethanol as an antidote because it does not cause sedation. Nalmefene and naltrexone are long-acting opioid antagonists that are used to manage opioid dependence; they are more potent than naloxone but much more expensive.

The 'golden hour' concept of gut decontamination

In the treatment of trauma patients, there is the 'golden hour' concept,[30] whereby the first hour represents the best chance to stabilise and treat potentially life-threatening injuries before the patient's condition deteriorates. In the management of ingested poisons, a similar concept should also be emphasised; after the first hour, the amount of poison removed form the body is much decreased. Medical personnel who care for poisoned patients should keep this concept in mind—that is, to consider early decontamination after the overdose, preferably within the first hour. The

poisons information centre should extend its service to the public by providing expert advice for emesis in indicated cases. The administration of activated charcoal should be added to the list of drug protocols for the use of EMA II, preferably in consultation with emergency physicians via radio-communication. After arriving at the emergency department, poisoned patients should be given high priority. With the aid of immediate computer access to a poisons index at all A&E departments, doctors can make an early decision about gut decontamination. This should reduce the time since ingestion and enable gut decontamination to be done within the 'golden hour'.

Conclusion

Emergency physicians should take a more active role in the emergency management of poisoning, not only in the A&E department, but also in the prehospital setting, where early decontamination and antidote treatment can be initiated if necessary. With the early use of appropriate gut decontamination methods, proper use of antidotes, and better supportive care, the risk of mortality from poisoning will greatly decrease and most patients will return to society with minimal disability.

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