

Childhood poisoning in Hong Kong

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Deaths due to poisoning are particularly tragic. The victims are mostly young people and many deaths and disabling sequelae could be prevented, if more attention were given to preventive measures in the home. Based on our experience in Hong Kong and that of other centres, we have tried to determine the factors that contribute to childhood poisoning and the preventive measures that can be undertaken. We also give an overview of the agents that are most relevant to Hong Kong or are particularly dangerous to toddlers.

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Introduction

Hong Kong is a densely populated territory with a population of approximately 6.1 million. As in most western countries, poisoning and injuries are the leading causes of death in those younger than 15 years.¹ In those aged 15 or more, poisoning accounts for 5% to 7% of acute medical admissions to a hospital,² with an overall rate mortality rate of 1.4%.³

Deaths due to poisoning are particularly tragic as they are preventable. Furthermore, the victims are mostly young people and many deaths and disabling sequelae could be prevented, if more attention were given to preventive measures at home, where most of the childhood poisonings occur.

Based on our experience in Hong Kong and that of other centres, we attempt here to determine what preventive measures can be realistically undertaken in the home and give an overview of the agents that are most relevant to Hong Kong and/or particularly dangerous to toddlers.

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The epidemiology of childhood poisoning in Hong Kong

Before any preventive measures can be planned, it is necessary to find out why poisonings occur, the types of poisons involved, and the age groups commonly affected.

Despite its importance as a health problem, there have been few studies of childhood poisoning in Hong Kong. We therefore decided to analyse the enquiries concerning subjects aged 14 years or younger that were received by the Drug and Poisons Information Bureau between January 1988 and December 1992.⁴ A total of 238 enquiries concerning 255 subjects were reviewed. The 2-year-olds (22%) were the most commonly involved age group. Household products, defined as non-medicinal products found in the home environment,⁵ and therapeutic drugs, were the main agents responsible (Table 1). The exposure to poisons occurred mostly at home (91%) or in school (5%), and was allegedly accidental in nearly all cases (97%). Ingestion was by far the most common route of exposure (97%).

Factors contributing to childhood poisoning

Since the vast majority of childhood poisonings occurred at home and were accidental in nature, we have first considered the current practices regarding the use and placement of drugs and chemicals in the home.

Table 1. Main agents involved in poisoning incidents in children reported to the Drug and Poisons Information Bureau, Hong Kong, between January 1988 and December 1992

Agents involved	% of total
Household products	
Household insecticides/rodenticides	8.2
Cleaning products/disinfectants	6.6
Desiccants	4.3
Mercury in thermometers	3.1
Others	17.6
Therapeutic drugs	
Paracetamol	7.1
Vitamins and minerals	4.7
Hypnotics/anticonvulsants	4.3
Topical preparations	3.9
Antihistamines/cough mixtures	3.5
Others	13.7
Chemicals	
Food-borne	1.6
Non-food-borne	10.2
Herbal/traditional medicines	4.3
Insecticides	
Vegetable-borne	1.6
Agricultural source	1.2
Others	3.9

Source: Chan YK, et al. J Paediatr Child Health 1994.⁴

Insecticides (e.g. for cockroaches) and rodenticides are often placed on the floor. The latter are also found in children's playgrounds and parks. Transparent plastic bags are often used to dispense medicines and the bright colours of some drugs may attract the attention of toddlers, who find it easy to open these plastic bags. Parents may be blamed for not placing poisons out of the reach of children, but often there are no adequate warnings on the labels to remind them of the importance of careful storage. This is particularly true for most over-the-counter patent medicines sold in Hong Kong.

There have been numerous studies in other countries that tried to determine why childhood poisonings occur in the home and whether or not these can be prevented.

The role of packaging and storage

In the United Kingdom,⁶ the 938 medications ingested by 877 children younger than five years of age, treated in one of 14 hospitals were compared with 5827 medications found in households with children. The relationship between the packaging and storage of individual medications in the home and their involvement in accidents was quantified using an Accident Association Index (AAI). A low AAI indicated that the involvement of a medication was less than would be expected based on its availability and that it was therefore safe. A high AAI indicated that the involvement was greater than could be expected and therefore unsafe. The medications involved in accidental poisonings were often packed in containers without child-resistant closures (63%) or with transparent blisters (20%); both had high AAIs. Conversely, child-resistant closures, strips, sachets, and opaque blisters had low AAIs. Only 40% of medications were in their normal storage place at the time of the accident. Medicine and bathroom cabinets, kitchen cupboards, and drawers were the safest storage places. Handbags, fridges, and shelves or ledges in the bathroom were the most unsafe places. The conclusion from the UK study was that safe packaging cannot compensate for unsafe storage.

The role of general practitioners and pharmacists

In Australia,⁷ 98 general practitioners and 68 pharmacists were given a list, in random order, of the 10 agents most frequently involved in childhood poisoning in Camperdown, New South Wales. The list included benzodiazepines, iron, paracetamol, anticonvulsants, caustic soda, dishwashing powder, quinine, digitalis, eucalyptus oil, and antihistamines. They were asked to rank these agents in order of toxicity and to indicate whether they gave precautionary advice (e.g. the need to store them in a secure place) when prescribing or dispensing these to patients.

Thirty per cent of general practitioners ranked paracetamol and caustic agents as having high toxicity. The high toxicity of anticonvulsants, quinine, iron, and digoxin was not widely appreciated. Seventy per cent of general practitioners ranked quinine and anticonvulsants in the bottom 40% of the list, while half gave iron and digoxin a similar ranking. One-third of general practitioners said that they never gave precautionary advice. Of those who did give advice, paracetamol and iron were the preparations most commonly warned about, and precautionary advice was rarely given when quinine and anticonvulsants were prescribed.

Seventy per cent of pharmacists ranked iron, digoxin, and quinine as having high toxicities. Anticonvulsants were given low rankings by 50%, and paracetamol, by 60% of pharmacists. Eighteen per cent of pharmacists that they never gave precautionary advice. Pharmacists were most likely to give such advice about iron and quinine, but rarely gave any about digoxin or paracetamol.

Public education on which substances are particularly dangerous to children and the giving of precautionary advice by those who prescribe or dispense medications should help to reduce childhood poisoning.

The role of the parents

One poison control centre in the United States tried to improve the preventive practices of families who had a pre-school child that had recently been poisoned.⁸ A nine-step checklist for poison-proofing the home was mailed to these families. A blind follow-up telephone interview was conducted three months later. Intervention families did not show a higher rate of compliance with suggested changes in practices to prevent poisonings, compared with control families who had not been sent the checklist. The poisoning recurrence rate was similar in both groups. The findings from this study suggest that even after a poisoning event, parents may not be sufficiently motivated to take poisoning prevention measures on their own.

Vegetable-borne pesticides

Agricultural pesticides are an important cause of accidental poisoning in Hong Kong, affecting both children and adults.⁹ Major outbreaks and sporadic cases of vegetable-borne methamidophos poisoning have been frequently seen since 1987.^{10,11} Methamidophos is banned in most countries. In Shenzhen and the neighbouring regions of China, however, where most of our green leafy vegetables are imported from, some farmers use methamidophos on their crops and then harvest too soon—before the organophosphate insecticide concentrations have fallen to nontoxic levels. It is water-soluble and the adequate rinsing of vegetables followed by boiling, straining, and discarding the water will remove most of the pesticide residues. However, this more Western-style of vegetable preparation may reduce the flavour and these steps are often omitted in busy local kitchens where vegetables receive only cursory rinsing before cooking.

Chinese herbal medicines

Herbal medicines are often used by the general public in the self-treatment of many common diseases. Their common use and the continued availability of toxic preparations may explain the frequent occurrence of serious and even fatal poisonings.^{12,13} Most cases are related to the use of the aconites. These contain highly toxic alkaloids, including aconitine, which are potent neurotoxins and cardiotoxins. The main causes of death in patients who have taken aconites are cardiovascular collapse and ventricular arrhythmias. Children may also be accidentally poisoned by herbal medicines given by their parents for the treatment of minor ailments in childhood.^{14,15}

Small doses can be fatal in children

Certain drugs or chemicals can be fatal to a toddler on ingestion of only one tablet, capsule, or other standard dose unit (Table 2).¹⁶ The labelling of these compounds differently from all others may help to warn parents and health professionals about their danger and thus may help to prevent serious morbidity and fatalities. Similarly, awareness that these compounds exist should help general practitioners and emergency personnel to take immediate measures when such exposures have occurred.

Camphor is an ingredient in liniments (which often contain up to 20% camphor) and related preparations designed to be applied externally for the relief of muscle aches.¹⁷ It is a cyclic ketone of the hydroaromatic terpene group. Terpenes are lipophilic, rapid-acting neurotoxins that have both excitatory and depressant actions. Severe toxicity may provoke seizures, respiratory depression, or coma.

Methyl salicylate poses the threat of severe, rapid-onset, salicylate toxicity because of its liquid, concentrated form.¹⁸ In Hong Kong, the most important source is Chinese medicated oils.¹⁹ For example, "Hung Far Oil" ("Red Flower Oil") contains up to 67% of wintergreen oil (methyl salicylate), which is the equivalent to 24 adult 300 mg aspirin tablets per 10 ml. Toxicity from these oils may also be due to other active ingredients including camphor and turpentine.

Two other products are also potentially very dangerous to toddlers, although there are as yet no published reports of fatal poisonings.¹⁷ Many over-the-counter eye and nose drops contain imidazoline-derived sympathomimetic agents. Mucosal application of these substances causes local α -adrenergic-

Table 2. Medicinal preparations that can be fatal to a 10 kg toddler on ingestion of a small dose

Compound	Minimal potential fatal dose	Maximal unit-dose available	Amount that causes fatality	Mechanism of toxicity /important effects
Camphor	100 mg/kg	1 g/5 ml	1 tsp	Rapid-acting neurotoxins with both excitatory and depressant actions
Chloroquine	20 mg/kg	500 mg	1 tab	Powerful cardiotoxin, respiratory arrest, seizures, coma
Hydroxy-chloroquine	20 mg/kg	200 mg	1 tab	As for chloroquine
Imipramine	15 mg/kg	150 mg	1 tab	Cardiac arrhythmias, respiratory failure, coma, anticholinergic effects
Desipramine	15 mg/kg	75 mg	2 tabs	As for imipramine
Quinine	80 mg/kg	650 mg	1-2 tabs	Visual damage, cardiac arrhythmias, coma, seizures, hypoglycaemia
Methyl salicylate	200 mg/kg	1.4 g/ml	<1 tsp	Severe, rapid-onset salicylate poisoning
Theophylline	8.4 mg/kg	500 mg	1 tab	Cardiac arrhythmias, seizures, profound hypokalaemia
Thioridazine	15 mg/kg	200 mg	1 tab	Cardiac arrhythmias, seizures, dystonic reactions
Chlorpromazine	25 mg/kg	200 mg	1-2 tabs	As for thioridazine

Maximal unit-dose available may be different from that in Hong Kong. Newer products, i.e.those introduced after approximately 1990, have not been included. Other tricyclics and phenothiazines may cause comparable effects.
Source: Koren G. *J Toxicol Clin Toxicol* 1993.¹⁶

mediated vasoconstriction and hence, decongestion. After systemic absorption, they may stimulate the central α^2 -adrenergic receptors. As a consequence, there is a reduction in neurotransmission from central sympathetic vasomotor centres and a fall in heart rate and blood pressure. Benzocaine is a local anaesthetic that is found in teething gels, haemorrhoid creams, first aid ointments, mouth rinses, and throat lozenges. Toxicity may result from mucosal absorption after excessive use and sometimes, from accidental ingestion. Benzocaine may be metabolised to aniline, which is then transformed

to phenylhydroxylamine and nitrosobenzene, both of which are methaemoglobin-forming compounds. Consequently, the oxygen-carrying capacity of the blood is reduced, thus leading to nausea and vomiting, palpitations, shortness of breath, lethargy, stupor, seizures, coma, and even death.

Other drugs that are potentially lethal to a toddler if they are ingested in excess include the monoamine-oxidase inhibitors, opiates, Lomotil (diphenoxylate and atropine), dimendydrinate, and orphenadine.^{16,17} Their toxicity is predictable based on their pharmacological

actions: central nervous system stimulation and excessive peripheral sympathetic activity from the monoamine-oxidase inhibitors, respiratory depression from the opiates, respiratory depression and anticholinergic effects from lomotil, central nervous system depression and anticholinergic effects from dimendydrinate, and anticholinergic and cardiotoxic effects from orphenadine.^{20,21}

Other highly toxic agents

In Hong Kong, a 24% paraquat solution is available as a domestic and commercial herbicide. Paraquat poisoning is relatively uncommon in the territory, but significant ingestion of the herbicide is nearly always fatal.²²

Dettol liquid (chloroxyleneol 4.8%, pine oil, isopropyl alcohol) is a common household disinfectant. After ingestion, 8% of patients develop serious complications such as aspiration (resulting in pneumonia, cardiopulmonary arrest, bronchospasm, adult respiratory distress syndrome) and severe laryngeal oedema with stridor.²³

Drain and oven cleaners (strong alkalis or acids) and automatic-dishwasher detergent (strong alkaline/caustic agent) are highly corrosive when swallowed,²⁴ and must always be placed out of the reach of children.

Many deaths and disabling sequelae in children following poisoning could be prevented if more attention were given to implementing preventive measures at home. Medications and chemicals should always be safely packed and stored. Education on which substances are particularly dangerous to children and the giving of precautionary advice to parents by health care professionals would also help to reduce the incidence of childhood poisoning.

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