CPD Article

Review of Children Hospitalised for Ingestion and Poisoning at a Tertiary Centre

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Abstract

Introduction: The main aim of this study is to determine the pattern of referrals of poisoning to a tertiary university hospital. The information will be used for poison prevention programme planning, and for educating and awareness promoting to the public. Materials and Methods: All patients (under 21 years of age) admitted to the paediatric wards between January 1997 and December 2002 with a discharge diagnosis indicating unintentional (UP) or intentional poisoning (IP) were identified through the computerised discharge information. Results: Sixty males and 98 females accounted for 161 admissions over the 6-year period. Their mean (standard deviation, SD) age was 8.2 (6.2) years. Sixty per cent of admissions involved UP. Females accounted for 47% of the UP but 86% of the IP [odds ratio of females for IP, 7.05; 95% confidence interval (CI) 2.95 to 17.28]. When compared with UP, IP patients were significantly older [mean (SD): 14.9 (1.7) versus 3.6 (3.3) years]. In 70% of the admissions, the patients ingested a single substance. Tablets and pills, especially in the IP adolescents, were more commonly ingested than syrups. The spectrum of substances ingested was vast but paracetamol, cough or cold medicines, and common adult household medications and agents accounted for the majority of medications ingested. The substances ingested were obtained at home in 81 cases (50%) and as over-the-counter medication in 33 (20%). The majority (92%) of patients presented within 24 hours of ingestion. On admission, 63% of UP and 45% of the IP were asymptomatic. No active treatment was required in 65% of patients. In IP, nearly 30% of IP who ingested paracetamol had toxic levels and received N-acteyl cysteine. A history of previous poisoning was more common and subsequent follow-up was offered to 74%. Conclusion: Young boys were more at risk of unintentional ingestion whereas adolescent girls were more likely to ingest medications as a gesture of suicide. Paracetamol is a frequently ingested medicinal for which an antidote is available.

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Key words: Gender, Hospitalisation, Intentional, Paediatric ingestion, Poisonings, Unintentional

Introduction

Childhood ingestion and poisoning is an important problem in many countries,[1-8] and accounts for a significant workload for emergency department consultations and hospital admissions.[9,10] About 4 million people are poisoned in the United States every year. Children under 6 years of age account for 60% of these cases, and more young children die of poisoning at home than are accidentally killed by guns in the home.[1,2,11,12] Poisoning is also recognised to be a significant hazard in early childhood in Australia.[5,8] In New Zealand, mortality rates are lower than in many countries, but hospitalisation rates are higher.[13] In Taiwan, the National Poison Center reported that childhood poisonings were underreported and of high mortality.[14] However, the epidemiology and disease spectrum of childhood poisoning in Asian cities, including Hong Kong,[15-20] has not been well characterised. Many paediatric ingestions are trivial and not referred to hospital for management.[9,10,21] Nonetheless, assessing the epidemiology of paediatric ingestions admitted to hospital will provide important information for establishing the magnitude of the problem in the tertiary paediatric service. This study set out to describe the pattern of childhood ingestions admitted to a tertiary university hospital, and to compare the

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epidemiological characteristics of the unintentional (UP) and the intentional poisoning (IP) groups.

Materials and Methods

Hong Kong had a population of 6,708,389 as of 2001 and approximately 90% of all hospital admissions in Hong Kong are to government public hospitals under the administration of the Hospital Authority (HA). The study was undertaken at the Prince of Wales Hospital (PWH), which is 1 of 18 HA hospitals providing inpatient care. It is also a tertiary teaching hospital affiliated with the Chinese University of Hong Kong. The hospital serves part of the New Territories of Hong Kong with a catchment population of around 1 million. From 1996, a computerised data collection system, the Clinical Management System (CMS) was introduced in phases to all public government hospitals to collect uniform discharge information on all patients. The CMS database for PWH was searched to identify all patients (under 21 years of age) admitted to the paediatric service with a primary or secondary diagnostic code that indicated unintentional or intentional ingestions. The following ICD-9-CM (*International Classification of Diseases, 9th Revision, Clinical Modification*) codes were included in the search: 960-979 (poisoning by drugs, medicinal and biological substances) and 980-989 (toxic effects of substances chiefly nonmedicinal as to source). Charts and computerised information were retrospectively reviewed and the nature of poisoning (intentional versus unintentional) was differentiated. The data were abstracted onto a standardised form. They were analysed by Student's *t*-test for parametric variables, and Pearson χ^2 or Fisher's exact test for proportions. *P* value <0.05 was considered significant. The Clinical Research Ethics Committee of the University approved this study.

Results

A total of 169 admissions were identified with the ICD codes of 960-989 and case notes on 161 were located for review. Eight admissions were excluded because of missing charts or wrong diagnosis. There were 60 males and 98 females, with a mean age of 8.2 years [standard deviation (SD), 6.2]. All cases involved poisoning by ingestion, and the majority (60%) of admissions involved UP (Table 1). The mean ages of IP versus UP patients were 14.9 (SD, 1.7) and 3.6 (SD, 3.3) years, respectively (*P* <0.001); the mean hospital stay was 3.8 days (SD, 2.7) and 2.6 days (SD, 1.3), respectively (*P* <0.001). One girl in the UP category and 2 girls in the IP category were admitted twice during this period. There were fewer males than females in the IP group but not in the UP group. The odds ratio (OR) for being female was 7.05 (95% CI, 2.95 to 17.28) in the IP group.

In 112 admissions (70%), the patients ingested a single substance. In 2 cases (1 UP, 1 IP), there was no clue as to what had been ingested. The spectrum of substances ingested was wide but paracetamol, cough mixture or cold medicines, and common adult medications accounted for the majority of medications ingested. There was no ingestion of poisonous plants. The substances ingested were obtained at home in 81 (50%), as over-the-counter medication in 33 (20%), and miscellaneous or unknown sources in the remainder. The timing of admissions is illustrated in Figure 1. Vomiting (18% of UP versus 17% of IP) and drowsiness/confusion (14% of UP versus 20% of IP) were reasonably common symptoms (Table 2). As a category, neurological symptomatology was protean.

The poisons identified in the cases are summarised in Table 3. Paracetamol (n = 14 admissions) and cough or cold medicines (n = 11) were the most common substances in the UP group. The OR of UP taking place at home was 4.67 (95% CI, 2.00 to 11.02). In the IP group, paracetamol (n = 21 admissions), cough or cold medicines (n = 11), and various "sleeping pills" of unknown composition (n = 11) were most frequently used. Alcohol was involved in the case of 1 adolescent boy and 3 girls, and illicit drugs, in the case of 2 girls. A history of previous drug ingestion or overdose was common (18% of IP), and drugs rather than household agents were taken by the IP group (OR 3.34; 95% CI, 1.27 to 9.14). The various reasons for ingestion in the IP group included depression, conflicts with family members, friends or teacher, relationship problems, and dissatisfaction with school performance.

Treatment given included ipecac (17 UP), gastric lavage (2 UP and 5 IP), charcoal (9 UP and 13 IP), and antidotes (4 UP and 8 IP). N-acetyl cysteine was prescribed in the case of 7 patients (1 UP and 6 IP) who had toxic paracetamol levels, according to standard toxicology nomogram of serum levels as a function of time. There was 1 ICU admission but no mortality. A 4-year-old girl, with a history of ingestion, was given methadone [mistaken as medication for upper respiratory tract infection (URTI)] by her

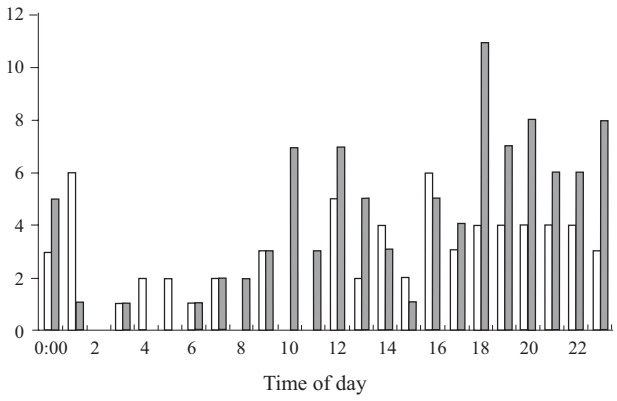

Fig. 1. Time of admission of intentional (white bars) and unintentional (black bars) cases.

Table 1. Details on Ingestion

Characteristics	Intentional (n = 65)	Unintentional (n = 96)	OR (95% CI)	*P*
Sex				
Female	56 (55)	45 (45)	7.05 (2.95-17.28)	<0.001
Male	9 (15)	51 (85)		
Substances taken				
Single	45 (37)	77 (63)	0.56 (0.25-1.22)	0.159
Multiple/unknown	20 (51)	19 (49)		
Substances taken				
Solid	58 (51)	56 (49)	3.77 (1.66-8.69)	<0.001
Liquid	11 (22)	40 (78)		
Location at which ingestion occurred				
Home	39 (32)	84 (68)	0.21 (0.09-0.50)	<0.001
Others/unknown	26 (68)	12 (32)		
Substance(s) involved				
Medicinals	59 (46)	70 (54)	1.99 (0.85-4.72)	0.121
Household agents*	11 (30)	26 (70)		
Occurrence of symptoms				
Presence	36 (50)	36 (50)	2.07 (1.04-4.13)	0.038
Absence	29 (33)	60 (67)		
Past history of ingestion				
Yes	12 (75)	4 (25)	5.21 (1.46-20.29)	0.007
No	53 (37)	92 (63)		
Treatment**				
Not prescribed	40 (38)	65 (62)	0.76 (0.38-1.55)	0.524
Prescribed	25 (45)	31 (55)		
Outcome				
Follow-up arranged	48 (83)	10 (17)	24.28 (9.58-63.39)	<0.001
No follow-up or DAMA	13 + 4 (17)	83 + 3 (83)		

CI: confidence interval; DAMA: discharge against medical advice; OR: odds ratio

Results expressed in number (row percent).

* Household agents include cleaning agents, solvents, polish, disinfectants, insecticides, pesticides, alcohol, etc.

** Treatment includes ipecac, charcoal, gastric lavage, N-acetyl cysteine, benztropine, or naloxone.

grandmother. She required ICU admission and treatment with naloxone. Psychological, social work and medical follow-up was offered to 74% of the IP patients and their families. Four patients in the IP group and 3 in the UP group were "discharged against medical advice" and follow-up information was not available.

Discussion

During the 6-year study period, there were 49,452 paediatric admissions to PWH, and UP and IP accounted for 0.19% and 0.13% of these (excluding 8 cases that were not reviewed). There were 497,535 paediatric admissions to the 18 HA hospitals (including PWH) during the same period. The pattern of poisoning admissions in our study is probably representative of the northern territories (New Territories) of Hong Kong as PWH sees the majority of such cases. Poisoning in children remained uncommon and we did not observe any increasing trends.

Adjusted UP (from birth to 9 years) was 24.8 admissions to the HA paediatric service/100,000/year, which was much lower than data reported by Rodriguez et al,[9] who found that children of "other races" had higher hospitalisation rates for poisoning than did white children for UP from birth to 9 years of age (124.2 per 100,000 compared with 51.9 per 100,000). Many of our findings are also similar to a New Zealand study on accidental poisoning but our hospitalisation rates appear lower.[13] In Hong Kong, it is not uncommon that the child's caregiver is a foreign domestic helper, especially when both parents are working. It is uncertain if close supervision by such helpers is a factor in the lower incidence in Hong Kong, and further studies are required to explore this issue.

Gender and Age

There were important similarities and differences between these 2 forms of childhood poisoning. Gender is an especially

Table 2. The Clinical Symptomatology of the Intentional and Unintentional Poisoning Cases

Symptomatology	Intentional	Unintentional
Asymptomatic	29	60
Gastrointestinal		
Symptoms		
Nausea	5	1
Vomiting	11	17
Abdominal pain/discomfort	10	5
Heartburn	1	0
Diarrhoea/loose stool	1	3
Neurological		
Symptoms		
Dizzy	6	2
Vertigo	1	0
Headache	2	2
Poor memory	0	1
Visual hallucination	1	1
Tinnitus	1	0
Unsteady gait	1	1
Weakness	0	1
Sleepy	1	3
Signs		
Drowsy or altered consciousness	5	10
Unarousable/unresponsive	2	1
Confusion or disorientation	4	1
Dystonia	1	0
Aggressiveness/impulsiveness	3	0
Struggling	0	1
Staring gaze	1	1
Mute	1	0
Slurred speech/dysarthria	1	0
Neck stiffness	1	0
Inappropriate speech	1	1
Sluggish pupils	1	0
Meiosis	0	2
Fixed dilated pupils	1	0
Disdiadochokinesia	1	0
Passed pointing	1	0
Nystagmus	0	1
Oculogyric cisis	0	1
Hypertonic	0	1
Apnoea	0	1
Convulsion	1	0
Cardiopulmonary		
Symptoms		
Chest discomfort	2	0
Shortness of breath	2	0
Palpitation	0	1
Signs		
Hypotension	0	1
Cyanosis or desaturation	0	2
Miscellaneous		
Symptoms		
Sweating	0	2
Dry mouth	1	0
Sore throat	1	2
Fell from stairs and had back pain	1	0
Lower lip pain	0	1
Poor feeding	0	1
Collapse	1	0
Signs		
Periorbital swelling	0	1
Pallor	1	0
Systemic symptomatology		
Malaise	0	1
Fever	1	3
Chills	1	0

important demographic factor. The UP group consisted of younger children with similar gender distribution, whereas the IP group was over-represented by older girls. Rodriguez and Sattin[9] reported that white male patients were hospitalised more frequently than white female patients in UP, but this gender difference did not occur in children of other races. Adolescent girls appeared to be more prone to emotional and situational crises that led to attention-seeking displays of self-harm.

The Poisons

Most patients (70%) ingested a single substance. Solids (tablets and pills), especially in the IP adolescents, were more often ingested. In nearly all cases, the substances ingested (or at least the class of substances) were apparent from the history. The spectrum of substances ingested was wide, but paracetamol, cough or cold medicines, and common household medications or agents accounted for the majority of ingested substances. Alcohol and illicit drugs were only occasional tools for IP. Our findings were similar to the Australian findings[8] but different from those of Litovitz et al,[22] who found that in the US, cosmetics and personal care products, cleaning substances, and plants were the most commonly implicated substances. Apart from checking the serum paracetamol level and comparing it against standard normogram of serum levels as a function of time, urine and serum drug screens are probably not helpful in the immediate management of our childhood poisoning incidents. Our results revealed that the substances ingested were obtained at home in half the cases and the ingestion took place in patients' homes in 88% of UP and 60% of IP. These findings suggest that targeting prophylactic measures such as education and counselling on poisons prevention in children's home environments may reduce paediatric poisoning.[8] For instance, parents should not keep excessive numbers of unused tablets (such as paracetamol, which is readily available at local shops and supermarkets) at home, and tablets should also be kept in child-resistant containers.[23] Despite the fact that there is no move towards adopting the universal use of child-resistant containers in Hong Kong, it is interesting to note that the incidence of recorded poisonings is not higher than the

Table 3. The Poisons Identified in the Intentional and Unintentional Poisoning Cases

Poisons	Intentional poisoning	Unintentional poisoning
Antipyretics/analgesics		
Paracetamol	21	14
Nonsteroidal anti-inflammatory drugs	5	4
Opioid analgesics	1	3
Unspecified analgesics	1	0
Central nervous system		
Hypnotics/anxiolytics (e.g., benzodiazepines, zopiclone, chloral hydrate)	17	7
Thioxanthene antidepressants (flupenthixol)	0	3
Tricyclic antidepressant (amitriptyline)	0	1
Selective serotonin re-uptake inhibitor (fluoxetine)	3	0
Unspecified antidepressants	1	1
Phenothiazine (perhenazine)	0	1
Butyrophenone (haloperidol)	1	1
Ketamine	1	0
Unspecified psychoactive substance	1	0
Anti-Parkinsonism (e.g., Sinemet CR, Benzhexol)	1	2
Anticonvulsants (e.g., Tegretol, Epilim, Benzhexol)	2	3
Cough and cold medicines		
Antihistamine-containing	9	5
Mucolytic (bromhexine)	0	1
Antitussive (noscapine)	0	1
Decongestant (phenylephrine)	0	1
Unspecified cough mixtures/decongestants	3	6
Miscellaneous		
Medicinals		
Chinese, herbal or homeopathic medicine	3	5
Bronchodilators (Bricanyl, Ventolin, theophylline)	0	4
Alcohol	4	0
Laxatives	1	0
Antidiarrhoeals	2	2
Antacids, Tagamet, Cisapride	2	3
Diuretic (Lasix)	1	0
Digoxin	0	1
Antihypertensives	1	4
Oral contraceptives	1	2
Bromocryptine	0	1
Vasobral	0	1
Oral hypoglycaemic (Daonil)	0	2
Slow K	1	0
Antibiotics	2	2
Health supplements (vitamins/minerals/fish oil)	0	13
Non-medicinals		
Insecticides/organophosphates	0	7
Fluorescent dye	0	3
Thinner, polish, toluene, kerosene, diesel	1	5
Dettol	3	0
Detergents/bleach	4	6
Flame retardant (Exolit)	0	1
Dessicant	0	1
Ethanolic dried horse chestnut extract	0	1
Unknown	2	4

figures quoted in developed nations. Further systematic examination of this issue is necessary before policies for child-resistant containers are implemented in Hong Kong.

Symptomatology and Management

Unlike Wiseman et al's series,[21] more patients in our series were symptomatic at admission (55% of IP and 38% of UP), with the commonest symptoms being vomiting and drowsiness/confusion. Vomiting may facilitate the spontaneous removal of poisons if it occurs early, but this can be hazardous in the presence of depressed consciousness. No active treatment was required in 65% of patients. Ipecac and gastric lavage have both fallen out of vogue.[24-26] Supportive care, charcoal and specific antidotes are the mainstays of treatment. Activated charcoal has been advocated even in pre-hospital settings, although none of our patients received charcoal prior to hospitalisation.[27] One in 5 patients who ingested paracetamol and had toxic drug levels in our series was given N-acetyl cysteine as an antidote. Like Litovitz et al's finding,[28] a history of drug ingestion or overdose in IP was common, occurring in 1 in 4 patients. This has important implications in terms of patient follow-up. Psychological, social work and medical follow-up appointments were arranged for three-quarters of our IP patients and their families.

One limitation of this study is that the hospital discharge data may have underreported the incidence of hospitalised poisoning because the identification of cases depended on the coding used by medical officers at the time of discharge. Another limitation is that the clinical details of those cases discharged from the Emergency Department have not been captured. Hospitalised patients form just the tip of the iceberg in terms of describing the burden of disease. There are many patients who are treated in and discharged from the Emergency Departments, or treated and then given specialist outpatient follow-ups. In addition, hospital policies and practices concerning patient admission may vary and confound data analysis. In Hong Kong, however, the threshold for admitting children and young persons to the paediatric service by the Emergency Department physicians is generally low.

Conclusion

Adolescent girls tend to ingest medications as a gesture of suicide. Younger children are more likely to have accidental poisoning. Despite these differences, there are also significant similarities between the 2 groups. Most childhood ingestions are trivial and not associated with significant morbidity. Common household medications and agents are involved and the ingestions often take place in the patients' own homes. Good supportive care is the cornerstone of management for childhood poisoning. Paracetamol remains an important medication in childhood poisoning for which an antidote is available.

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