Emergency Visits for Childhood Poisoning: A 2-Year Prospective Multicenter Survey in Spain

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Objectives: To describe the characteristics of childhood poisoning leading to consultation to 17 pediatric emergency departments in Spain.

Methods: During a 2-year period (January 2001 to December 2002), accompanying people of 2157 children with acute intoxication who visited consecutively at the emergency room were prospectively surveyed.

Results: Childhood poisoning accounted for 0.28% of all emergency visits during the study period. The median (interquartile range, 25th–75th percentile) age was 24 months (22–60 months); 67% of children were younger than 4 years. Drug ingestion was involved in 54.7% of cases (paracetamol was the most frequent drug), domestic products in 28.9%, alcohol in 5.9%, carbon monoxide in 4.5%, and illicit drugs in 1.5%. A total of 61.3% of patients were admitted within 1 hour after exposure to the toxic substance, and 10.3% had been already treated before arrival; 29.1% of patients were referred for clinical manifestations which were mostly neurological symptoms. Laboratory tests and other investigations were performed in 40.7% of cases. Gastrointestinal decontamination was used in 51.7% of patients, with activated charcoal in 32.3%. Treatment varied significantly according to the individual hospitals. A total of 83.3% of patients were treated as outpatients, 15.2% were hospitalized, and 1.5% were admitted to the intensive care unit. One 11-month-old boy with carbon monoxide intoxication died. Six patients had permanent sequelae (esophageal stenosis in 5 and partial blindness in 1).

Conclusions: Young children who accidentally ingested drugs, and less frequently, domestic products accounted for most cases of intoxication who presented at the pediatric emergency department.

Key Words: poisoning, pediatric toxicology, toxic substances

Poisoning remains a major public health care problem, particularly in children. However, childhood poisoning still represents an infrequent cause of admission in pediatric emergency departments. Ingestion of a harmful substance is among the most common causes of injury to young children. Fortunately, in most cases, the ingested agent has minimal or no clinically important toxic effects. Occasionally, however, such ingestion can be life-threatening or can even result in death.[1] It is therefore important that pediatric emergency departments have available protocols for effective management of poisoning in children. On the other hand, emergency department personnel have an important opportunity to provide poisoning prevention education to families of children at high risk for repeat occurrence.[2]

It has been consistently observed that, in young children, most acute intoxications are accidental exposure to poisoning agents, via the oral route, occurring at home. Substances ingested are mainly pharmaceutical drugs and household products, often present in a place that can be easily reached by the child.[3,4] Deliberate self-poisoning and unintentional intoxication during recreational activities are frequent circumstances of poisoning in older children and teenagers. Occupational toxic exposures related to low-skill, entry-level jobs most frequently filled by adolescents are also an underestimated hazard.[5]

Effective preventive and therapeutic approaches in the area of childhood poisoning should be based on appropriate knowledge of general epidemiologic data of poisoning in our region and on a national scale.[6] This study carried out by the Clinical Toxicologic Working Group of the Spanish Society of Pediatric Emergency Medicine was designed to characterize the epidemiology, clinical management, and outcome of children with acute intoxication seeking medical care at the pediatric emergency departments of 17 acute-care hospitals in Spain.

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ISSN: 0749-5161/06/2205-0334

METHODS

During a 2-year period (January 2001 to December 2002), all cases of acute intoxication attended at the Pediatric Emergency Departments of 17 tertiary care or teaching hospitals from eight Autonomous Communities of Spain were prospectively recorded using specific questionnaire. All patients younger than 15 years admitted to 10 emergency departments and younger than 19 years admitted to the remaining 7 emergency departments with a diagnosis of poisoning according to history, clinical manifestations, and laboratory and analytical toxicology, when necessary, were included. Organizational characteristics of the Spanish public health care system at the level of the Autonomous Communities accounted for differences in age-related thresholds (<15 and <19 years) for the provision of care in the pediatric emergency departments.

The following cases were excluded: adverse reactions and drug secondary effects; early poisoning-related death, although a toxic cause of death was suspected; insect bites; and inert foreign body ingestions.

Information on poisoning-related circumstances, including toxic substances, was collected from interviews conducted with parents, caretakers, or accompanying people as well as the patients themselves in children aged 12 to 18 years. Interviews were performed by the physician in charge and took place at the pediatric emergency department. Oral consent was obtained before the surveys were conducted. For each patient, the following data were recorded: age and sex; attending hospital; circumstances associated with the poisoning, including month, day of the week, and time; toxic compound type; time between exposure and arrival to the emergency department; symptoms and signs; type of medical assistance before admittance to the emergency room; treatment at the emergency department (basic life support, gastrointestinal decontamination, antidote, or symptomatic therapy); laboratory tests and other investigations including toxicological analysis; patient's final outcome; and discharge conditions from the emergency department. Information regarding whether poison control centers were called before the child/adolescent came to the emergency department was not recorded.

Categorical data were examined using the χ^2 test. Normally distributed continuous data were compared with the Student *t* test. Nonparametric data were compared with the Kruskal-Wallis test and the Mann-Whitney *U* test. The SPSS 11.5 for Windows (SPSS Inc, Chicago, IL) was used for all statistical calculations. Statistical significance was defined as *P* value of less than 0.05.

RESULTS

Childhood poisoning (n = 2157) accounted for 0.28% of all emergency visits during the study period (N = 753,961). The mean (SD) age was 55 months (56 months); 67% of the children (n = 1445) were younger than 4 years, and 12% (n = 258) were older than 13 years. Fifty percent of patients were boys. However, the distribution by sex varied significantly ($P < 0.001$) according to age, that is, 52.8% of boys younger than 10 years and 61.3% of girls older than 10 years. On the other hand, patients older than 10 years compared with children younger than 10 years showed statistically significant differences ($P < 0.001$) with regard to the presence of symptoms (70.8% vs 20.4%) and signs on physical examination (39.5% vs 9.8%); frequency of laboratory tests and other investigations (62.9% vs 36%) and indication of treatment (60.5% vs 49.9%); and admission to the observation unit of the emergency department (23.7% vs 17.7%), hospital ward (32.4% vs 11.5%), and intensive care unit (ICU) (3.7% vs 1%).

As shown in Table 1, medication products were involved in 54.7% of cases (n = 1180), domestic products in 28.9% (n = 624), ethanol in 5.9% (n = 127), carbon monoxide in 4.5% (n = 97), illicit drugs in 1.5% (n = 33), mixture of medications in 1.2% (n = 25), other products in 2.5% (n = 56), and unknown toxic substance in 0.7% (n = 15). Distribution of toxic substances varied significantly according to age; pharmaceutical agents and household products were more frequently involved in young children, and pharmaceutical products, alcohol, and illicit drugs in the older age groups. Paracetamol was the most frequent drug in the poison (15.3%) followed by ethanol; carbon monoxide; sodium hypochlorite; a combination of phenylephrine, diphenhydramine, and chlorpheniramine (present in some over-the-counter cold drugs mostly in decongestants for short-term symptom relief); ibuprofen; and fluorine (Table 2). Of children younger than 5 years, 19.5% were visited because of paracetamol accidental intoxication. However, hepatic toxicity related to paracetamol was not observed. There were no significant differences with regard to the number of childhood poisoning attended at the emergency department and the days of the week, although most episodes associated with ethanol ingestion and use of illicit drugs occurred at weekends. In addition, most episodes of poisoning occurred between 11:00 AM and 3:00 PM and between 6:00 PM and 10:00 PM.

TABLE 1. Distribution of 2157 Poisoned Patients According to Age and Poisonous Agent

	Patients Age, y			
Agent	**≤6**	**7–13**	**≥14**	**Total**
Medication products	1006 (59.2)	69 (34.2)	105 (41.2)	1180 (54.7)
Domestic products	567 (33.4)	49 (24.3)	8 (3.1)	624 (28.9)
Alcohol	4 (0.2)	29 (14.4)	94 (36.9)	127 (5.9)
Carbon monoxide	50 (2.9)	39 (19.3)	8 (3.1)	97 (4.5)
Illicit drug	12 (0.7)	4 (2)	17 (6.7)	33 (1.5)
Mixture of medications	4 (0.2)	1 (0.5)	20 (7.8)	25 (1.2)
Other	46 (2.7)	10 (4.9)	0	56 (2.5)
Unknown	11 (0.6)	1 (0.5)	3 (1.2)	15 (0.7)
Total	1700 (100)	202 (100)	255 (100)	2157 (100)

Values in parentheses are percentages.

TABLE 2. Active Principles Most Frequently Involved in 2157 Cases of Childhood Poisoning

Poisonous Agent	No. Cases
Paracetamol	331
Ethanol	148
Carbon monoxide	97
Sodium hypochlorite	95
Combination of phenylephrine, diphenhydramine, and chlorpheniramine	76
Ibuprofen	38
Fluorine	35

A total of 1040 patients (61.3%) were admitted within 1 hour of poison ingestion (78.9% within 2 hours), and 224 (10.3%) had been already treated before arrival, mainly induced emesis (n = 37), activated charcoal (n = 34), gastric lavage (n = 29), and antidote (n = 10). At the time of admission to the emergency department, 70.8% of children were asymptomatic. The percentage of asymptomatic patients was significantly higher in the younger age group ($P < 0.001$). In the remaining symptomatic patients, neurological symptoms were the most frequent (17.9%) (Table 3). On the other hand, the percentage of patients with clinical manifestations was significantly lower among patients admitted within 1 hour of poison ingestion (45.1%) compared with those admitted later (54.9%) ($P < 0.01$). Signs were detected on physical examination in 15% of children, mostly altered consciousness and lesions in the oral mucosa (Table 3). A total of 64.4% of children admitted within 1 hour of poison ingestion were asymptomatic, whereas 57.4% of patients admitted after 1 hour had signs on examination ($P < 0.01$).

Laboratory tests and other investigations were requested in 40.7% of patients (Table 4). A total of 1116 children (51.7%) were treated at the emergency department and included activated charcoal in 697 cases (32.3% of the total study population), gastric lavage in 214 (9.9%), syrup of ipecac in 168 (7.8%), and the administration of antidote in 83 (3.8%) (flumazenil in 32 and N-acetyl cysteine in 29). In the group of 1180 cases of poisoning caused by pharmaceutical products, treatment included gastrointestinal decontamination in 634 (53.7%) (activated charcoal in 81.8% of cases), syrup of ipecac in 152 (24%), and gastric lavage in 170 (26.9%). However, treatment varied significantly according to individual pediatric emergency departments: between 61% and 96.7% for the use of activated charcoal, between 0% and more than 50% for ipecac, and between 2.2% and 60% for gastric lavage.

A total of 83.3% of patients (n = 1798) were discharged from the pediatric emergency department (without any type of treatment in 633), and 18.7% were discharged after admission to the short-stay observation unit. However, 15.2% of patients (n = 327) were hospitalized, and 1.5% (n = 32) were admitted to the ICU. The percentage of patients admitted to the hospital among childhood poisoning (359/2157) was significantly higher than the hospitalization rate of the remaining patients attended in the pediatric emergency department during the study period (37,615/713,830) (16.6% vs 5.2%, $P < 0.01$).

One 11-month-old boy with carbon monoxide intoxication died. Six patients had permanent sequelae, including different degrees of esophageal stricture in 5 children aged

TABLE 3. Clinical Manifestations and Findings on Physical Examination in 2157 Cases of Childhood Poisoning

		Age, y		
Data	Total (%)	≤6	7–13	≥14
Clinical manifestations		1700	202	255
Asymptomatic	1529 (70.8)	1379 (81.1)	74 (36.6)	76 (29.8)
Neurological symptoms	388 (17.9)	126 (7.4)	77 (38.1)	133 (52.1)
Gastrointestinal symptoms	165 (7.6)	116 (6.8)	27 (13.3)	21 (8.2)
Respiratory symptoms	26 (1.2)	23 (1.3)	1 (0.4)	0
Neurological and gastrointestinal symptoms	15 (0.6)	26 (1.5)	18 (8.9)	22 (8.6)
Other	34 (1.5)	30 (1.7)	5 (2.4)	3 (3.1)
Predominant signs				
None	1834 (85.0)	1536 (90.3)	150 (74.2)	148 (58.0)
Altered consciousness	139 (6.4)	47 (2.7)	34 (16.8)	82 (32.1)
Lesion oral mucosa	57 (2.6)	47 (2.7)	1 (0.4)	1 (0.3)
Ataxia	39 (1.8)	23 (1.3)	6 (2.9)	13 (5.0)
Cardiovascular	21 (0.9)	16 (0.9)	3 (1.4)	2 (0.7)
Respiratory findings	13 (0.6)	11 (0.6)	1 (0.4)	1 (0.3)
Ocular lesion	8 (0.3)	7 (0.4)	1 (0.4)	0
Other	29 (1.3)	13 (0.8)	6 (2.9)	8 (3.1)

Values in parentheses are percentages.

TABLE 4. Laboratory Tests and Other Investigations Performed in the Pediatric Emergency Department in 2157 Cases of Childhood Poisoning

Procedures	No. Cases (%)
None	1280
Plasma levels	
Paracetamol	184
Oxygen saturation (co-oximetry)	90
Ethanol	86
Toxic agents in blood	10
Salicylate	8
Methemoglobin	5
Digoxin	3
Methanol	1
Valproate	1
Detection of toxic substances in urine	142
Radiological imaging studies	146
ECG	84
Upper gastrointestinal endoscopy	6
EEG	6

ECG indicates electrocardiogram; EEG, electroencephalogram.

15, 20, 24, 36, and 48 months and partial bilateral blindness caused by caustic soda burn in a 36-month-old boy, who required bilateral corneal transplantation.

DISCUSSION

Exposure to a potentially toxic substance is an infrequent reason of consultation in Spanish pediatric emergency departments, which accounted for less than 0.3% of all visits. This percentage is lower than 3% of total medical emergencies in children admitted to a pediatric emergency care unit in Bordeaux, France, in 1995.[7] Childhood poisoning presents a series of peculiarities, such as the type of poisoning, the substances involved, and the time interval between exposure and arrival to the emergency department, determining that, even in similar geographic areas and temporal circumstances, the management of poisoning in children is largely different from the therapeutic approach of acute intoxications in adults.[6]

In our study, like others, acute poisoning was especially frequent in the group of children younger than 5 years.[7–9] Pharmacological products were the most common substances involved in the different pediatric age groups, which is similar to that in previous reports.[10] Paracetamol was the leading cause of unintentional childhood ingestion of medications. In agreement with other authors,[11,12] toxic substances involved varied with age. Antipyretics (mainly paracetamol) and cough and cold preparations are more frequently involved in young children, whereas in children older than 10 years, alcohol and/or illicit drugs accounted for a similar number of poisonings than pharmacological drugs. On the other hand, a number of studies have shown that children are somewhat protected from acute paracetamol hepatotoxicity because of developmental differences in metabolic and detoxification pathways.[12–15]

In young children, most poisoning exposure is accidental and benign, mainly because of the small amount of the substance ingested.[13–15] It has been shown that the distribution of medications, both prescription drugs and over-the-counter drugs, reflects the common presence of such agents in the home rather than their inherent toxicity.[1] On the other hand, the Spanish public health care system, in which universal free health care services are provided to every citizen, facilitates easy access to the emergency department and prompt management of these patients. However, the lack of legislation of the use of safety caps and containers for medicines also contributes to poisoning exposure in children. The introduction of child-resistant containers for medicines is highly effective[10,17,18] in terms of primary prevention, avoiding unnecessary admissions to the pediatric emergency department, laboratory tests, administration of treatment, hospitalization in pediatric wards, and so on.

In young children, and in agreement with other studies,[10,19] accidental ingestion of domestic products, including diluted bleach and general household cleaning products, was also frequent. However, the low incidence of symptoms at this age can be explained by the low toxicity of many substances and limited extent of contact.[20] Esophageal damage occurs rarely and is associated with concentrated solutions or the ingestion of large volumes. In our study, however, there were 5 cases of caustic esophageal stricture. All these poisonings could have been prevented by better adult vigilance and safer storage of these substances in the home.

In older children, the poisonings are more similar to those in adults; exposure also occurs outside the home; it is sometimes intentional and involves mainly pharmaceutical poisons, alcohol intoxication, and consumption of illicit drugs.[16,21] Ecstasy poisoning in toddlers and infants after accidental ingestion of these attractive design pills has been also reported.[22] Management of these patients at the emergency room may be difficult because the composition of poisoning substances may be unknown, and also, multiple ingestions are frequently reported. In a study of hospitalizations for pediatric intoxication among children in Washington State,[21] self-inflicted intoxications in teenagers were associated with the highest costs (hospital charges), length of stay, and number of readmissions.

Although characteristics of treating physicians (residents, pediatricians, and specialists in emergency medicine) cannot be provided because these data were not gathered, it may be speculated that differences in the management of childhood poisoning found in this study are apparently related to criteria of individual physicians rather than location, patient volume, or type of hospital (university vs community setting). Many clinicians find it difficult to overcome the desire to do something to reduce gastrointestinal absorption or enhance elimination of an ingested toxic. However, it is rare for pediatric toxic ingestions to result in significant toxicity, and gastrointestinal decontamination should not be routinely used in these patients.[1,10,23] However, if gastrointestinal decontamination is to be used, the procedure

of choice is activated charcoal.[1,24–27] The use of ipecac has no value in the emergency department, and gastric lavage is unlikely to be of benefit.[28] The present survey showed that, in some hospitals, ipecac has been used for gastrointestinal decontamination in more than 50% of cases, which was a matter of concern and prompted a publication of the management of acute childhood poisoning sponsored by the Spanish Society of Pediatric Emergency Medicine which was recently distributed among pediatric emergency departments over the country. In 15% of our poisoned patients, activated charcoal was provided before arrival to the emergency department, so that valuable time associated with delay in initiation of activated charcoal therapy was not lost.[29] In our study, however, 48% of children were not treated, and in 59% of cases, laboratory tests and other investigations were not performed. These findings indicate that many accidental poisoning exposure in children is benign and emphasizes the need for better information of the population on poison control centers calling facilities, to decrease the number of direct admissions to the pediatric emergency department.[2,7,30] Most cases of childhood poisoning can be managed in a short-stay observation unit, avoiding unnecessarily prolonged hospitalization.[7] In our study, like others,[2] a small number of children required admission to the pediatric ICU. Moreover, the hospitalization rate of pediatric poisoning was significantly higher than the number of patients hospitalized for other causes during the study period.

There was only 1 fatal event in an 11-month-old infant with carbon monoxide intoxication. It is likely that carbon monoxide poisoning may be underrepresented in our series because a high index of clinical suspicion is necessary in such cases. Improvement of safety measures is probably 1 of the most effective measures to prevent occult carbon monoxide exposure in the household.[31,32]

In summary, children younger than 5 years who accidentally ingested pharmaceuticals especially paracetamol, and less frequently, domestic products accounted for most intoxications attended at the pediatric emergency department. Large variations in the management of childhood poisoning are a matter of concern. This prospective multicenter study provides useful information to develop prevention and therapeutic strategies in our country and in others as well.

ACKNOWLEDGMENT

The authors thank Marta Pulido, MD, for editing the manuscript and for editorial assistance.

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