Unintentional Intoxications in Children: Detecting Risks
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Abstract

Introduction: Poisonings are an important problem in children. Identifying risk factors related with unintentional poisonings can help reduce their incidence and severity. The objective of this study was to define the characteristics of unintentional poisonings in children, with particular attention on drugs and household products.

Materials and Methods: Observational retrospective study performed in a Spanish urban maternity and children’s hospital from June 2012 to December 2014. We reviewed the computerized clinical history of suspected unintentional poisonings in patients under 18 years old, analyzing epidemiological and clinical variables.

Results: 908 patients consulted due to suspected poisoning; in 558 of them (61.4%) the mechanism was unintentional. Males were 55%, and the median age was 2.5 years (IQR: 1.7-4.4). Drugs represented the most frequent group involved (49.6%) followed by household products (37.1%). The main pharmacological group involved was psychotrophic drugs. These were the ones most often associated clinical symptoms, as well as requiring medical treatment and admission. Dose error was more frequent in poisonings due to analgesics than in other groups. Among household products, the main group involved was caustics. Of the 25 detergents involved, 8 were laundry detergent pods. In 17.9% of the cases the product was out of its packaging. Three patients presented caustic esophagitis, while 2 of them developed stenosis. None of the patients died.

Conclusions: Although poisonings are not frequent, they represent a high risk and may cause persistent sequelae. It is important to insist on well-known preventive measures like correct packaging and careful written prescription.

Keywords: Intoxications; Unintentional; Children; Drugs; Household products; Prevention

Introduction

Poisonings are a relevant health problem in children. Although they tend to resolve after light, reversible symptomatology, in some cases they can be dangerous for the patient, produce disabling sequelae and even death [1]. Moreover, especially in some cases, healthcare expenses may be enormous. Identifying risk factors related with unintentional poisonings must be a major target for physicians since this can help us to reduce their incidence and severity.

Suspected toxic exposures represent approximately 0.3% of the visits attended in pediatric emergency departments (PED) of Spanish hospitals according to the data reported by the Intoxication Workgroup of the Spanish Pediatric Emergency Society (SEUP) [3]. This percentage has remained practically invariable in recent years [4,5]. The majority of suspected toxic exposures in pediatric age under 12 years old are unintentional [3]. Drugs and household products are responsible for the majority of them [4,5]. The characteristics of pediatric toxic exposures change continuously, especially considering changes in medical prescriptions [6] and with the appearance of new domestic products available in the market [7,8]. In the specific case of unintentional poisonings due to abuse substances, these change according to the distribution pattern of the substances available [9].

There are general prevention measures and regulations, but they may be not enough. Therefore, it is important to understand the epidemiology of the poisonings in order to create preventive measures for these events.

The objective of this study was to define the epidemiological and clinical characteristics of unintentional poisonings in children, with particular attention on drugs and household products.

What is already known on this subject: Suspected toxic exposures in children are a relevant health problem that represents approximately 0.3% of the visits attended in pediatric emergency departments of Spanish hospitals. Drugs and household products are responsible for the majority of them.

What this study adds: Poisonings represent a high risk for children and may cause persistent sequelae. It is important to insist on well-known preventive measures such as correct packaging of toxic substances and careful written prescription of drugs. Learning about new risk factors related to unintentional poisonings in children may allow for the proposal of better preventive measures in the future.

Materials and Methods

Observational retrospective study performed in a Spanish urban maternity and children's hospital attending a catchment area of 300,000 inhabitants which receives about 100,000 visits at the PED per year. The period of the study was from June 2012 to December 2014 (30
months). We selected all the patients that consulted in the PED with either reason for visit or final diagnosis of toxic contact, after which we included those in whom the mechanism was unintentional. We reviewed the computerized clinical history of the patients under 18 years old.

The epidemiological variables analyzed were age, sex, place of the poisoning, toxicological group involved (drugs, household products, ethanol, illegal drugs, gases, metals, plants, and poisonous animals), number of substances involved in the poisoning, and means of transport to the hospital. In drug exposures we also analyzed the mechanism of intoxication (dose error versus other unintentional mechanisms). In the case of domestic products we recorded whether the substance was in or out of its original container.

The clinical variables were presence and kind of symptoms, general management, complementary tests required, need for admission, transfer to another hospital, and clinical evolution. All the variables were analysed from the global sample and separately for drugs and domestic products, which are the most frequent groups of unintentional poisonings in children reported in the literature [10,11].

Each individual PED visit was used for the demographic description, while each substance involved was a unit of the epidemiological analysis (considering that in some cases there was more than one substance involved).

Data analysis was conducted using SPSS software v 20.0 for Windows (IBM Corp., Armonk, NY). Descriptive statistics were reported in terms of absolute frequencies or rates for categorical variables and in terms of median value with interquartile range (IQR: 25th percentile-75th percentile) for continuous variables. The Kolmogorov-Smirnov test was used for the data distribution study. Statistical comparisons were made using Pearson χ2 test or Fisher’s exact test for categorical variables, and Student’s t-test or Mann-Whitney U test for continuous variables. The confidence interval (CI) was calculated at 95%. P values less than 0.05 were considered significant.

The study was approved by the ethics committee of the hospital. Since the data were extracted from the registry, the information contained in it was anonymous, and as no intervention was performed on patients, informed consent was not required or requested.

Results

During the study period, 908 patients consulted due to suspected poisoning, representing 0.4% of the total number of visits to the PED. In 558 of them (61.4%) the mechanism was unintentional. Products involved are shown in Table 1. In 40 cases (7.2%) there was more than one toxic substance involved. General epidemiological data are compiled in Table 2.

### Table 1: Products involved in the 558 visits to the PED due to unintentional poisonings (n = 602).

| Characteristic | Drugs (n=277) | Household products (n=207) | Others (n=74) | Total (n=558) |
|----------------|--------------|-----------------------------|---------------|---------------|
| Age (years)    | 2.9 (1.9 – 4.6) | 2.0 (1.4 – 3.1) | 3.8 (1.6 – 7.6) | 2.5 (1.6 – 4.4) |
| Male sex       | 162 (58.5) | 109 (52.7) | 36 (48.6) | 307 (55) |
| Place of poisoning |  |  |  |  |
| Parents’ residence | 174 (62.8) | 146 (70.5) | 46 (62.1) | 366 (65.6) |
| Other relatives’ residence | 17 (6.2) | 4 (1.9) | 0 (0.0) | 21 (3.8) |
| Public area    | 1 (0.5) | 3 (1.4) | 11 (14.8) | 15 (2.7) |
| Car            | 1 (0.5) | 2 (1.0) | 4 (5.5) | 7 (1.3) |
| Missing information | 84 (30.3) | 52 (25.1) | 13 (17.6) | 149 (26.7) |
| Means of transport to get to the hospital |  |  |  |  |
| Own vehicle    | 241 (87) | 170 (82.1) | 45 (60.8) | 456 (81.7) |
| Ambulance      | 18 (6.5) | 21 (10.1) | 24 (32.4) | 63 (11.3) |
| Other          | 1 (0.4) | 0 (0.0) | 0 (0.0) | 1 (0.2) |
| Missing information | 17 (6.1) | 16 (7.7) | 5 (6.8) | 38 (6.8) |

### Clinical characteristics

- **Other psychotropics**: 28 (35.8)
- **Other cleaning products**: 25 (11.4)
- **Analgesics**: 69 (22.3)
- **Air fresheners**: 10 (4.6)
- **Paracetamol**: 43 (62.3)
- **Nontoxic products**: 8 (3.7)
- **Ibuprofen**: 14 (20.3)
- **Glues**: 7 (3.2)
- **Other analgesics**: 12 (17.4)
- **Hydrocarbons**: 6 (2.7)
- **Anticatarrhals**: 37 (12.0)
- **Other household products**: 24 (11.0)
- **Cardiovascular drugs**: 26 (8.4)
- **Others**: 74 (12.3)
- **Other drugs**: 99 (32.1)
- **Gases**: 30 (40.5)
- **Antihistamines**: 25 (25.3)
- **Poisonous plants**: 12 (16.2)
- **Oral contraceptives**: 16 (16.2)
- **Homeopathic/natural products**: 8 (10.8)
- **Others**: 58 (58.5)
- **Metals**: 7 (9.5)
- **Poisonous animal bites**: 5 (6.7)
- **Ethanol**: 8 (10.8)
- **Illegal drugs**: 3 (4.1)
- **Others/unknown**: 1 (1.4)
Table 2: Unintentional poisonings in children: Epidemiological characteristics.

There were 309 substances involved in the 277 cases of suspected drug poisonings (Table 1). In 14.1% (39) the mechanism was a dosage error. As shown in Table 2, 59 (21.3%) of the children had clinical signs or symptoms, with neurological alterations the most common (39 - 66.1%), followed by digestive (23 - 39%) and others (3 - 5.1%). Complementary examinations were performed in 108 patients (39.4%) of cases. These were electrocardiogram (69 - 63.9%), basic blood test (48 - 44.4%), urine toxicological test (19 - 17.6%), blood toxicological test (16 - 14.8%), x-ray (6 - 5.6%) and others (11 - 10.2%). One hundred four patients (37.5%) required medical treatment, 97 (93.3%) received activated carbon and 9 (20%) other treatments such as fluid therapy, gastric protection, and/or analgesia. Three patients with domestic product intoxication presented caustic esophagitis and 2 of them developed esophageal stenosis as a consequence of the ingestion.

Table 3: Unintentional intoxications in children by drugs (n=277): Differences between drug groups.

There were 207 cases of suspected unintentional intoxication by domestic products (Table 1). Of all detergents involved, 8 were laundry detergent pods (32%). In 17.9% of cases (37) the product was out of its original packaging. Previous actions were performed at home in 40.1% (83) of cases: giving water (36 - 43.4%), milk (45 - 54.2%), or oil (7 - 8.4%) to the patient, inducing vomiting (17 - 20.5%), and others (4 - 4.8%). Symptoms appeared in 87 cases (42%), with a predominance of digestive (77 - 88.5%) followed by respiratory (7 - 8%), neurological (4 - 4.6%), ocular (4 - 4.6%), skin (3 - 3.4%), and other symptoms (1 - 1.1%). A total of 45 subjects (21.9%) received medical treatment: 2 (4.4%) received activated carbon and 9 (20%) other treatments such as fluid therapy, gastric protection, and/or analgesia. Three patients with domestic product intoxication presented caustic esophagitis and 2 of them developed esophageal stenosis as a consequence of the ingestion.

Discussion

This study notes that the exposure to toxic substances attended in the PED is unintentional in most cases. It affects children younger than 3 years old, without finding statistically significant differences in sex.

Age is an important risk factor to consider in child poisoning. Children able to walk can access many corners and containers in the home. Moreover, they progressively improve their motor skills to open packages and lead objects to mouth for tasting or swallowing, unaware of the potential risk of a poisoning. In addition, they are not always supervised by an adult, which can increase the risk and delay medical attention.

As reported in previous studies, these poisonings generally take place at the parental residence and in almost all cases only one substance is involved [2,6]. Families consult of their own initiative and the symptoms and action taken depend on the toxic substance involved [1,12].

As shown in other studies, the most frequent group in poisonings is drugs, followed by household products [2,3,5,6].

Analyzing the intoxication group by drugs, this study shows an association between the diversity of drug poisoning and the fast distribution and accessibility of drugs, even those dispensed without prescription.

Psychotropic drugs are the substances most frequently involved in unintentional poisonings by drugs in children, surpassing analgesics. We attribute this to the increasing distribution of psychotropic medicine in our environment [13]. This explains why neurological alteration was the most common finding in the physical exploration. Psychotropics are the drugs that imply the greatest toxicity because of their narrow therapeutic range. This may explain why they are the drugs with the highest rate of hospital admission and the ones that entail the greatest medical spending [11]. In consequence, doctors who prescribe psychotropic drugs need to stress to parents the importance of not taking drugs in the presence of children, because they tend to imitate adult behavior, and also of storing drugs in a safe place, out of range of children [12-14].

Analgesics and antipyretics are the second group in frequency, and the ones in which dosage error was most frequently a factor in the mechanism of poisoning. Analgesics are the most frequently used drugs in children and it is known that almost 75% of pediatric patients seen in the PED are already receiving drugs before they arrive at the hospital, in many cases as a result of self-medication (on the part of the parents) [13]. Even so, the percentage of dosage error could be higher considering that many times parents are not aware of the dosage mistake, so they do not consult at the PED. Moreover, analgesics have a wide therapeutic range so they are drugs that less frequently produce...
Conclusions

Although poisonings are not frequent, they represent a high risk for the patient and may cause persistent sequelae. It is important that physicians and authorities insist on well-known preventive measures such as correct packaging of toxic substances; avoid taking drugs in front of children and careful written prescription. To improve in children security, better health education and broadcasting general knowledge of preventive measures is required. Moreover, legislation has to be updated in order to punish those responsible for children poisoning. Learning about new risk factors related to unintentional poisonings in children may allow for the proposal of better preventive measures in the future.

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