

# Hospitalizations for pediatric intoxication: a study from İstanbul

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The objective of this study was to describe the epidemiological features of pediatric patients hospitalized for intoxication. Data were collected from the medical records of children  $\leq 14$  years of age, admitted for intoxication in 2005-2007. Of the 2,989 admissions, 330 (11%) were intoxication cases; 238 (72.1%) were  $< 5$  years old. Pharmaceutical agents were identified in 76.1%. Psychotropics were the most frequently ingested drugs (33.9%), and tricyclic antidepressants were the most common (27.1%). Non-pharmaceutical agents were identified in 79 (23.9%) patients, 54.4% of which were pesticides. The majority of all cases were accidental poisonings (90%), which occurred mostly in children  $< 5$  years old (71.5%), mainly by pharmaceuticals, followed by self-inflicted intoxications (8.2%), which demonstrated the highest ratio in children  $> 10$  years old (6.7%).

Intoxications are important especially among children  $< 5$  years old. Preventive measures such as implementation of the use of child-proof drug prescription bottles and efforts towards public education may reduce the risks.

*Key words:* childhood, intoxication, pediatric emergency units, accidental.

One of the most common medical emergencies in childhood is intoxication<sup>1,2</sup>. The epidemiological properties of childhood intoxication differ country to country. In order to determine the problem and establish preventive measures, special epidemiological surveillance for each country is necessary<sup>3,4</sup>. Intoxication that necessitates hospitalization remains an important source of morbidity in children<sup>5,6</sup>. The kind of agents involved, the type of intoxication and the population at risk may differ by country depending on the lifestyle habits, geographical localization and other factors. Recognition of these data might enhance preventive measures and treatments to reduce morbidity and mortality related to childhood intoxications.

Although there are considerable data in the literature about pediatric poisonings admitted to the Emergency Units (EUs), only a few studies have evaluated childhood intoxications

that result in hospitalization. Due to the paucity of literature on the subject in our region<sup>7-9</sup>, this retrospective study was undertaken to describe the epidemiological features of pediatric patients hospitalized for intoxication and to determine the incidence of hospitalization, the principal agents of poisoning, hospital length of stay (LOS), and outcome.

## Material and Methods

In this retrospective study, a database of all admissions to our department was used. To review the cases hospitalized for intoxication, the data were extracted from the medical records of children  $\leq 14$  years old, who were admitted to the medical ward of the Department of Pediatrics I through the EU between January 2005 and December 2007. Subjects with a primary diagnosis of intoxication were included in the study. The classification of agents as pharmaceuticals and non-pharmaceuticals was

done according to the ICD-10 (International Classification of Diseases, Tenth Revision). We excluded all the newborns and all intoxications with an adverse reaction to avoid cases where the intoxication was either iatrogenic or had occurred during hospitalization. Cases with a diagnosis of food poisoning were not included, with the exception of plant and mushroom poisonings.

Information was recorded as demographic data, the circumstances of ingestion (the mode and the place of ingestion, time lapsed until seeking medical attention), the agents ingested, and the hospital data (the duration of observation in the emergency room and hospital LOS, the necessity of Pediatric Intensive Care, outcome). The monthly, seasonal and yearly variations in occurrence were also noted. Patients without an identified cause were excluded from the study. Intoxications were grouped as pharmaceutical agents and non-pharmaceutical agents. Intoxications were further grouped into three types as accidental, self-inflicted and therapeutic error. This study was approved by the Institutional Ethics Committee.

Statistical calculations were performed using the SPSS 13.0 program. Besides standard descriptive calculations (frequencies, mean and standard deviation), the chi-square test was performed for evaluation of qualitative data. Statistical significance level was established as  $p < 0.05$ .

## Results

Of the 2,989 admissions between January 1, 2005 and December 31, 2007, 330 (11%) were identified as cases of primary intoxication. There were 184 (55.8%) females and 146 (44.2%) males with a female/male ratio (F/M) of 1.26. The mean age was  $4.57 \pm 3.52$  years (range: 6 months-14 years).

Two hundred thirty-eight children constituting 72.1% of all the patients were <5 years old, 55 (16.7%) were 5-10 years old and 37 (11.2%) were >10 years. Of the <5-year-olds, 29 (8.8%) children were <12 months. Among all the intoxication cases admitted to our department, the highest number of hospitalized patients due to intoxication were in the group aged <5 years ( $p = 0.0001$ ).

Among the children aged 0-5 years, no gender predominance was found (F/M=1); however,

among the children in the age groups of 5-10 years and >10 years, there was a female predominance, with F/M ratios of 2.2 (38/17) and 2.7 (27/10), respectively.

Pharmaceutical agents were identified in 76.1% (251/330) of the intoxications (Table I). Psychotropic agents were the most commonly ingested drugs (33.9%), among which the tricyclic antidepressants accounted for the highest percentage (27.1%). The second most common cause of intoxication with pharmaceutical agents was multidrug ingestion (14.3%) followed by analgesic agents (9.6%), among which acetaminophen was the most common (4%). The remaining causes of pharmaceutical agent intoxications are presented in Table I. Non-pharmaceutical agents were identified in 79 (23.9%) patients. Among this group, the most common agents were pesticides (54.4%), followed by mushroom (27.8%) and alcohol (7.6%) poisonings.

The majority of all cases were due to accidental poisonings (90%), which occurred mostly in children <5 years old (71.5%,  $n = 236$ ), mainly by pharmaceutical agents, followed by self-inflicted intoxications (8.2%), which had the highest ratio in children >10 years old (6.7%,  $n = 22$ ). Among all the poisonings, 6 (1.8%) were due to therapeutic error, mostly in those aged 1-10 years (Table II). In those <12 months, all the poisonings were accidental (8.5%,  $n = 28$ ). In those aged 1-5 years, accidental poisonings (208/210; 99%) and in those >10 years self-inflicted intoxications (22/37; 59.5%) carried the highest ratios, as expected (Table II).

Antidepressants and multidrugs were more common in self-inflicted intoxications compared with unintentional intoxications. All of the intoxications with non-pharmaceutical agents were accidental (Table I). Intoxication with a single agent was found in 297 (90%) patients, whereas ingestion of more than one agent was reported in 33 (10%) cases. The most common route of poisoning was oral, in 317 (96.1%), followed by inhaler in 11 (3.3%) and ophthalmic in 2 (0.6%) patients. Indoor poisoning was determined in 317 (96.1%) patients and outdoor poisoning in 11 (3.3%).

The seasonal distribution pattern was as follows: 71 (21.5%) cases were admitted

Table I. Distribution of Cases According to Type of Intoxications

	Accidental poisonings	Self-inflicted poisonings	Therapeutic error	Total n (%)	% of all patients (n=330)
Pharmaceutics					
Analgesics				24 (9.6)	(7.2)
• paracetamol	10	0	0	10 (4)	(3)
• acetyl salicylic acid	8	1	0	9 (3.6)	(2.7)
• other NSAI	5	0	0	5 (2)	(1.5)
Sedative-hypnotic, antiparkinsonians	17	0	2	19 (7.5)	(5.8)
Psychotropic drugs				85 (33.9)	(25.7)
• tricyclic and tetracyclic antidepressants	58	9	1	68 (27.1)	(20.6)
• other antidepressants	1	0	0	1 (0.4)	(0.3)
• neuroleptics and others	14	1	1	16 (6.4)	(4.8)
Autonomic nervous system drugs	6	2	0	8 (3.2)	(2.4)
Systemic and hematologic drugs	14	2	0	16 (6.3)	(4.8)
Cardiovascular drugs	15	0	0	15 (6)	(4.5)
Gastrointestinal drugs	4	0	0	4 (1.6)	(1.2)
Smooth and skeletal muscle drugs	13	1	0	14 (5.6)	(4.2)
• antiasthmatics	5	1	0	6 (2.4)	(1.8)
• cold medications	3	0	0	3 (1.2)	(0.9)
• antitussives and expectorants	3	0	0	3 (1.2)	(0.9)
• other	2	0	0	2 (0.8)	(0.6)
Topical medications	5	0	2	7 (2.8)	(2.1)
Hormonal drugs	10	2	0	12 (4.8)	(3.6)
Antibiotics	1	0	0	1 (0.4)	(0.3)
Multidrug	28	8	0	36 (14.3)	(10.9)
Unidentified drugs	10	0	0	10 (4)	(3)
Total	218	27	6	251 (100)	(76.1)
Non-pharmaceutics					
Pesticides	43	0	0	43 (54.4)	(13)
• organophosphates and insecticides	6	0	0	6 (7.6)	(1.8)
• other	37	0	0	37 (46.8)	(11.2)
Plant and mushroom poisonings	22	0	0	22 (27.8)	(6.7)
Alcohol	6	0	0	6 (7.6)	(1.8)
Organic solvents	5	0	0	5 (6.3)	(1.5)
Corrosives	1	0	0	1 (1.3)	(0.3)
Detergents	1	0	0	1 (1.3)	(0.3)
Metals	1	0	0	1 (1.3)	(0.3)
Total	79	0	0	79	(23.9)

NSAI: Non-steroidal antiinflammatory.

during winter, 67 (20.3%) during spring, 84 (25.5%) during summer, and 108 (32.7%) during autumn. There was no significant difference regarding seasonal distribution of hospitalization of pediatric intoxication cases ( $p=0.213$ ).

The mean duration of time from ingestion to admission to the Pediatric Emergency Unit (PEU) was  $3.72 \pm 5.56$  hours (range: 0-48 hours). The mean duration of observation in the PEU was  $1.18 \pm 0.63$  hours. Of the patients, 103 (31.2%) received intervention before

admission to the PEU, while 227 (68.8%) patients did not. Among the cases who received intervention before admission, 95 (92.2%) were treated at a medical center, whereas 8 (7.8%) received the first intervention at home.

Among the 330 hospitalized patients, 114 (34.5%) were symptomatic, and the remaining 216 (65.5%) were admitted to the PEU with only drug ingestion history without any symptoms. The results of the physical examination were found to be normal in 292 (88.5%) patients, whereas in 38 (11.5%)

**Table II.** Distribution of Patients (n) According to the Types of Intoxications in Different Age Groups

Age (yrs)	Accidental n=297 (90%)		Self-inflicted n=27 (8.2%)		Therapeutic error n=6 (1.8%)	
	Pharmaceutic	Non-pharmaceutic	Pharmaceutic	Non-pharmaceutic	Pharmaceutic	Non-pharmaceutic
<1	16	12	0	0	0	0
1-5	162	46	0	0	2	0
5-10	31	15	4	1	4	0
>10	10	5	22	0	0	0
Total	219	78	26	1	6	0

patients, abnormal physical findings were recorded.

After hospitalization, only 32 (9.7%) of the patients received specific treatment besides symptomatic treatment. In 298 (90.3%) patients, only symptomatic treatment was applied. The mean hospital LOS was  $2.77 \pm 1.72$  days (median: 2 days). Among the hospitalized patients, 19 (5.8%) were transferred to the Intensive Care Unit (ICU), and the mean duration of stay in the ICU was  $2.04 \pm 1.39$  days.

During the study period, two patients died due to acute poisoning. The mortality rate was 0.6%. One case was a 12-year-old girl with mushroom poisoning; the other was an 8-year-old boy with multidrug ingestion for self-inflicted poisoning.

### Discussion

We found that intoxications represented 11% of the total pediatric patients hospitalized in our department during the study period. In the study of Mintegi et al.<sup>10</sup>, childhood intoxications accounted for 15.2% of their hospitalized children. Our results differ from those of Gauvin et al.<sup>5</sup>, who reported that the average incidence of hospitalization for intoxication in children was 45 per 100,000 children per year in Washington, and intoxication accounted for 0.06% of all pediatric hospitalizations. These different results may be explained by the differences among the study populations, regional differences in health care and the extent of the medical facilities.

In this study, children <5 years old constituted the majority (72.1%) of the hospitalizations. Our findings agree with the prior reports. Shotar<sup>11</sup> reported that, among the children admitted due to drug poisoning, the majority

(89.7%) were <6 years old. In the study of Mintegi et al.<sup>10</sup>, 67% of children were <4 years old, 57% of whom were boys. In the study of Andiran et al.<sup>3</sup>, among pediatric poisoning cases, 63.6% were <5 years old; among those <10 years old, 52.3% of those intoxicated were boys, while in those >10 years old, more girls (79%) were involved. Similar to the previous data about gender predominance, we found that while among the children aged 0-5 years, the male to female ratio was 1, female predominance was found among the children aged  $\geq 5$  years.

As in the literature, pharmaceuticals were the most common agents in childhood poisonings in our study. This finding parallels other studies such as those of Gauvin et al.<sup>5</sup> (80%), Andiran et al.<sup>3</sup> (57.7%) and Izuora et al.<sup>12</sup> (64.3%). Furthermore, Andiran et al.<sup>3</sup> and Gauvin et al.<sup>5</sup> reported that analgesics were the most common agents, followed by antidepressants. Andiran et al.<sup>3</sup> pointed out that multiple drug ingestion and tricyclic antidepressant ingestion were in significant increase in terms of frequency. However, in contrast to other reports, Lacroix et al.<sup>13</sup> reported in their study that tricyclic antidepressants were the leading cause (22%) of pediatric hospitalizations due to poisonings. Similarly, according to our data, psychotropic drugs, especially tricyclic antidepressants, were the most common drugs (27.1%). Our hospital is located in the suburbs of İstanbul, where the residents can be described as belonging to a lower socioeconomic stratum. This finding in our study may be explained by the widespread use of various antidepressants without prescription, some of which are quite inexpensive and can be easily obtained.

In the study of Gauvin et al.<sup>5</sup>, the leading non-pharmaceutical agents were alcohol (6%), street

drugs (4%) and fumes, which were identified in 22% of patients with intoxications. Al Hazmi<sup>14</sup> from Saudi Arabia reported that hydrocarbon ingestion was the leading cause of accidental poisoning in children, followed by drugs, household chemicals and pesticides. The finding in our study that non-pharmaceutical agents were identified in 24% of the patients, of which the most common agents were pesticides followed by mushroom poisonings, was striking. These findings may show that non-pharmaceutical agents also play an important role in childhood poisonings, and the type of the involved agent may reflect the socioeconomic, cultural and environmental features of each population.

In this study, the majority of cases were due to accidental poisonings that occurred mostly in children <5 years old, mainly by pharmaceutical agents, followed by self-inflicted intoxications, which had the highest ratio in children aged >10 years. This pattern is consistent with previous reports<sup>15,16</sup>. In the study of Pillai et al.<sup>15</sup>, the majority of poisoning cases were due to accidents (84.6%) and suicide (11.2%)<sup>15</sup>. Andiran et al.<sup>3</sup> reported that, although accidental poisonings were the leading cause, the increase in the incidence of self-poisonings was remarkable. Our findings are consistent with the results of Al Hazmi<sup>14</sup>, who found that the highest percentage of accidental poisoning was within the 2-5 years of age group (61%).

Andiran et al.<sup>3</sup> reported that ingestion of the poison was the most common route of childhood poisonings and most were ingested inside the house. Similarly, our results demonstrated that the most common route of poisoning was oral and the majority of the poisonings took place inside the house. It should be emphasized that drugs, pesticides and household chemicals should never be within easy reach of children, especially those <5 years old, at home. In addition, 11 of our patients (3.3%) presented with intoxication by the inhaler route, also inside the house. They all had carbon monoxide poisoning, which took place due to the widespread use of coal stoves around the region where the hospital is located.

Al Hazmi<sup>14</sup> reported that children ingesting medications generally experienced only mild symptoms and therefore presented late for

medical attention, in most cases more than two hours after ingestion. Our findings of a mean duration of time from ingestion to hospital admission of  $3.72 \pm 5.56$  hours and of the majority of patients being asymptomatic (65.5%) were consistent with previous reports<sup>12</sup>. Andiran et al.<sup>3</sup> pointed out that in most of their cases, hospital treatment was non-specific, including general measures of decontamination and supportive-symptomatic therapy. Similar to the previous reports, the majority of patients (90%) in our study received only symptomatic treatment.

The data about the LOS of pediatric poisoning cases differ widely. In this study, the median LOS was 2 days. Our results contrast with those of Gauvin et al.<sup>5</sup> and Oguche et al.<sup>17</sup> with a median LOS of 1 and 0.66 days, respectively. Al Hazmi<sup>14</sup> found that, among children with accidental drug ingestion, the majority stayed less than 48 hours and all were discharged within 72 hours. Although treatment policies for childhood poisonings are universally similar, the diverse types of agents involved and the institutional differences in medical facilities in each study population could account for this difference.

During our study period, 5.8% of the hospitalized patients were transferred to the ICU. In the study of Mintegi et al.<sup>10</sup>, among hospitalized children due to intoxications, 1.5% were admitted to the ICU. Similarly, Kohli et al.<sup>18</sup> from India reported that 2.7% of pediatric poisoning cases were admitted to the Pediatric Intensive Care Unit (PICU). These variations may reflect the differences among the agents of poisonings, availability of PICUs and different departmental referral strategies to the PICU.

Gauvin et al.<sup>5</sup> reported a mortality rate of 0.2% among hospitalized pediatric poisoning cases. Andiran et al.<sup>3</sup> from Turkey reported a significant decrease in mortality in pediatric poisoning cases, from 7.6% to 0.4%, over 20 years. Similar to the previous data, we found a low mortality rate of 0.6%. The early awareness of poisoning and implementation of appropriate therapeutic measures seem to contribute to a very low mortality rate.

In conclusion, acute intoxications, particularly with pharmaceutical agents (mostly psychotropics and analgesics) continue to be an important cause of childhood hospitalization in İstanbul.

This observation points out the urgency of the promotion and implementation of the use of child-proof drug prescription bottles, in order to eliminate or reduce accidental childhood drug poisoning. Our data also show that non-pharmaceutic poisonings like pesticides and mushroom poisonings should still be an issue of concern. Parental education about the prevention of childhood poisoning at home remains a major issue, especially with regards to keeping everyday medications and household products out of the children's reach. The use of child-resistant containers for medications or household products and use of locked cabinets would help in the prevention efforts. The habit of picking up wild mushrooms should be discouraged and the families should be educated about the possible fatality of wild mushroom ingestion. We further encourage the implementation of various awareness programs regarding the use of coal stoves, pointing out their potential dangers, such as carbon monoxide poisonings.

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