

Acute ingestion poisoning in children: Insights from a 15-month analysis in pediatric emergency care

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Abstract. *Background and aim:* Acute pediatric poisonings remain a major global health problem. They constitute a frequent reason for emergency medical consultations and are among the leading causes of death and morbidity worldwide. This study aims to evaluate the extent of accidental and suicidal intoxication by ingestion in children and to describe its epidemiologic and clinical characteristics. *Methods:* Our study was conducted at the pediatric emergency department of the Children's Hospital in Rabat. It involved a retrospective descriptive analysis spanning 15 months, from October 1, 2020, to December 31, 2021. We included all acute intoxications in children aged 1 month to 18 years due to ingestion of toxic substances such as medications, caustic products, pesticides, cannabis derivatives, and plants. *Results:* The study included 221 cases of poisoned children, the M/F sex ratio was 1.12. Accidental poisoning was predominant (86%) and the severity of intoxication was mostly minor (42.5%). Baby walkers were the most affected (56.3%). Drug poisonings were prevalent (46%) dominated by nervous system medications, followed by caustic substance exposures (31.7%). Pesticide intoxications accounted for 15%, while cannabis derivatives and plant ingestions represented 4.5% and 2.8%, respectively. The clinical symptoms varied significantly based on the responsible toxic agent. *Conclusions:* Acute pediatric poisoning is a critical health challenge, especially in children. Most intoxications occur accidentally, with medications being the primary implicated toxic agents. In pediatrics, the consequences of poisoning are mostly benign, However, this apparent harmlessness should not lead us to ignore prophylactic measures that are widely effective. (www.actabiomedica.it)

Key words: acute ingestion, poisoning children, retrospective analysis, emergency, pediatric care, patterns, accidental, intentional, toxicology, outcomes

Introduction

Acute poisoning is a critical and growing public health problem worldwide, especially in children (1) and is a common reason for emergency department consultation and admission to the pediatric intensive care unit (2). Poisoning by ingestion occupies, after trauma, the 2nd place of accidents in the home life of children (3). Poisoning is defined as the occurrence of a toxic effect in humans following a single or repeated exposure to a mixture or a natural or synthetic substance that is commercially available or present in

the environment (4). The annual report of the American Association of Poison Control Centers referred to more than two million calls for human exposure to toxic substances in 2017, with more than 50% involving acute poisonings in children under the age of 13 (5). The World Health Organization (WHO) estimated that 300,000 people died annually from poisoning in 2013 (6), Most of these deaths occur in low- and middle-income countries (7). More than a third of poisonings occur before the age of 15, and young children are frequently victims (5). Poisoning in children is on the rise in Morocco, since 2009,

there has been a significant increase in reported cases of poisoning, with the incidence of cases rising from 23.1 per 100,000 inhabitants in 2010 to 28.8 per 100,000 inhabitants in 2019, the overall mortality rate in 2019 was 0.46% and is dependent on both age and, in particular, the substances involved (8). This study aims to evaluate the extent of accidental and suicidal intoxication by ingestion in children and to describe its epidemiologic and clinical characteristics.

Patients and Methods

Type, location and period of the study

This is a retrospective and descriptive study conducted in the pediatric medical emergency department of the Rabat Children's Hospital. It covered a period of 15 months, from October 1, 2020 to December 31, 2021.

Inclusion criteria

The inclusion criteria were all cases of acute accidental and intentional poisoning in children aged 1 month to 18 years admitted to the pediatric emergency department. Our study focused on ingestion of caustic products, drug poisoning, pesticides, cannabis derivatives and plant poisoning.

Exclusion criteria

We exclude the following from our series: medication errors, unknown poisoning, food poisoning, ingestion of foreign bodies, irritations, and scorpion bites.

Methodology

A descriptive analysis was carried out using the hospital registers, focusing on the socio-demographic characteristics of the victims (age, gender...etc.), the characteristics of the toxicant (chemical class and type of use) and the specifics of the poisoning (route, location, circumstances and clinical symptoms). The INTOX classification was used for the age group (9). The severity of the poisoning was assessed using the Poisoning Severity Score (PSS).

Statistical analysis

Quantitative variables were expressed as medians and interquartile ranges, and qualitative variables as counts and percentages. Cross-tabulations between different qualitative parameters were performed using the Chi 2 test and Fisher's exact test. A p-value < 0.05 was considered statistically significant.

Results

Epidemiological and socio-demographic aspects

Table 1 illustrates the collected results, 221 children were received in the emergency department due to ingestion of toxic products out of a total of 40441 admissions, corresponding to a hospital incidence of 0.54%, with a male predominance of 52.9% (N = 117) (P = 0.006) and a M/F sex ratio of 1.12: 1. The median age was 3 [2; 5] years, with extremes ranging from 1 month to 18 years. The class of children was the most affected 71% (N=157) (P<0.001) and the baby walker category alone accounted for 55.2% (N=122). The duration between product ingestion and medical consultation ranged from 15 minutes to 3 weeks with a median of 2.5 [1; 5] hours.

Specific data by type of intoxication

As described in Table 2, intoxication was accidental in 86% (N=190). Drug ingestion was the most

Table 1. Population Characteristics.

Characteristics	Values
Age (years) #	3 [2 ; 5]
Gender[§]	221 (100%)
Male	117 (52.9)
Female	104 (47.1)
Age class §	
Infant	29 (14.6)
Baby walker	122 (56.3)
Child	35 (13.1)
Teenager	35 (16.1)
Consultation time (hours)#	2.5 [1 ; 5]

Results expressed as median and interquartile range; § Results expressed in numbers (percentage)

Table 2. Distribution of acute poisonings in children according to the nature, causes and circumstances of the poisoning.

Characteristics of poisoning	Values (N = 221)
Accidental poisoning[§]	190 (86)
Intentional poisoning[§]	31 (14)
Accidental drug poisoning[§]	77 (34.8)
Neuroleptic [#]	11
Analgesic [#]	8
Non-steroidal anti-inflammatory drug [#]	7
Contraceptives [#]	7
Antidepressants [#]	6
Antiparkinsonian [#]	4
Antiepileptic [#]	3
Antiparasitic [#]	3
Anxiolytic [#]	2
Iron [#]	2
Antibiotic [#]	2
Antispasmodic [#]	2
Others ^{1#}	20
Intentional drug poisoning[§]	25 (11.3)
Anxiolytic [#]	6
Antidepressants [#]	4
Non-steroidal anti-inflammatory drug [#]	3
Iron [#]	3
Antispasmodic [#]	3
Antiepileptic [#]	2
Antihistamine [#]	2
Accidental caustic product poisoning[§]	70 (31.7)
Paint essence [#]	23
Bleach [#]	18
Hydrocarbon [#]	10
Henna Thinner [#]	9
Cleaner [#]	3
Others ^{2#}	7
Accidental pesticides poisoning[§]	29 (13.1)
Raticides [#]	16
Organophosphates [#]	13
Intentional Pesticides poisoning[§]	4 (1.8)
Raticides [#]	2
Organophosphates [#]	2
Accidental Cannabis derivatives poisoning[§]	10 (4.5)

Characteristics of poisoning	Values (N = 221)
Accidental plant poisoning[§]	5 (2.3)
<i>Juniperus oxycedrus</i> oil [#]	2
<i>Atractylis gummifera</i> [#]	1
<i>Lawsonia inermis</i> [#]	1
<i>Ricinus Communis</i> oil [#]	1
Intentional plant poisoning[§]	1 (0.5)
<i>Atractylis gummifera</i> [#]	1

[§] Results expressed in numbers (percentage); [#] Results expressed in numbers; Others^{1#}: Levodopa, muscle relaxant, homeopathy, cough suppressant, Antidiarrheal, Orexigenic...; Others^{2#}: Unblocking base, hydrogen peroxide, etc.

common 46% (N=102) (P <0.001) followed by ingestion of caustic products 31.7% (N=70) and pesticides 15% (N=33).

Assessment of clinical severity depending on the nature of the poisoning

As illustrated in Table 3, the severity of poisoning was mostly low in 42.5% of cases (N=94) (P <0.001).

Drug ingestion

According to Tables 2 and 4, the group of children was the most affected 65.6% (N=67) (P <0.001), the poisoning was accidental in 75.4% (N=77) of cases, but 100% of suicide attempts were exclusively among adolescents (N=25). Among the medications, those of the nervous system dominated (N=38) (P <0.001), especially neuroleptics (N=11) and antidepressants (N=10). Digestive symptoms accounted for 36.5% (N=37), dominated by vomiting (N=23) (P=0.02), followed by neurological disorders 26.5% (N=27), especially somnolence (N=9) (P=0.03) as mentioned in Table 5.

Caustic ingestion

Paint essence was the most incriminated caustic product with 33% (N=23) of the poisonings (P <0.001), followed by bleach 26% (n=18), with

Table 3. Assessment of clinical severity depending on the nature of the poisoning

	Poisoning Severity Score				
	None	Minor	Moderate	Severe	Total
Accidental drug poisoning	40	26	9	2	77
Intentional drug poisoning	10	5	4	6	25
Accidental pesticides poisoning	12	15	0	2	29
Intentional Pesticides poisoning	1	1	0	2	4
Accidental plant poisoning	3	2	0	0	5
Intentional plant poisoning	1	0	0	0	1
Accidental caustic product poisoning	14	42	12	2	70
Accidental Cannabis derivatives poisoning	0	3	4	3	10
Total	81	94	29	17	221

Results expressed in numbers

Table 4. Distribution of acute poisonings in children according to age groups (INTOX classification)

INTOX AGE	Accidental Drug Poisoning	Intentional Drug Poisoning	Accidental Pesticides Poisoning	Intentional Pesticides Poisoning	Accidental Plant Poisoning	Intentional Plant Poisoning	Accidental Caustic Product Poisoning	Accidental Cannabis Derivatives Poisoning	Total
Infant	10	0	5	0	1	0	9	4	29
Baby walker	47	0	16	0	3	0	54	2	122
Child	20	0	6	0	1	0	6	2	35
Teenager	0	25	2	4	0	1	1	2	35
Total	77	25	29	4	5	1	70	10	221

Results expressed in numbers

children predominating 86% (n=60) (P <0.001), as summarized in Tables 2 and 4. According to Table 5, only 7% (N=5) of patients were asymptomatic and 53% (N=37) had digestive symptoms in the form of vomiting.

Pesticide ingestion

We recorded 33 cases of poisoning, 15 cases by organophosphates and 18 cases by rodenticides, with children predominating at 67% (N=22) (P <0.001). All poisonings were unintentional, except those involving adolescents, which were all suicide attempts, as indicated in Tables 2 and 4. 61% (N=20) had digestive symptoms such as vomiting, while only 12% (N=4) of patients were asymptomatic according to Table 5.

Cannabis derivative poisoning

As summarized in Tables 4 and 5, all reported cases of poisoning were unintentional. The 10 reported cases reported slight preponderance in favor of infants (N=4) (P<0.001). Regarding symptomatology, all cases developed neurological disorders manifesting as somnolence, behavioral disturbances, and impaired consciousness.

Plant ingestion

We collected 6 cases of poisoning; they were all accidental except one case. Children were most frequently affected (N=4) (P<0.001). The responsible plants were *Atractylis gummifera* and *Juniperus oxycedrus*

Table 5. Clinical symptoms according to the nature of the poisonings

Symptoms	Drugs	Caustic products	Pesticides	Cannabis derivatives	Plants
Digestive symptoms[§]	37 (36.5)	37 (53)	20 (61)	0	2 (33.3)
Vomiting [#]	23	30	11	0	1
Abdominal pain [#]	9	7	6	0	0
Diarrhea [#]	5	0	3	0	1
Neurological symptoms[§]	27 (26.5)	0	6 (18)	10 (100)	2 (33.3)
Somnolence [#]	9	0	2	4	0
Hypotonia [#]	7	0	1	2	0
Hallucinations [#]	5	0	1	0	0
Others [#]	6	0	2	4	2
Cutaneo-mucosal symptoms[§]	5 (5)	15 (21.5)	0	0	0
Skin lesions [#]	5	15	0	0	0
Cardiac symptoms[§]	4 (4)	0	3 (9)	3 (30)	0
Rhythm disorders [#]	4	0	3	3	0
Respiratory symptoms[§]	2 (2)	13 (18.5)	0	0	0
Cough [#]	2	13	0	0	0
Without symptoms[§]	27 (26)	5 (7)	4 (12)	0	2 (33.3)

[§]Results expressed in numbers (percentage); [#]Results expressed in numbers; Others[#]: Behavioral disorders, Consciousness disorder

oil with 2 cases each. The main symptomatology was characterized by digestive problems such as vomiting in 34% (N=2), as shown in Tables 2, 4 and 5.

Management and evolution of poisoning

95% (N=211) of patients were hospitalized for monitoring and appropriate medical care. 66% (N=139) required many check-ups: 37% (N=51) radiology examinations (63% chest x-ray, 37% Electrocardiogram and CT scan), 22.5% (N=31) biological and toxicological analysis, 13 % (N=18) antidotes administration (40% N acetyl cysteine, 28% atropine, 16% activated carbon, 11% vitamin K, 5% pralidoxime), 8% (N=11) symptomatic treatment (100% of patients received filling and hydration with electrolytes and gastric protection drug), 5% (N=7) gastric lavage, 15% (N=21) needed complementary examinations, for the remaining cases 34% (N=72) just a supervision was required. Evolution was favourable in 98 %. However, 2 cases of death were recorded, and 2 patients left the hospital against medical advice.

Discussion

Our study included 221 cases of poisoning from October 1, 2020 to December 31, 2021. National and international statistics reported higher numbers. The Moroccan Center for Poison Control and Pharmacovigilance (CAPM) received 3411 cases of poisoning in children in 2020, with 721 cases recorded in the Rabat region (8). France registered 19,039 cases of poisoning in 2011 and in Australia 2015 census recorded 164,363 cases, and statistics from the Swedish Center for Poison Control are consistent with those cited (10). This considerable discrepancy in prevalence at a national level is due to the under-reporting of cases by Moroccan hospitals, so public awareness campaigns to curb the development of this menacing scourge remain essential. The preponderance of cases in the group of baby walkers is classic in the literature, which is explained by the fact that the child has acquired a certain mobility at this age that allows him to satisfy his curiosity by exploring the world around him and also by putting everything in his mouth. In adolescents,

especially at the beginning of the phase, it is a self-harm and destruction as a result of the lack or loss of resources in the face of the various problems they encounter. At national level, on the other hand, the average age is around the class of adolescents and adults, baby walkers are in third place (11). In some countries, such as Tunisia and Australia, boys predominate, which is explained by the active and turbulent side of boys (10). The consultation time generally registered in the available literature is also about 2 hours on average, corresponding to our series of studies (9,11).

Specific data by type of intoxication

We recorded the same order of classification for intoxications at the national level (12), which is consistent with data from developed countries, whose drugs and household products are the most exposures observed in paediatrics (13,14). On the other hand, in other developing countries, non-pharmaceutical products, mainly pesticides and caustic products, are the most common among the youngest children, while drug are the most prevalent in adolescents (9).

Drug poisoning

According to the Celegen report in 2021, drug poisoning was responsible at 86.2% (1), similar figures can be found in Australia in the study by Lee and al (15). In our series, drug poisoning accounts for 46.1%; this figure has doubled compared to the results of the CAPM analysis published in 2009, which indicates a significant increase in drug poisoning, representing 21.9% of all cases recorded during this period (9). There was a male predominance (52.9% versus 47.1%), consistent with the literature data (14,16,17). In our series, accidental ingestions (86%) predominated over voluntary poisoning, which is in line with other studies revealing more than 80% of cases (13,16), which is explained by the predominance of the age group of baby walkers in our series. Regarding the drugs involved, the international studies illustrated a similar ranking as in our study (18). Thus, with Lee and al in Taiwan and Azab in Egypt, we reported that psychotropic drugs rank first, followed by analgesics (15,16). The data collected by the CAPM and the French, Belgian and Indian Poison Control Center confirm this distribution (13,19). However, it is

the antidepressants that take the lead in the category of psychotropic drugs, as reported by Ozdemir and al in Turkey (20). In Celegen's report, analgesics such as paracetamol occupy first place, followed by antidepressants (1). The importance of psychotropic intoxications in our series can be explained by the change of chronic diseases, including mental health, which is taking an increasingly important place in our society, as well as the fact that our study was conducted during the COVID pandemic. Patients with symptoms present with a polymorphic clinical symptom dominated by digestive symptoms, which are the first means of response to xenobiotic poisoning. However, almost the same disorders as those mentioned in our analysis occur, varying degrees depending on which toxin is involved (6,15,21).

Caustic poisoning

They are very frequently responsible for serious exposures with disabling and severe consequences and account for more than 34.7% of the total annual poisoning rate at national and global levels (22,23), which is consistent with our case series (31.7%). In addition, the CAPM recorded 6336 poisonings between 1980 and 2011, 88.5% of which were due to caustic products (22) and in 2020, the same center received 506 cases of poisoning by household products (8). The data from other studies are partially coherent with our results, which illustrate a predominance of baby walkers class (35%) (21,22). In Morocco, bleach is one of the most common causes of poisoning in children (60%), according to the Moroccan General Toxicovigilance report for 2020 (8) compared to the 26% recorded in our study after the paint essence, which has 33%, this can be explained by the autonomy that families have acquired during the COVID pandemic for DIY and painting stains. The same symptoms are observed in almost all patients worldwide, with a degree of severity that depends on the exposure stage and mainly concerns digestive signs of the bucco-pharyngeal type (23), as our results reported.

Pesticide poisoning

Nationally, pesticide exposure ranks second in childhood poisoning according to CAPM reports (13.4%) in 2020, consistent with our series (14.9%) (8). In developing countries such as India, Sri Lanka

and Morocco, there were more cases of poisoning in baby walkers 80% (26). Between 2008 and 2016, the CAPM recorded an average of 21.7 years \pm 13.6 years, which puts it on a par with developed countries, where the average age is similar. All the poisonings recorded in our series were unintentional, except those involving adolescents, we were only able to incriminate organophosphates (46%) and raticides (54%), these results are similar to those of most available scientific journals (24). This high prevalence rate can be explained by non-compliance with legislation and household availability. The symptoms listed in the various scientific journals mainly included neurological, hepatodigestive and cardiovascular disorders. This is illustrated by the review by Achour et al. in which most of the clinical symptoms of intoxicants were gastrointestinal disorders, followed by respiratory symptoms in line with the symptomatology reported by Abidli et al (24,25).

Cannabis derivative poisoning

In a study conducted in the pediatric emergency department of a hospital in Ottawa, there were 37 cases of children under the age of 7 who were intoxicated between 2018 and 2020 (26) and a hospitalization rate that has risen from 120 children between 2015 and 2018 to 461 between 2018 and 2021 (27). In the United States, a retrospective review of calls to poison control centers registered that 9,000 illicit drugs were taken by children under the age of 10 between 2006 and 2016, with marijuana being the leading cause (28). The CAPM data between 1980 and 2008 also revealed 1795 drug poisonings, 23.5% of the cases attributable to cannabis behind Maajoune (a local mixture) (9). The adolescent class is prevalent in all available literature with more than 80% of cannabis ingestions following intentional exposures leading to overdose (4). In contrast to our study, which found a slight preponderance in favour of young children and the accidental nature of all reported cases. The symptoms are mainly neuropsychic: euphoria, followed by somnolence or complete sedation, hallucinations, as described in our study (29).

Plant ingestion

In the National Poison Data System (NPDS) report for 2016, there was 2.7% plant exposure in the

United States (30). In 2020, the CAPM recorded 126 cases of plant poisoning, making them the eighth most common cause of poisoning in Morocco (8). In our series, children were most exposed to accidents from ingesting poisonous plants because they are curious and confuse their plants with the plants normally found in the kitchen. All poisonings recorded in our study were accidental, except one case that occurred in an adolescent. This is consistent with the results of international studies which register 90% accidental ingestions and attempted suicide are more common in adults, the plants responsible for the poisonings in our case series were: *Juniperus oxycedrus oil*, *Atractylis gummifera*, *Ricinus Communis* oil and *Lawsonia inermis*, in fact, *Atractylis gummifera* and *Datura stramonium* are the plants most frequently observed in poisoning in children (31,32). The clinical symptoms observed in our study follow the same dynamics in the different countries, although each plant produces different symptoms. The majority of patients had essentially developed neurological signs (deep coma, convulsions) and digestive signs (diarrhea, vomiting, abdominal pain) when exposed to plants (9).

Management and evolution of poisoning

In our series, patients received symptomatic treatment on admission to neutralize the toxic agent, and a check up to assess vital functions and neurological status. In general, intoxicated people benefit on average from 7 hours of observation. Cases of long-term hospitalization are rarely observed, although this duration varies greatly according to age, it follows an ascending path. As the majority of these are benign exposures, the evolution noted on a transnational and national level is symbiotic with that of our analysis. However, the mortality rate remains much higher in the available literature than that observed above (1,15).

Conclusion

Acute poisoning in children is a critical health problem worldwide. As our series of studies also described, the rates recorded in different countries illustrate a colossal incidence of this scourge. No age group is spared, especially children under the age of 5, who are the most affected worldwide. Drugs poisoning is

prevalent, followed by caustic products and pesticides. Voluntary poisoning, on the other hand, mainly affects young people. Furthermore, the results revealed that cases of accidental poisoning are due to ignorance of the dangers of certain products and also to easy access to drugs. The clinical symptoms observed is extremely heterogeneous, depending on the toxic substance responsible, the quantity ingested and the time of consultation. In addition, hospitalization for medical monitoring is almost mandatory, as the type and quantity of poison ingested is often unknown. The consequences of pediatric poisoning are benign in most cases. However, this apparent harmlessness should not obscure the potential seriousness of poisoning or neglect the prophylactic measures which have been shown to be widely effective.

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