

Children's poisoning profile during the Covid-19 pandemic – Experience of Hassan II University Hospital in Fez, MOROCCO

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Abstract. Introduction. —The Covid-19 pandemic and the containment situation, has generated enormous risks for children. Indeed, with the closure of schools, children, forced to stay at home, found themselves in permanent contact with dangerous products (drugs, disinfectants, plants) exposing them to accidental poisoning. Objective. —To describe the epidemiological, clinical and evolutionary aspects of the cases of pediatric intoxications in the UHC during the period of Covid-19, in order to assess the repercussions of this pandemic on the profile of these intoxications, in terms of number and incriminated products. Material and method. — This is a retrospective descriptive comparative study of intoxication cases admitted to the pediatric emergency department of the University Hospital of Fez spread over 2 years; from March 1, 2019 to February 2021; comparing intoxications admitted during the period of Covid-19 with the previous year. Results. — The emergency department recorded 132 cases of intoxication during the Covid-19 period (compared to 104 cases in 2019). Fez was always the most concerned city (66.21% against 69.02% in 2019). The cases emanated from the urban environment in (58.78%). The accidental circumstance was the most frequent, with an increase from 77.88% in 2019 to 82.02%. The rate of cases of envenomation that consulted was almost similar; children are more exposed to scorpion stings (73.52%) than snake bites. The analysis of incriminated products was marked by the increase of Caustics (20.38% in 2019 to 24.24% in 2020), and the decrease of pesticides (19.41% in 2019 to 13.63%). The symptomatology was dominated by neurological signs in 25.75% of cases, followed by respiratory disorders (18.18%). The evolution was favorable in 95.46%, and death occurred in 4.54% of cases compared to 3.84% in 2019. The Covid-19 pandemic has changed the use of antidotes.

1 Introduction

The emergence of the COVID-19 (Coronavirus Disease-2019) pandemic has risen to be a significant global public health concern [1], that promoted a drastic and sudden change in the way we organize ourselves as social human beings. In March 2020, WHO declared that COVID-19 reached a pandemic status, putting the planet in a state of maximum alert and grew to dimensions that still cannot be measured today [2]. The literature has pointed out that older individuals are more susceptible to develop COVID-19, and those with major comorbidities such as diabetes, hypertension and obesity can be more affected and could potentially be at higher risk for severe illness and death [3]. Although youngsters appear to be less vulnerable to COVID-19, the side effects of the pandemic can be devastating [4]. In the context of the ongoing COVID-19 pandemic, most parents had to reorganize their lives to deal with working at home in addition to children's management, this sudden overload has been putting parents under extra stressful conditions, potentially increasing the risk of children face enormous dangers [5]. Indeed, with the closure of schools, children, forced to stay at home, found themselves in permanent contact with dangerous products (drugs, disinfectants,

plants) exposing them to accidental poisoning. In fact, among children, the circumstances of intoxication are generally accidental and favoured by the deconditioning of the product and the non-respect of safety standards by some manufacturers [6]. This problem is aggravated by the presence of an informal market whose products are not subject to labelling or control of safety conditions [7]. More than 30% of intoxicated subjects in Morocco are children. More than 1000 deaths were recorded during the thirty years of the study, scorpionic envenomation, ingestions of toxic plants and the therapeutic errors are the most common cause of toxic deaths [8]. Moroccan studies in this field are rare, and the only study carried out by the CAPM on this subject was only interested in the characteristics of the intoxicated and the incriminated products. The present work will describe the epidemiological, clinical and evolutionary aspects of the cases of pediatric intoxications in the CHU Hassan II during the period of Covid-19, in order to assess the repercussions of this pandemic on the profile of these intoxications, in terms of number and incriminated products.

2 Materials and methods

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It is a retrospective descriptive comparative study of intoxication cases occurred in children hospitalized at the pediatric emergency department of the Hassan II University Hospital of Fez during a period of 2-years; from 1st March 2019 to February 2021; in order to compare the intoxications hospitalized during the period of Covid-19 with the previous year.

We included in this study, all types of intoxication, drugs, disinfectants, plants, pesticides etc. The data collection was realized by form of exploitation, to collect all the characteristics of the patient, the specificities of the intoxication (the place, the route, the circumstances, the product in cause). The clinical symptomatology presented by the patients was classified according to the classification of PSS; Poisoning Severity Score that grades the severity of the signs presented as (0) none, (1) minor, (2) moderate, (3) severe, and (4) fatal poisoning[9]. The evolution of the intoxicated person was also followed-up. All the collected data were tabulated in Excel® and analysed using the Epi software. A descriptive analysis of all variables was performed. Quantitative variables were expressed as mean, standard deviation, median and range. The qualitative variables as number and percentage.

3 Results

During the period of our study, the paediatric emergency department of the CHU Hassan II recorded 132 cases of intoxication during the Covid-19 period compared to 104 cases in 2019, with an augmentation of 28 cases during the Covid-19 period. These children were of urban origin in 79.65% (105/132); and emanated from the region of Fez-Meknes, Tanger-Tetouan-Al-Hoceima 0.96 (1/132) respectively. Fez was always the most concerned city (66.21% against 69.02% in 2019) in the region of Fez-Meknes, as shown in **Table 2**.

The average age of our patients was 5.65±4.54 years with extremes ranging from 2 months to 18 years, the sex ratio (M/F) was 0.95 in favor of a female predominance. In 2019, The average age was 5.70 ±5.07 years with extremes ranging from 9 months to 18 years, the sex ratio (M/F) was 0.88 in favor of a male predominance. The most affected age group in Covid-19 era was 1 to 4 years in 51.51% of cases (68/132), followed by 5 to 14 years in 0.40% of cases (53/132). In 2019, the distribution of age groups was almost similar; from 1 to 4 0.55% (58/104), followed by the age range from 5 to 14 29.8% (31/104)

Table 1.

Table 1. Age classification according to the INTOX system of the IPCS

Age classification	2019	2020
Baby	58	68
Child	31	53

Teenager	15	11
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The Anti-Poison Center of Morocco (CAPM) uses this classification in order to meet international requirements, as it is based on the INTOX system in the registration of cases of intoxication that are reported to it. The classification of age groups according to INTOX, is interesting because it allows to classify the age groups according to following a logic of the circumstances of intoxication as well as the physical and mental development of the child. For example, the age range of the baby, between 1 and 5 years, is a period of acquisition of walking and of a great curiosity of the child which predisposes him to intoxications in the within the framework of the classic accident [8].

Table 2. Distribution of acute intoxications in children according to cities

Cities	Control period 2019	%	Study period 2020	%
FEZ	72	69.20	86	65.15
MEKNES	2	1.92	4	3.03
TAZA	3	2.88	3	2.8
Taounate	18	17.3	18	13.7
Other	3	2.88	5	3.8
Unknown	6	5.76	26	19.69

The accidental circumstance was the most frequent, with an increase from 77.88% in 2019 to 87.12% (115/132) in the Covid-19 era. We noticed as well, a light diminution of the suicidal circumstance cases, from (16.34%) of cases to 10.6% (14/132), observed mainly in Teenagers with extreme age range of 12 to 14 years. (**Table 3**)

The analysis of the route of intoxication showed that the oral route was predominant in both 2020 and 2019, followed by the dermal route, mainly related to scorpion stings and snake bites, as shown in **table 6**.

Table 3. Distribution of acute intoxications in children according to the circumstances of the intoxication

	Control year		Study period	
	2019	%	2020	%
Accidental	82	78.84	115	87.12
Suicidal	17	16.34	14	10.60
Unknown	5	4.8	3	2.27

The analysis of incriminated products was marked by the increase of Caustic products in the Covid-19 era from (20.38% in 2019 to 24.24% in 2020). The Caustic products were exclusively represented in the study by Petroleum distillate marking an increase from 23.8% in 2019 to 59.37% (19/32) in the Covid-19 era. With regard to caustics, household products were responsible for 28.12% (9/32) of cases of poisoning that were only due to the ingestion of hydrochloric acid and homemade bleach. The cases related to pesticides poisoning have shown a

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slight decrease (19.41% in 2019 to 13.63%). Otherwise, the drug poisoning cases were almost similar during the period of the study. A large variety of drug in cause.

Table 4. Main toxic classes responsible for acute intoxication in children

	Control year		Study year	
	2019	%	20	%
Drugs	20	17.7	22	16.66
Antiepileptic drugs	7	38.8	7	31.68
Neuroleptic drugs	4	22.7	4	18
Antibiotic drugs	3	16.6	1	4.5
Antihistaminic drugs	0	0	1	4.5
Analgesic drugs	3	16.6	1	4.5
Antihypertensive	1	5.55	0	0
Unknown	2	11.1	8	36.36
Pesticides	19	19.4	20	13.6
Insecticide	6	31.5	3	15
Herbicide	0	0	1	5
Raticide	7	36.8	8	40
unknown	6	31.5	8	40
Plants	6	5.76	5	3.78
Animals	22	21.1	35	26.51
Scorpion	19	86.3	25	71.42
Snake	3	13.6	10	28.57
Caustics	21	20.3	32	24.24
Strong acid				
Hydrochloric acid	3	14.3	6	18.8
Strong base				
Bleach	1	4.7	1	3.12
Other				
Petroleum distillate	5	23.8	19	59.37
Methanol	0	0	1	3.12
Disinfectant	2	9.5	2	6.25
Cosmetics	1	4.7	0	0
Vinegar + alcohol	0	0	1	3.12
Unknown	9	42.5	2	6.25
Food poisoning	1	0.96	2	1.51
Addictive drugs	3	2.88	4	3.03
Unknown	9	8.56	11	8.33

The study of clinical characteristics during lockdown period showed that 76.04% of our patients were symptomatic. The most frequent symptoms were neurological signs in 26.51% of cases (35/132). They were mainly dominated by unconsciousness in (13.4%) of cases, drowsiness (8.3%), agitation (6.5%) and seizure in (5.5%) of cases. Respiratory signs were present in second place in 25% of cases (24/96); mainly tracheal stenosis, cough, respiratory distress, chest pain, bronchitis and dyspnea. Digestif signs were found in 9% (8/89) of cases, including vomiting, diarrhoea, abdominal pain. Hematemesis related hospitalisation was due to ingestion of caustic product (Table 5). The analysis of the poisoning severity based on the PSS classification, shows the predominance of moderate and minor poisoning in both years of the study. Up to 15.16% of patients experienced Grade III severity issues with a significant increase from (8.6% in 2019 to 15.16% in 2020) requiring intensive care.

Table 5. The clinical signs presented by the patients.

Clinical signs	Control year		Study period	
	2019	%	2020	%
Neurological				
✓ Drowsiness	8	13.4	9	8.3
✓ hypotonia	3	5	5	4.6

✓ unconsciousness	10	16.7	15	13.4
✓ agitation	3	5	7	6.5
✓ seizures	2	3.4	6	5.5
✓ Status epilepticus	1	1.7	1	0.92
✓ Muscarinic syndrome	1	1.7	1	0.92
✓ Cephalaea	0	0	1	0.92
✓ desorientation	0	0	2	1.9
✓ Hallucination	0	0	1	0.92
✓ Vertige	0	0	1	0.92
✓ Confusion	0	0	1	0.92
✓ Coma	0	0	1	0.92
Respiratory				
✓ Tracheal stenosis	2	3.4	1	0.92
✓ bronchitis	2	3.4	4	3.7
✓ dyspnoea	2	3.4	1	0.92
✓ Cough	0	0	2	1.9
✓ Respiratory distress	0	0	1	0.92
Digestif				
✓ vomiting	15	25	19	17.5
✓ diarrhea	1	1.7	2	1.9
✓ Pain	5	8.3	6	5.6
✓ HEMATEMESE	0	0	1	0.92
ORL				
✓ Ulcerations	0	0	4	3.7
✓ Necrotic lesions	0	0	3	2.8
Metabolic				
✓ Acidocétose metabolic	0	0	1	0.92
Renal				
Renal failure	0	0	1	0.92
Cardio vascular				
✓ Bradycardia	2	3.4	2	1.9
✓ tachycardia	3	5	0	0
✓ hypotension	2	3.4	1	0.92
✓ Chock	0	0	1	0.92
Dermal				
✓ Oedeme	0	0	9	8.4
Total	60	100	108	100

A symptom may be present in one or more patients.

Table 6. Main routes of poisoning in pediatric population.

Route of poisoning	Control year		Study period	
	2019	%	2020	%
Oral	76	73.1	91	68.9
Dermal	22	21.2	35	26.5
Non-specified	6	5.8	6	4.5

Table 7.1. Distribution of the evolution of the cases according to the studied parameters.

Evolution complications	Control year		Study period	
	2019	%	2020	%
Evolution	95	92.23	119	95.46
Death	1	0.96	1	-
Unknown	5	3.84	7	4.54
	3	2.88	4	-

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During the study period, 35 children were admitted for a scorpion sting and snake bite. The medical records were analysed. As shown in table 4, The rate of cases of envenomation that consulted was almost similar in both years of the study; children are more exposed to scorpion stings (73.52%) than snake bites, there have been 11 patients (50%) within the grade II group and 1 patient (4.5%) within the grade III group. The rest of the patients had moderate signs in 2019. In the Covid-19 period, we

noticed that 20% of cases were hospitalized for grade II symptoms and a noticeable increase in patients with grade III symptoms (11.35%), while the rest had moderate signs or have not presented no signs at all.

Snake and scorpion envenomation are more frequent within the summer; in fact, 91.7% of our patients were admitted between July and October.

Table 7.2 Comparison of paediatric emergency hospitalisations for poisonings cases, during the COVID-19 lockdown period and the corresponding period of the previous year.

	Favorable evolution		Death		Unknown	
	Control year 2019	Study year 2020	Control year 2019	Study year 2020	Control year 2019	Study year 2020
Median age [minimum; maximum] (years)	3 [1 ; 18]	4 [0.7 ; 18]	3 [1 ; 6]	4 [1 ; 15]	6 [1; 15]	4.5 [1; 10]
Gender:						
Female	54	65	2	2	2	2
Male	42	54	3	5	1	2
Provenance						
Rurale	25	31	1	2	2	3
Urban	66	76	4	5	1	1
Unknown	5	13	0	0	0	0
Circumstance						
Accidental	73	109	5	2	2	4
Suicidal attempt	16	12	0	2	1	0
Unknown	7	0		3		0
Incriminated products						
Drugs	18	21	0	1	0	0
Caustic Household products	21	32	0	0	0	0
Animals	21	31	0	2	1	2
Plants	3	4	2	1	1	0
Pesticides	18	17	1	2	1	1
Addictive drugs	3	4	0	0	0	0
Food poisoning	1	2	0	0	0	0
Unknown		9	2	1	0	1
Grade of severity (PSS classification)						
Stade 0	22	26	0	0	0	0
Stade I	23	19	0	0	0	1
Stade II	30	29	0	0	2	0
Stade III	9	20	0	0	0	0
Stade IV	0	0	5	7	0	0
Non specified	14	27	0	0	1	3

A detailed analysis of the envenomated cases in both years of the study showed the mean age of the children was 5.38±4.40 years in 2019, (5.43±4.41 in 2020) with a male predominance as shown by the sex ratio (M/F); 1.33 in 2019 and (1.69 in 2020). These children emanated from the rural environment in the majority of the cases (70% in 2019) and (94.2% in 2020).

The envenomation was accidental in all cases. Death occurred in a 1-year-old child who accidentally got stung while being outdoors. The median time from poisoning to management was 4 hours with a minimum of half an hour and a maximum of 360 hours in 2019, and 5.5 hours in 2020 with a minimum of 0.25 hour and 480 hours. The evolution was favorable in 95.46%, and death occurred in 4.54% of cases compared to 3.84% in 2019.

4 Discussion

Long-term home isolation due to lockdown measures to prevent the spread of the COVID-19 outbreak bears the potential for increased risk of domestic accidents in children, as an additional collateral damage of this pandemic.[10, 11] Consequently, we intended to evaluate the impact of Covid-19 on poisoning cases in children in terms of recurrence (frequency) and severity between 1st March, when lockdown measures were upheld in our country, and 28 February 2021 compared with the same corresponding period during the earlier year. We looked through the paediatric department (emergency and reanimation) electronic information base for cases identified with accidental or intentional poisonings. We

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excluded children hospitalized for domestic accidents related to foreign bodies as well as any presentations flagged as a domestic injury. Our study showed that during lockdown period the frequency of poisoning cases in children has slightly increased. Intoxication varies from country to country and remains difficult to specify since, in most cases, it is a benign intoxication that does not even give rise to a medical consultation and thus escapes any statistical study [12]. In Morocco, between 16 March 2020 and 16 April 2020, the Moroccan Poison and Pharmacovigilance Center (CAPM) recorded 145 reports of poisoning cases in children, which represents 45.03% of all poisoning cases that occurred during the same period apart from scorpion stings and envenomation [13]. In our study, we collected 132 cases of poisoning in children, with an average of 11 cases per Month. In our series, the age group most concerned was between 1 and 4 years with a female predominance. These results are consistent with other published data in this area [13, 14]. At this age, children tend to explore their immediate environment, it is also the age of walking acquisition where the hand-mouth activity is very important. Pesticides are involved in domestic accidents when they are left within reach of children due to negligence or accessible storage. When older children are involved, accidents often result from the misuse and the unpacking of products. The oral route and the accidental circumstance are the most frequent and most reported characteristics of intoxication in all series [13, 15-18] [17]. Indeed, deconditioning and failure to follow safety standards seem to be the main cause of accidental ingestion cases in children in our setting. In our study, the main incriminated products were caustic products dominated in 24.24% of cases, petroleum distillate, bleach and household products are the leading cause of caustic poisoning among children. However, the Covid-19 period has seen the recording of a case of poisoning by a new type of mixture (vinegar + white spirit) (absent in 2019). Petroleum distillate is a Moroccan specificity in our study, it was responsible for 19 cases of ingestion. It has been widely used in most Moroccan households as a disinfectant for surfaces and air, in order to reduce the propagation of the virus, this would be the cause of accidental ingestion in children, especially during the application of these products for viricidal purposes. The appearance of cases of intoxication by mixtures of disinfectants was also recorded by the Moroccan Poison Control and Pharmacovigilance Center (CAPM), this practice was observed during the Covid-19 health crisis and is wrongly assumed to increase the virucidal effectiveness of the disinfectants used. The use of disinfectant mixtures seems to expose to an increased risk of poisoning mainly in children [13]. Drugs represent 16.66% of cases, pesticides have known a decrease from (19.41% in 2019 to 13.63%). According to data from the Moroccan Poison Control and Pharmacovigilance Center (CAPM) [13], The analysis of products incriminated in intoxications in 2020 showed that drugs were in the lead (55.16%) followed by disinfectants (14.40%) and pesticides and agricultural products while in 2019, drugs were in the lead (45%) followed by pesticides and agricultural products (10.36%) and disinfectants (8.04%).

According to Moroccan series, the clinical manifestations are essentially respiratory, neurological and followed by digestive signs, which is consistent with the results recorded in our study [1,13]. The immediate complications are often limited and related to the substance in cause. Among children, the exposure to toxic agents is not always accidental. In our series, voluntary intoxications involve children over 10 years of age, mainly females. These suicide attempts are related to the ingestion of various drugs or pesticides available to their reach. According to a paediatric study, 19% of organophosphate intoxications were voluntary [19]. In our study, the main toxic agents involved were, organophosphates, aluminium phosphate and alpha chloralose. The suicidal attempt has significantly decreased, which is not consistent with the data from CAPM and international studies [13, 20]. Poisoning in children during the Covid-19 pandemic is fatal. In our study, the rate of death has increased from 3.84% in 2019 of cases compared to 4.54% in the same period in 2020, this can be related to the increase in the delay between the intoxication and management, due to the fear of population to be infected by the SARS-Cov virus. A detailed analysis of death cases reveals that the median age of these children was 4 [1; 15] with a sex ratio of 2.5 with a male predominance. The distribution of deaths according to the circumstance showed that the accidental circumstance was responsible for 2 deaths among 7 cases (28.6%); related to scorpion sting, and 2 cases among 7 in suicidal attempts (28.6%), The main toxic agents in cause were related to pesticides, represented exclusively by aluminium phosphide. Indeed, Aluminium phosphide is used in Morocco as a fumigant to control rodents and pests in grain-storage facilities [21]. The trade name of the fumigant is Phostoxin®. Aluminium phosphide is highly toxic, low cost and easily accessible. This explains why it is the main cause of poisoning in our study. Patients who intend to commit suicide take tablets. Once mixed with aqueous solutions in the stomach, phosphine gas (PH₃) is released [22]. The release of cytotoxic phosphine gas primarily affects the heart, lungs, gastrointestinal tract and kidneys, although all organs can be involved. Only 1 death case by plant poisoning was recorded, while in 2019 2 cases of death were related to poisoning by plant (*Chenopodium ambrisoide*) has been recorded. In fact, this plant is widely used in traditional Moroccan remedies especially among children, as an antipyretic, vermifuge, antispasmodic, or for its healing effect in oral ulcerations [23]. However, the misuse of this plant in traditional remedies is responsible for many cases of intoxication, which would be related to an overdose, since the toxic dose is very close to the therapeutic dose. The most important bioactive compounds in the aqueous extract and essential oil of the plant are p-cymene (50.0%), terpinene (37.6%) and ascaridol (3.5%). The toxicity of the plant is due to the three active ingredients mentioned, as they are responsible for the inhibition of the complex I of the mitochondrial respiratory chain leading to a multivisceral lesions that starts with digestive disorders (vomiting, diarrhea) and reaches the neurological system (CNS depression, headaches, convulsions, coma), neurosensory disorders (deafness, visual impairment) and can be

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complicated by cardiovascular, hepatic and renal signs [24] which is consistent with the data of our study.

Conclusion

The Covid-19 health crisis and the sanitary lockdown situation had an impact on the profile of children's poisoning in PED. An increase in cases of caustic poisoning, the use of disinfectant mixtures, and the appearance of new poisoning circumstances. Even though, There is limited data regarding the epidemiologic characteristics and clinical features of SARS-CoV-2 in children [25]. We acknowledge our data are limited by the single-centre design, with the possibility that little variations in numbers in each period could influence the impact size of our results. However, we acknowledge they are valuable and useful to raise awareness that domestic accidents are posing a higher danger to children's wellbeing and health than COVID-19, as well as to gain a better comprehension of the global effect of COVID-19 on the paediatric population.

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