



Original article

Pattern of Acute Pediatric Poisoning at Assiut University Hospitals: A Prospective Study
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ARTICLE INFO

Article history

Received: 21/11/2024

Revised: 20/12/2024

Accepted: 15/1/2025

Keywords:

Pediatric Poisoning,
Assiut, accidental,
outcome.

ABSTRACT

Background: Child poisoning is a serious health issue that affects both developed and developing nations, and it is a key factor in the morbidity and death of young people.. **Aims:** This study aimed to analyze the trends and results of pediatric poisoning cases admitted to Assiut University hospitals over one year, from 1/2/2022 to 31/1/2023. **Patients and Methods:** A prospective cross-sectional study was carried out on 359 children under 18 years old who had acute poisoning. All necessary information was gathered and statistically analyzed, including the patient's demographic status, clinical assessment, poisoning data, investigations, treatment measures, admission location, and outcome. **Results:** Throughout the study period, there were 359 admitted cases. Males outnumbered females by 53.2% to 46.8%. The main age group (37.0%) was from 2 to less than 6 years. Medication poisoning came in first, with 29.2%. Pesticide agents came in second with a rate of 25.4%. Suicide attempts accounted for only 24.8% of poisoning cases; the majority (72.7 %) were unintentional. The oral route accounted for 77.7% of poisoning cases. A mortality rate of 2.2% was observed, with 97.8% of cases being completely cured and about 35.1% requiring Intensive Care Unit hospitalization. **Conclusion:** Most poisonings in children occur accidentally, primarily through oral ingestion and mostly due to medications and insecticides. Most cases had a complete recovery.

I . Background

Acute pediatric poisoning is a common worldwide problematic emergency and is a frequent cause of emergency department admissions throughout the world. This can be explained as the evident curiosity for the surroundings and the desire to explore and emulate adults, which expose children to acute intoxications ([Pianca et al., 2017](#)).

Even in the same region, the etiology and demographics of pediatric poisoning can change over time. This is based on factors like socioeconomic status, education, local beliefs, customs, age, distribution, causes of poisoning, and types of products involved ([Bhat et al., 2012](#)). Therefore, surveillance of the epidemiology and patterns of children's acute poisoning in each country is beneficial to define the scope of the problem and its management regarding The

Assiut governorate lacks good recent demographic and epidemiological data regarding pediatric poisoning. The purpose of this study was to document the prevalence, pattern, and epidemiology of acute pediatric poisoning in patients under the age of 18 who were admitted to Assiut University Hospitals. It also sought to identify the various causative agents, clinical characteristics, and outcomes regarding mortality and morbidity as a plan for its appropriate prevention and management.

II. Subjects and Methods

This research was carried out at Assiut University Hospitals for a year from 1/2/2022 to 31/1/2023. All participants provided their written informed consent, and the research was authorized by the Assiut Medical Ethical Institutional Review Board (Ethical approval number. 17101676).

II. 1. Study Design: A hospital-based prospective cross-sectional study was conducted at Assiut University Hospitals for a year from 1/2/2022 to 31/1/2023.

Patients: All cases of acute pediatric poisoning of both sexes, in age less ≤ 18 years old, were included:

Inclusion criteria: Children with acute poisoning (whose adverse effects occur following administration of a single dose of a substance or multiple doses within 24 hours) ([Colerangle, 2017](#)).

Exclusion criteria: Those with allergic reaction, foreign body ingestion (coins, plastics, or toys), chronic toxicity and any child with chronic diseases.

Collected data:

1. Demographic data (age, sex, and residence).
2. Toxicological data including causative agents, manner of exposure, either intentional or unintentional, exposure route, time delay, clinical characteristics.
3. Clinical manifestation data, either general or systemic.
4. Patients were classified according to poison severity score (PSS) ([Persson et al., 1998](#)):
5. Results of different laboratory and radiological investigations were recorded.
6. Patients' outcome data
7. **III. 3. Data analysis**

The obtained data was analyzed using the Statistical Package for the Social Sciences (SPSS) version 26 for Windows. Quantitative data was tested for normality by the Shapiro-Wilk test and expressed as mean $\pm$ SD or median (range) according to their distribution, while qualitative data was presented by frequencies and percentages. The Chi-square and Fisher's Exact tests were used to compare the proportions between groups. p -value < 0.05 was considered statistically significant.

III. Results

Table (1) showed that 359 cases were admitted to the Emergency Units of Assiut University Hospitals. The age from 2 to 6 years represented the highest percentage (37.0%), that of (12-18) and less than 2 years (30.4% and 19.8%, respectively), and the age group 6- 12 years (12.8%). Male cases outnumbered the females (53.2% versus 46.8%). Cases from rural areas (74.4%), while urban cases represented 25.6. According to Table (2), The most frequent route of acute poisoning was oral (77.7%), followed by animal sting or bite (19.2%) and inhalation (2.5%), and only 0.6% of cases were exposed to poisoning by injection. Most

Table (1): Demographic data of children with acute poisoning admitted to Assiut University Hospitals during the study period.

Parameters	Total (Number of cases= 359)	%
Age		
< 2 years	71	19.8%
2 to < 6 years	133	37.0%
6 to < 12 years	46	12.8%
12–18 years	109	30.4%
Gender		
Male	191	53.2%
Female	168	46.8%
Residence		
Urban	92	25.6%
Rural	267	74.4%

incidents of poisoning were accidental (74.6%) while 24.8% were suicidal, and only one case was homicidal. Regarding the main time of exposure was during the day (69.4%), while night poisoning represented 30.6% of total cases. (73.8%) of the cases were admitted within two hours of poisoning, within two to six hours after the poisoning was (24%), and cases admitted after more than six hours (2.2%). 64.9% of cases were admitted to the inpatient department of the emergency unit, while 35.1% of patients required ICU hospitalization. The highest number (77.4%) of cases stayed between one day and three days; 20.6% stayed for less than one day, and 2% were admitted for more than three days (Table 2).

As shown in Table (3a), medications were the primary cause of acute poisoning (105 cases; 29.2% of all cases), mainly central nervous system medications. In Table (3b), pesticides were the most common frequent cause of non-medical substance exposure (25.4% of all cases. Animal poisoning (19.2%) ranked as the third in terms of frequency of acute poisoning cases in the form of scorpion stings (17.3%) and snake bites (1.9%). Corrosive exposure occurred in 5.9% of cases, while hydrocarbon exposure occurred in 4.5%; where benzene was the main source. About 3.6% of cases exposed to the substances of abuse, of them 1.9% took cannabis. 3.3% (12 cases) of admitted cases presented with multiple ingestions (11 cases due to multiple drug ingestion, and only 1 case due to pesticide and hydrocarbon co-ingestion), while unknown ingestion was

found in 2.8%. Food poisoning in 2.5% of cases, while gases, paraphenylenediamine dye, and alcohol exposure occurred in 1.7%, 1.1%, and 0.8%, respectively. Table (4) shows that animal poisoning was higher in males than females (23.0% versus 14.9%). The substance of abuse was 5.8% in males and 1.2% in females while multiple ingestion was more common in females than males (5.3% versus 1.6%, respectively). There was a highly significant difference between the alleged manner of poisoning and gender, with males experiencing accidental toxicity at a higher rate (87.5% of male cases versus 60.1% of female cases versus 12.5% of all male cases) (p -value < 0.05).

Table (2): Toxicological data and circumstances of acute poisoning in children admitted to Assiut University Hospitals during the study period.

Toxicological data	Total (N=359)	%
Route of exposure		
Ingestion	279	77.7%
Sting/bite	69	19.2%
Inhalation	9	2.5%
Injection (IV/SC)	2	0.6%
Alleged Manner of exposure		
Accidental	268	74.6%
Suicidal	89	24.8%
Homicidal	1	0.3%
Unknown	1	0.3%
Time of poisoning		
Day	249	69.4%
Night	110	30.6%
Delay time (hrs.)*		
≤ 2 hrs.	265	73.8%
> 2hrs. to 6 hrs.	86	24.0%
> 6 hrs.	8	2.2%
Site of admission		
Inpatient	233	64.9%
ICU	126	35.1%
Duration of hospitalization (hrs.) *	24.0hrs. (0.25–240 hrs.)	
< 1 day	74	20.6%
1 day to 3 days	278	77.4%
> 3 days	7	2%

N: Number of cases, %: Percent, IV: intravenous, SC: subcutaneous, hrs: Hours, ICU: Intensive care unit.

Table (3a): Types of agents causing pediatric poisoning among cases admitted to Assiut University Hospitals during the study period.

Types of agents	Total (N=359)	%
Medications	105	29.2%
CNS	62	17.3%
Antiepileptic drugs	10	2.8%
Carbamazepine	9	2.5%
Valproate sodium	1	0.3%
Atypical antipsychotic drugs	26	7.1%
Risperidone	17	4.7%
Clozapine	9	2.4%
Typical antipsychotic drugs	10	2.8%
Chlorpromazine	5	1.4%
Haloperidol	5	1.4%
Dopamine agonists	4	1.1%
SSRIs	3	0.8%
Sedatives	2	0.6%
CNS stimulants	2	0.6%
Neuroprotective drugs	2	0.6%
Tricyclic antidepressants	2	0.6%
Anticholinergics	1	0.3%
Analgesic (NSAIDs, paracetamol)	9	2.5%
CVs (BBs, CCBs, digitals)	5	1.4%
Cardiopulmonary (Methyl xanthine)	4	1.1%
GIT (PPI, digestion)	3	0.8%
Hypoglycemics (Insulin, OHAs)	3	0.8%
Pulmonary (respiratory drugs)	2	0.6%
Miscellaneous drugs*	17	4.7%

CNS: Central nervous system, SSRI: Selective serotonin reuptake inhibitors, NSAIDs: nonsteroidal anti-inflammatory drugs, CVs: cardiovascular system, GIT: Gastrointestinal system, PPI: Proton pump inhibitors, BBs: Beta blockers, CCBs: Calcium channel blockers, OHAs: Oral hypoglycemic agents, *Miscellaneous drugs include vitamins, iron, antibiotics, antiviral, sexual, capillary supporting drugs, and muscle relaxants. N: Number of cases, %: Percent.

Table (3b): Types of agents causing pediatric poisoning among cases admitted to Assiut University Hospitals

Types of agent	Total (N=359)	%
Pesticides	91	25.4%
OPCs	27	7.6%
Zinc phosphide	22	6.1%
Carbamate	20	5.6%
Aluminum phosphide	15	4.2%
Pyrethroid	4	1.1%
Warfarin	3	0.8%
Animal poisoning	69	19.2%
Scorpion sting	62	17.3%
Snakebite	7	1.9%
Corrosives	21	5.9%
Hydrocarbon	16	4.5%
Benzene	5	1.4%
Kerosene	4	1.1%
Solar, gasoline	2	0.6%
Acetone	1	0.3%
Others	4	1.1%
Substance of abuse	13	3.6%
Cannabis	7	1.9%
Amphetamine	3	0.8%
Opioid	2	0.6%
Tramadol	1	0.3%
Multiple ingestion	12	3.3%
Unknown ingestion	10	2.8%
Food poisoning	9	2.5%
Gases (Carbon monoxide)	6	1.7%
Paraphenylenediamine dye	4	1.1%
Alcohol (Ethanol)	3	0.8%

Data were expressed as frequency and (%). OPCs: organophosphorus compounds

The relationship between gender and site of hospital admission was significant, with most male cases (72.8% versus 56% of female cases) being admitted to the inpatient department, while 44% of female cases versus 27.2% of male cases were admitted to the ICU department (Table 4).

Table (4): Association between Toxicological data of children admitted to Assiut University Hospitals with acute poisoning and their gender during the study period

Variable	Gender		p-Value*	
	Male (N=191)(%)	Female (N=168)(%)		
Agent				
Medications	58(30.4%)	47(28.0%)	0.619	0.03
Pesticides	41(21.5%)	50(29.8%)	0.071	
Animal poisoning	44(23.0%)	25(14.9%)	0.050	
Corrosives	10(5.2%)	11(6.5%)	0.597	
Hydrocarbon	10(5.2%)	6(3.6%)	0.446	
Substances of abuse	11(5.8%)	2(1.2%)	0.024	
Multiple ingestion	3(1.6%)	9(5.3%)	0.046	
Gases	2(1.0%)	4(2.4%)	0.424	
Others	12(6.3%)	14(8.3%)	0.454	
Alleged manner of exposure				
Accidental (N=268)	167(87.5%)	10(60.1%)	< 0.001	
Suicidal (N=89)	24(12.5%)	65(38.7%)		
Homicidal (N=1)	0(0.0%)	1(0.6%)		
Site of admission				
Inpatient (N=233)	139(72.8%)	94(56.0%)	0.001	
ICU (N=126)	52(27.2%)	74(44.0%)		

*Data were expressed as frequency and (%), Chi-Square test/Fisher Exact test were used to compare proportions between groups. *p*-value* < 0.05 is significant. N: Number of cases, %: Percent.

Figure (1) shows the relation between age and the route of exposure to toxin; ingestion was the main route of toxin exposure in different age groups, while animal sting/bite was the main route in the age group from 6 to < 12 years (54.4%) with P-value of < 0.001.

Table (5) shows the correlation between different poison agents and the patient's residence, which is statistically significant (*p*-value < 0.05). A higher percentage of medications and substances of abuse were recorded in urban areas (42.4% and 8.7%, respectively), while pesticides and animal poisoning were higher in rural areas (28.5% and 22.5%, respectively).

Table (5): Distribution of residence in acutely poisoned children admitted to Assiut University Hospitals according to type of poisonous agent during the study period

Agent	Residence		p-Value*
	Urban (N=92)(%)	Rural (N=267)(%)	
Medications	39 (42.4%)	66 (24.7%)	0.001
Pesticides	15 (16.3%)	76 (28.5%)	0.021
Animal poisoning	9 (9.8%)	60 (22.5%)	0.009
Corrosives	2 (2.2%)	19 (7.1%)	0.119
Hydrocarbon	5 (5.4%)	11 (4.1%)	0.598
Substances of abuse	8 (8.7%)	5 (1.9%)	0.003
Multiple ingestion	4 (4.3%)	8 (3.0%)	0.512
Gases	1 (1.1%)	5 (1.9%)	0.999
Others	9 (9.8%)	17 (6.3%)	0.276

*Data were expressed as frequency and (%), Chi-Square test/Fisher Exact test were used to compare proportions between groups. *p*-value* < 0.05 is significant. N: Number of cases, %: Percent.

As shown in Table (6), the admitted cases were classified according to the outcome and poison severity score (PSS). Severe PSS that resulted in death was 8 cases (grade 4), and the case fatality rate was 2.2% of admitted cases. The cure rate was 97.8% for the total children. 37.3% of cases of poisoning were manifested by minor symptoms or signs (Grade 1), followed by moderate symptoms (Grade 2), asymptomatic (Grade 0), and severe cases (Grade 3) (35.1%, 20.1%, and 5.3%, respectively).

Table (6): Outcome and Poison Severity Score of cases admitted to Assiut University Hospitals during the study period.

Outcome	Total (N=359)	%
Survivors	351	97.8%
Died	8	2.2%
Poison severity score system		
G 0	72	20.1%
G 1	134	37.3%
G 2	126	35.1%
G 3	19	5.3%
G 4	8	2.2%

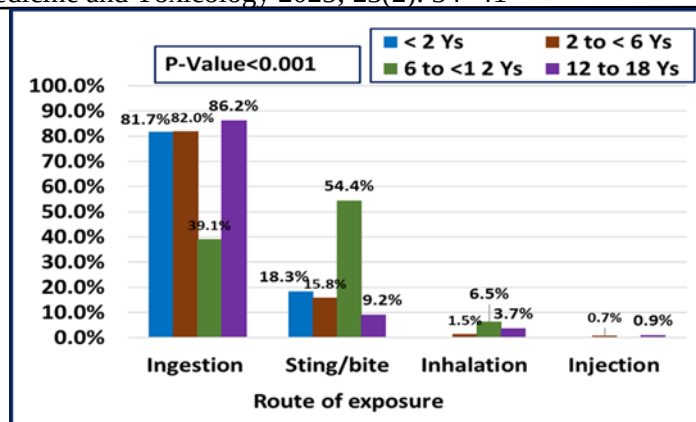


Figure (1): the association between the route of exposure and the age of cases admitted to Assiut University Hospitals during the study period

Regarding the treatment lines, 311 children needed supportive care (86.6%). Intubation was done for 5 cases (1.4%). 105 children (29.2%) were decontaminated by gastric lavage, 81 (22.6%) were decontaminated by activated charcoal. Only 1 case needed elimination by hemodialysis. 156 cases (43.5%) required a specific antidote. 306 children (85.2%) received symptomatic treatment (Figure 4).

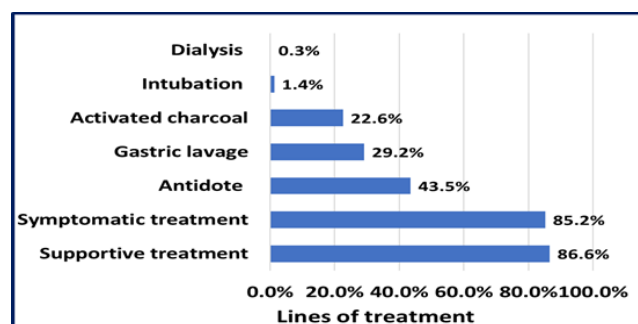


Figure (2): A bar chart showing the treatment lines given to the poisoned children admitted to Assiut University Hospitals during the study period.

IV. Discussion

In this study, 56.8% of the children involved in the current study were under the age of 6 years. These results agree with research from other governorates in Egypt over various periods, such as a study done in Zagazig [Hassan and Siam, \(2014\)](#) and at the Banha Poisoning Control ([Farag et al., 2020](#)). These findings are also consistent with studies conducted in other nations over different ranges of periods, including those conducted in Saudi Arabia [Ibrahim et al., \(2023\)](#) and India ([Ramawat and Jain, 2021](#)).

Those findings are in line with the findings of the study done in the Ain Shams University Hospitals, which showed that children under the age of four made up most

poisoned children, followed by those over the age of twelve [Abu El-Naga et al., \(2022\)](#). The current study showed male predominance; this goes in line with many studies conducted in Egypt and other countries, such as a study done in Zagazig [Hassan and Siam, \(2014\)](#), a study conducted in Menoufia Poison Control Center [Kandeel and El-Farouny, \(2017\)](#), and a study conducted in Rome, Italy ([Soave et al., 2022](#)).

The current findings conflict with those of two studies that found a preponderance of female cases over males [Abd ElKader, \(2022\)](#) & [Abd-Elhaleem and Al Mughem, 2014](#)).

According to the current findings, most poisoned cases (74.4%) came from rural areas. These results are in harmony [Hassan and Siam, \(2014\)](#) and a study done at Sohag University Hospitals ([Abd ElKader, 2022](#)).

Regarding the manner of poisoning, the current study found that most of the children (74.6%) were intoxicated accidentally, with the suicidal cases coming in second (24.8%). The findings concur with those of a study done in Saudi Arabia [Alghadeer et al., \(2018\)](#), a study done in Sohag University Hospitals [Abd ElKader, \(2022\)](#), and a study done in north-west London [Corlade-Andrei et al., \(2023\)](#).

In the present data. In males, accidental poisoning outnumbered intentional poisoning; in females, the opposite pattern was observed. This could be explained by a higher prevalence of mental health issues, particularly depression, in adolescent females ([Haghighat et al., 2013](#)). [Abu El-Naga et al., \(2022\)](#) reported that suicidal behavior was predominant in males, while accidental intoxication recorded a greater rate in female

In the present work, the oral route predominated in most cases (77.7%), which was explained by young children's natural curiosity and oral exploration, which was more pronounced as most of the studied patients were under six years old. Also, young children's senses are mostly visual and gustatory at this age ([Abu El-Naga et al., 2022](#)). Oral exposure was the main route of poisoning in all age groups except from 6 to 12 years, in which animal poisoning predominates as reported by ([Farag et al., 2020](#)).

The delay between poisoning and arrival at the hospital was less than or equal to two hours in most cases. The fact that most of Assiut's villages and centers are close to the city. Those results agree with [Abd ElKader, \(2022\)](#), and ([Lee et al., 2019](#)).

This study showed that pharmaceuticals were the most frequent cause of pediatric poisoning. The current results align with [Ragab and Al-Mazroua, \(2015\)](#). A study conducted at the Menoufia Poison Control Center, showed that 34.4% of

poisoning cases were caused by pesticides, with cleaning products coming in second ([Kandeel and El-Farouny, 2017](#)).

In the current study, pesticides were the most frequent cause of non-pharmaceutical toxicity. These results can be explained by the agricultural nature of the Assiut governorate. Furthermore, pesticide occurrences were more frequent in rural areas (28.5%) than in urban areas (16.3%). The easy availability, packaging, and colorful look of pesticides increase their danger for young children. Additionally, they are widely used in agriculture and at home. Furthermore, because they are so accessible, they are frequently used in suicide attempts ([Chitra et al., 2013](#)).

The present data disagrees with the study done in rural Sri Lanka [Dayasiri et al., \(2018\)](#), which discovered that pesticides were the least common cause of pediatric poisoning.

The third most frequent cause of pediatric poisoning was animal poisoning, mainly scorpion stings that agree with ([Mohamad et al., 2014](#)).

The results of the current study demonstrated that gender could impact the type of toxic chemical. Males had higher rates of animal poisoning than females did, while females were more likely to be exposed to multiple ingestions. Numerous studies have confirmed that poison can be affected by gender, such as results from [Abd-Elhaleem and Al Mughem, \(2014\)](#) and [Mohamed et al., \(2019\)](#), who reported similar results. The main reason is that boys exhibit more activity and are more exposed to accidental threats than girls ([Farag et al., 2020](#)).

In the current study, non-specific hospital care was provided for most cases. This included supportive (86.6%), symptomatic (85.2%), and general decontamination techniques such as gastric lavage (29.2%) and activated charcoal (22.6%). 43.5% of cases received a specific antidote (mainly scorpion antivenom, 15.9%), which may have contributed to a low fatality rate and favorable outcome.

Regarding the outcome, during the current study, 64.9% of patients were in the inpatient department, while 35.1% required an intensive care unit. Also, most cases needed admission for less than 3 days (98%); these results are like the results reported by a study done in 2017 at Zagazig University Hospitals, which stated that about 72.7% of cases were admitted for less than 3 days ([Sarhan et al., 2018](#)). 2.2% of admitted children in the current study died, while 97.8% of them were cured. The ICU admission and case fatality rate in this study was shown to be comparable to other studies as a study done in Saudi Arabia, where 11.6% of patients were admitted to the pediatric intensive care unit,

with a 1.44% fatality rate ([Tobaiqy et al., 2020](#)). The short delay times (less than or equal to 2 hours for 73.8% of admitted children) and quick actions taken to save the lives of pediatric patients may have contributed to the low fatality rate. The findings are consistent with other studies, such as [Elshoura et al., \(2016\)](#), and [Seif et al., \(2016\)](#) studies which found that most cases were uncomplicated and fully recovered after being admitted to the hospital with a low mortality rate.

V. Limitations of the study

escaped cases and cases that didn't need hospitalization weren't involved in this study.

VI. Conclusion:

Most poisonings in children occur accidentally, primarily through oral ingestion and mostly due to medications and insecticides. Most cases had a complete recovery.

Declarations:

Ethical approval and consent to participate: (Ethical approval number: 17101676)

Consent for publication: has been obtained from all authors.

Availability of data and material: The data supporting this study's findings are available from the corresponding authors.

Conflicts of interest: The authors declared no potential conflicts of interest concerning the research.

Funding: This research received no specific grant.

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How to cite: George, S., Abdellah, N., & Abdelrahman, S. (2025). Pattern of Acute Pediatric Poisoning at Assiut University Hospitals: Prospective Study. *Zagazig Journal of Forensic Medicine and Toxicology*, 23(2), 34-41. doi: 10.21608/zjfm.2025.338323.1208