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Clinico-Epidemiological Profile of Acute Poisoning in Children: An Experience from a Tertiary Care Centre of North India

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ABSTRACT

Background: Acute poisoning in children is a common health issue worldwide. Knowledge about the changing epidemiology becomes imperative for both public health authorities and physicians, for, it may be of immense help in devising not only the preventive strategies but also treatment readiness. Taking this into account we investigated the epidemiology of acute poisoning among children admitted to the emergency department of our tertiary care hospital.

Methods: This retrospective observational study was conducted from December 2021 to December 2023 in the Pediatric Emergency Department of a tertiary care hospital. All children under 12 years of age admitted with a history of acute poisoning or envenomation were included. Case records were analyzed for epidemiological profiles, poisoning characteristics, and various clinical variables.

Results: Of 214 patients, 135 (63%) were males. Most were aged 1–3 years (44.85%). Urban residents formed 58.41%. Drugs were the leading poisoning agents (21.96%), followed by mosquito repellent (14.01%), snake bite and corrosives (10.75% each), and paint thinner (7.94%). Over half (52.8%) were asymptomatic. Among symptomatic patients (47.2%), vomiting (39.6%) and altered sensorium (23.76%) were common. Mechanical ventilation was needed in 5.6%, and mortality was 4.2%.

Conclusion: This study indicates that children specially boys, aged 1-3 years, due to their exploratory nature and tendency to put anything in their mouth, are the most at risk of acute poisoning. Drugs and medication were the most common agents followed by mosquito-repellent liquid vaporizers. We also found that corrosive and thinner poisoning was more common if they were stored in empty bottles of soft drinks.

Key-words: Acute poisoning, Emergency, Poisoning, Children, Epidemiology, Mortality

INTRODUCTION

Acute poisoning (AP) is a clinical condition caused by exposure to a toxic substance within the last 24 hours [1]. It is the 4th commonest cause of admission to the Pediatric Emergency Department (PED) followed by trauma, burns, and drowning. Poisoning was found to be the fourth leading cause of accidental deaths among children [2,3].

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The 41st Annual report from American poisoning centers reported 28.1% and 39.8% of overall human exposures in children <3 Years and <5 years respectively [4].

According to the WHO Global Burden of Disease project, accidental poisoning was responsible for the death of over 345,000 people worldwide, out of which about 45000 deaths were reported among children and young people (under 20 years of age). Compared to their developed counterparts, the death rate was four times greater in low- and middle-income nations [5]. It may result via skin contact, ingestion, or inhalation of substances (such as carbon monoxide, plants, or detergents) that are not recommended for ingesting or inhalation.

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In most cases, these substances are minimally toxic but rarely can cause death or be life-threatening [6-8]. The young preschooler or toddler being developmentally immature is prone to accidental poisoning. Once the infant starts crawling, they have this tendency to explore the surrounding environment and put things into their mouths. While accidental poisoning is more common in children under five, particularly those between the ages of 18 months and three, purposeful poisoning is more likely in older children and adolescents [8-10]. Kerosine and other household products are reported to be the most common substances of poisoning in India specially in cities [11-13], while insecticide poisoning is commonly seen in rural areas [14].

Global data about poisoning-related morbidity and mortality is lacking and regional data cannot be compared due to disparity in access to healthcare services [15]. The developed world has accurate information on the incidence of poisoning in children [4,15-17], but developing countries like India lack this information, therefore, the real burden may be far more than being reported. In contrast to affluent nations, Asian nations such as India, Sri Lanka, and Taiwan are thought to have poor and inadequate surveillance of data on poisoning; around 90% of poisoning cases are selectively reported by physicians rather than by the general people [18].

Since childhood poisoning-causing agents have changed over the years due to rapid urbanization and sociocultural changes. Availability of such information may prove crucial both for planning preventive strategies and preparedness of health establishments for the management of the sick. The goal of the current study was to comprehend the etiology, demographic background, incidence, and pattern of poisoning in children under the age of twelve.

MATERIALS AND METHODS

Study Design and Setting- This was a retrospective, observational study conducted in the Department of Pediatrics at a tertiary care hospital in New Delhi, India. The study period spanned two years, from December 2021 to December 2023.

Inclusion Criteria- Children under 12 years of age who were admitted to the Pediatric Emergency Department with a history of acute poisoning or envenomation during the study period were included.

Exclusion Criteria- Patients with known systemic illnesses or documented drug allergies were excluded from the analysis.

Data Collection- Patient records were accessed from the Medical Records Department. Data collected included age, sex, type of poison, presenting symptoms, time elapsed before presentation, treatment administered, hospital course, and outcome. Relevant clinical investigations such as chest X-ray, complete hemogram, liver and renal function tests, PT/INR, and urine examination were reviewed. All cases were managed according to standard treatment guidelines. In each case, expert consultation was sought from the National Poison Information Centre (NPIC), AIIMS, New Delhi.

Statistical Analysis- Data were recorded using a structured proforma and transferred to Microsoft Excel for analysis. Descriptive statistics including frequencies, percentages, means, and medians were used to summarize the findings.

RESULTS

Total patients admitted were 214 of which 63.08% (135) were male. Median age was 4 years (range; 9 months-12 years). Most children were in the 1–3-year age group (n=96, 44.85%), followed by the 3–6-year age group (n=53, 24.76%) (Table 1). The median time of presentation to the hospital was 4 hr, it ranged from 30 min to 18 hr (40 cases presented within 1 hr, 91 cases in 1- 2 hr, 68 cases in 2–6 hr, and 15 cases after 6 hrs).

Table 1: Distribution of Study Participants by Age Group and Gender (n=214)

Age (Years)	Sex		Total, n (%)
	Male, n (%)	Female, n (%)	
< 1	5 (3.70)	9 (11.39)	14 (6.54)
1-3	60 (44.44)	36 (45.56)	96 (44.85)
3-6	35 (25.92)	18 (22.78)	53 (24.76)
6-10	28 (20.74)	9 (11.39)	37 (17.28)
>10	7 (5.18)	7 (8.86)	14 (6.54)
	135	79	214

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Drugs and medications were the most common agent responsible for poisoning in 21.96% (n=47) of cases with antiepileptics being most common (15 cases), followed by Cough syrup (11), Thyroxin tablets (9 cases), Iron syrup (5 cases), Paracetamol (4 cases), Permethrin (2 cases) and Hydroxyzine syrup (1 case). Further, drugs and medication poisoning were found to be more common in the urban population (57.44%) in comparison to the rural population (42.55%).

In our study, Liquid mosquito repellent vaporizers (LMRV) were found to be the most common household product poisoning agent (30 cases;14.01%) and were seen predominantly in the urban population (73.33%). Paint thinner, snake bite, kerosene, turpentine oil, naphthalene balls (Paradichlorobenzene), organophosphorus, corrosive substances, and rat poison were the other agents involved (Table 2). In 64.70% (11/17) cases of thinner exposure and 52.17% (12/23) cases of corrosive poisoning, these toxic compounds were stored in the bottles of popular soft drinks, which may have tempted children to drink the liquid promptly.

Table 2: Types of poisoning and their distribution according to residence

Type of poison	Urban, n (%)	Rural, n (%)	Total cases
Drugs and medications (Antiepileptics, Thyroxin, Iron syrup, Paracetamol)	27 (57.44%)	20 (42.55%)	47 (21.96%)
Mosquito-repellent liquid vaporizer (Prallethrin/Allethrin/Transfluthrin with 97% Deodorised kerosine)	22 (73.33%)	8 (26.66 %)	30 (14.02%)
Snake bite	7 (30.43%)	16 (69.56%)	23 (10.75)
Paint thinner	15 (88.23%)	2 (11.76%)	17 (7.94%)
Kerosine	4 (33.33%)	8 (66.66%)	12 (5.6%)
Turpentine oil	5 (55.55%)	4 (44.44%)	9 (4.20%)
Organophosphorus	1 (14.28%)	6 (85.71%)	7 (3.27%)
Corrosive (Toilet cleaner, acidic and diluted corrosives)	14 (60.86%)	9 (39.13%)	23 (10.75)
Bee sting	2 (40.00%)	3 (60.00%)	5 (2.33%)
Rat poison	4 (66.66%)	2 (33.33%)	6 (2.80%)
Naphthalene balls Paradichlorobenzene	4 (100%)	0 (00%)	4 (1.87%)
Unknown substances	15 (65.21%)	8 (34.78 %)	23 (10.75)
Permethrin	5 (62.50%)	3 (37.5%)	8 (3.74%)
	125	89	214

n: Number of cases

Out of 214 patients, 113 (52.80%) were asymptomatic. Among symptomatic patients, vomiting (39.60%) was the most common symptom followed by altered sensorium (23.76%). Few patients presented with serious manifestations such as breathlessness/irregular respiration (14.85%) and convulsions (7.92%) (Table 3). Of the 30 patients with LMRV poisoning, 18 cases were asymptomatic, while others presented with vomiting (6 cases), respiratory complaints (4 cases), unconsciousness (2 cases), altered sensorium (4 cases), and seizures (2 cases). There was no mortality.

There were 23 cases of snake bite, majority (16/23; 69.56%) were from rural areas. Out of 23 cases, 12 were symptomatic, all of which were neurotoxic. There was no vasculotoxic case, thus revealing a clear preponderance of neurotoxic envenomation. Symptomatic patients were given Anti-Snake Venom Serum (ASVS). Atropine and Neostigmine were also given. Ventilatory support was needed in 7 cases. Prolonged mechanical ventilation (>1 week) was required in 3 cases. Mortality was 8.69% (2/23 cases).

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Table 3: Distribution of Reported Symptoms among Poisoned Children

Symptoms	Number of cases n(%)
Vomiting	40 (39.60%)
Pain in abdomen	25 (24.75%)
Altered sensorium and unconsciousness	24 (23.76%)
Breathlessness/Irregular respiration	15 (14.85%)
Pain and swelling at bite site	13 (12.87%)
Oral burns	12 (11.88%)
Convulsions	8 (7.92%)
Hematemesis	8 (7.92%)
Restlessness and agitation	7 (6.93%)
Diarrhea	6 (5.90%)
Fever	6 (5.94%)
Odor of poison	5 (4.95%)
Urticarial rash	3 (3%)
Asymptomatic	113 (52.80%)

Preadmission interventions included induced vomiting at home in 26 (12.14%) cases and gastric lavage in 36 (16.82%) cases. Mechanical ventilation was required in 12 (5.60%) cases, with snake bite being the leading cause (n=7), followed by hydrocarbon poisoning (n=2). There were 9 fatalities, with poisoning from an unknown substance accounting for 3 deaths, hydrocarbon ingestion for 2, and snakebite and organophosphorus poisoning each contributing to 2 deaths.

DISCUSSION

Acute childhood poisoning is a significant cause of both morbidity and mortality in both developing and developed nations. It accounts for 0.33% to 7.6% of total admissions in pediatric wards across various hospitals in India, though this is likely an underestimate as many cases remain unreported [9]. Consistent with other studies in India, our research found that the most affected age group was 1–3 years. This higher rate of unintentional poisoning in this age group is linked to their exploratory behavior and natural inclination to put objects in their mouths. Additionally, as seen in other studies, a male predominance was observed, with a male-to-female ratio of 1.5:1 [11,12,14].

Drugs and medicines were the most common cause of poisoning in our study. This could be due to the easy availability of over-the-counter medications in our country and a lack of awareness among adults about keeping drugs safely out of reach of children. Roy *et al*. [12] and Devaranavadagi *et al*. [19] have also in their study reported prescription drugs as the most common cause of poisoning in the urban population. Bhat *et al*. [14] in contrast to our study found insecticides and pesticides as the most common agents of unintentional childhood poisoning followed by drugs. It may be explained by a greater number of rural patients in their study in comparison to our study (63.2% vs 41.59%).

Kerosine oil has been reported as the most common agent of childhood accidental poisoning by previous studies from the Indian subcontinent [13,20-22]. However, in our study kerosine was implicated only in 12 (5.6%) cases. Other recent studies have also demonstrated a similar trend [14,23]. This decline in the trend of Kerosine poisoning can be ascribed to a shift in the use of cooking fuel from kerosene to natural gas.

In our study, LMRV emerged as the most common household substance responsible for childhood poisoning. LMRVs are increasingly used in areas affected by malaria and dengue. The liquid formulations available in India typically contain synthetic pyrethroids, such as transfluthrin, prallethrin, and allethrin (~1%), along with deodorized kerosene (97%) as the solvent. Pyrethroids can cause symptoms such as headache, dizziness, impaired consciousness, vomiting, seizures, and coma. Local effects may include mouth ulcers, sore throat, and skin irritation. While cardiac dysfunction has been reported, lung injury is considered rare [24,25].

In our study, 4 cases of LMRV poisoning presented with respiratory symptoms. Reddy *et al*. [26] have reported aspiration pneumonitis as an important presentation in children with LMRV poisoning. As synthetic Pyrethroids present mainly with neurological symptoms so, this pulmonary presentation can be attributed to the hydrocarbon/Kerosine component of LMRVs. Due to its less viscous and highly volatile nature, kerosene has been reported to cause life-threatening lung injuries like aspiration pneumonitis and ARDS (acute respiratory distress syndrome) [27]. So, it can be inferred that LMRV exposure increases the risk of kerosene poisoning even in a setting where it is not used as fuel. We emphasize that LMRV poisoning should be considered as a risk factor for kerosene poisoning. In the absence of a specific antidote, the management of LMRV poisoning is largely supportive of skin decontamination [28].

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Paint thinner was implicated in 7.94% of cases of poisoning in our study which is comparable to the study by Suting *et al*. [23] In our study, snake bite was reported in 10.74% of cases which is lower than a study by Mandal *et al*. [29] (19%), this may be explained by the fact that Mandal et al had 80% cases from rural background. Organophosphorus compounds have been reported to be the most common agent of poisoning in rural areas [14,22,23]. In our study also, it was seen more commonly in the rural population (n=6; 85.71%), as compared to the urban population (n=1; 14.28%).

Overall, vomiting was the most observed symptom in our study, followed by pain and swelling at the bite site. Previous studies have also reported vomiting, pain abdomen, breathing difficulty, and altered sensorium as the common presenting complaints [12,14,20]. Our study observed an overall mortality of 4.2%. Other recent studies have also reported mortality rates comparable to our study [14,19,22,23].

Accidental poisoning in children can be largely prevented by avoiding toxic agents from the immediate environment (e.g. keeping prescription drugs and insecticides out of reach of children), enforcing the use of child-resistant packaging (e.g. Prescription drugs and household chemicals), wearing protective equipment like shoes to prevent snake bite and by advising parents to not store the corrosive agents/ thinner in the used bottles of soft drinks. Further, with continuous changes in the living environment of the children, it becomes imperative for parents and physicians to keep pace with these changes to prevent unwanted and unintentional poisoning in children.

The major limitations of our study were the small sample size, retrospective nature, and a single-center study. Therefore, multicentric studies with large sample sizes are recommended to know about the true epidemiology of acute childhood poisoning.

CONCLUSIONS

Clinico-epidemiological data of acute accidental poisoning is of crucial importance especially in 1-3 years age group children, since these children are found to be most vulnerable in our study. Sufficient awareness among parents and caregivers can be of immense help in decreasing poisoning-related morbidity and mortality. Therefore, it becomes essential for the pediatrician to educate parents sensitively to prevent exposure to household poisons from the first visit to the clinic.

CONTRIBUTION OF AUTHORS

Research concept- Vimal Kumar Nag, Deepak Bhasin
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Data analysis and Interpretation- Deepak Bhasin
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