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Original Research Article

Clinicoetiological profile and outcomes of acute poisoning in children: experience in a tertiary care centre in North India

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ABSTRACT

Background: Pediatric poisoning is one of the most commonly presenting emergencies. Children due to their playful and inquisitive nature consume substances that are harmful to them unintentionally. Poisoning is also seen with the ideation of self-harm. Understanding the etiology and clinical profile of the commonly consumed poisons in children will help in proper management. Aims and objectives were to study the clinical profile and outcome of children presenting with poisoning in a tertiary care hospital.
Methods: This prospective observational study was conducted over a span of 18 months including 211 patients. Appropriate statistical tests were applied and the results were extracted.
Results: Accidental poisoning (86.3%) was more frequently observed in males (50.7%), whereas intentional poisoning (13.7%) was more common in adolescent girls (p value=0.007). Longer durations before admission were associated with higher mortality rates (p value <0.0001). Household products (24.6%) were the leading cause of poisoning in children followed by organophosphate poisoning (22.3%), pharmacological drug intake (19%), corrosive intake (12.3%), Celphos poisoning (11.4%), food poisoning (3.8%), plant-based poisoning (3.8%) and rat poison intake (2.8%). Overall, out of the 211 cases, 197 (93%) patients were discharged with follow up advice, while 14 (7%) unfortunately succumbed to their death.
Conclusions: Spreading awareness in the community, educating children and their parents, keeping harmful substances away from children, ensuring mental well-being of adolescents, prompt treatment as per protocol and timely referral to a health center where adequate facilities are available will drastically improve the outcome and significantly reduce morbidity and mortality.

Keywords: Intensive care, Mortality, Poisoning, Suicidal ideation

INTRODUCTION

Acute poisoning in children is one of the major medical emergencies with significant morbidity and mortality. Owing to their curious and exploratory nature, children may often consume harmful substances unknowingly. This accidental ingestion or exposure in the pediatric age group makes poisoning a common preventable emergency all over the world.

The profile and outcome of children that present in the emergency setting depend on factors like socio economic status, cultural practices followed by the family, educational background of the parents and the access to health care.[1]

Worldwide, the incidence of poisoning seen in the pediatric age group varies from 0.33 to 7.64% of the total admissions.[2]

Major poisonings seen in the Indian population include household and agricultural products, and pharmacological drug intake. Dose of the poison consumed makes a huge difference on the outcome.

Accidental poisoning can be reduced through proper education of parents and by keeping poisonous substances out of children's reach. Rapid globalization and increased stress have heightened the risk of suicidal poisoning. A medico legal perspective also has to be kept in mind while dealing with these cases. Such cases are mainly seen among adolescents and children in troubled households. Often underlying psychiatric illnesses (e.g. depression, manic disorders, and learning disabilities) play a role. As such, a careful examination of such patients has to be done keeping the aspect of mental and emotional health of the child in mind.

Need of study

Poisoning cases in the pediatric age group are of utmost urgency and need to be dealt in an emergency setup with minimal time period between the onset of ingestion or exposure to the poison and the initiation of treatment.

Statement of problem

The present study deals with clinical profile and outcome of children presenting with suspected poisoning in a tertiary hospital setup. The incidence and prevalence of acute poisoning and intoxication cases was extracted from the data of admissions from children hospital and pediatric intensive care unit of department of pediatrics, Ganesh Shankar Vidyarthi Memorial and Lala Lajpat Rai hospital Kanpur. The patients were managed as per unit protocol and outcomes evaluated.

Aims and objectives

Aims and objectives were to study the clinical profile of children presenting with poisoning; and to study the outcome of children presenting with poisoning.

METHODS

Study design

It was a prospective observational study**.**

Study setting

The study was conducted in the pediatric intensive care unit of Department of Pediatrics, GSVM Medical College Kanpur from May 2023 to July 2024.

Duration of study

The duration of the study was for 14 months (from May 2023 to July 2024).

Sample size calculation

The prevalence of acute poisoning and intoxication cases was extracted from the data of admissions of Department of paediatrics, GSVM Kanpur. The prevalence of acute poisoning and intoxication cases was found to be approximately 0.5 i.e. 5 out of 100 cases that were admitted to the emergency ward of children hospital and PICU were of acute poisoning and intoxication in the month of September 2022.

Sample size was extracted using the formula given.

$$Sample\ size = 4 \times PQ/d^2$$

Here, p=prevalence of poisoning cases, Q=1-prevalance, D=permissible error.

$$Sample\ size = \frac{4 \times 5 \times 95}{3 \times 3} = 211$$

Statistical methods

Data was coded and recorded in Microsoft excel spreadsheet program. Statistical package for the social sciences (SPSS) v 23 (IBM Corp.) was used for data analysis.

Descriptive statistics were elaborated in the form of means/standard deviations and medians/IQRs for continuous variables, and frequencies and percentages for categorical variables. Data were presented in a graphical manner wherever appropriate for data visualization using histograms/box-and-whisker plots/column charts for continuous data and bar charts/pie charts for categorical data.

Group comparisons for continuously distributed data were made using independent sample ‘t’ test when comparing two groups.

For non-normally distributed data, Wilcoxon test was used. Chi-squared test was used for group comparisons for categorical data. Fisher’s exact test was used when the expected frequency in the contingency tables was found to be <5 for >20%. Linear correlation between two continuous variables was explored using Pearson’s correlation (for normally distributed data) and Spearman’s correlation (for non-normally distributed data). Statistical significance was kept at $p<0.05$.

Paired analysis for continuous variables was carried out using paired t-test. For non-parametric data, Wilcoxon signed rank test was used. When comparing more than two continuous variables, repeated measures analysis of variance (ANOVA)/Friedman test were used.

RESULTS

The study was conducted over a time span of 14 months (from May 2023 to July 2024) in the department of pediatrics, GSVM Medical College and Lala Lajpat Rai Hospital to understand the clinical profile and outcome of children presenting with poisoning and intoxication.

The study included a total of 211 subjects aged 1 to 17 years presenting with suspected poisoning. In certain cases, where no history of exposure to poison could be certainly elicited, patients with identifiable toxidromes were treated as such. The patients were managed according to the protocol and sub grouped into different etiologies and outcomes were observed.

Key observations

Most common poison

Organophosphates and household products are the most commonly reported poisons in several studies.

Route of exposure

Oral ingestion is the most frequent route of exposure, except for the study by Yousef et al., where skin exposure was predominant (84%).

Intent

Most studies report accidental poisoning as the leading cause, with a few focusing on intentional poisoning (e.g., Fernando et al., 2020).

Survival rates

Survival rates vary from 83% to 100%, with some studies indicating higher survival rates for accidental poisonings.

The mean age of the study participants was 7.44 years (5.53). Out of the 211 admissions, 50.7% (117) of the participants were male and 49.3% (104) of the participants were female. Thus, the incidence was higher in males compared to females.

In our study we noted that 86.3% of the participants had accidental exposure or ingestion of the poison while 13.7% had intentional exposure - mostly suicidal or after emotional disturbance due to disturbed household or personal relationships.

A significant association was noted between 'gender' and 'intent'. Accidental poisoning was more commonly noted among the males. Intentional poisoning (mostly suicidal) was seen more in females (20.2%, commonly among the adolescents).

It was noted that age also correlated significantly with the intent of poisoning. The mean age in accidental poisoning was 5.99 years while in the intentional poisoning it group was 16.55 years. This consolidated the fact that toddler and school going age group was more inclined to unintentional poisoning due to their inquisitive nature while the intent of self-harm or emotional disturbance leading to suicidal ideation and subsequent use of poisons was more commonly noted in the age group >15 years.

Etiology of the poisoning was studied and the distribution pattern among the 211 participants was noted to understand the clinical profile of the poisoning. Household products including kerosene, petrol, diesel, naphthalene balls, vermillion etc. emerged as the leading cause of poisoning across all age groups. (52 cases were reported accounting to 24.6% of the cases). The cause of this was easy access and availability in every household.

The sale of kerosene in cola and plastic bottles and use in household for cleaning and cooking purposes made it one of the most common causes of poisoning in children.

This was followed by organophosphate and pesticide group of poisoning of which 42 cases (22.2%) were seen. They were predominant in the families with agricultural background. Organophosphate use was also seen in the few noted cases of intentional poisonings in adolescents who had either suicidal ideations or due to emotional disturbance from troubled households.

Pharmacological drug intake, seen in 40 cases (19% cases), was another leading cause of poisoning in which the children were either exposed due to their curious nature or mimicking their parents who consume these medicines. Poisoning was seen due to overuse of paracetamol syrup, anti-epileptics, anti-thyroid, anti-diabetic, anti-psychotic medication. The major determinant in these poisons was the amount of drug consumed and the duration which the patient took before presenting in emergency.

Corrosives including acid and alkali seen in 26 cases (12.3%) also formed a part of the poisoning group. These were mostly unintentional and were caused due to intake of these substances from plastic and cola bottles by mistake. Their use in household and industrial cleaning was the major cause of availability of these poisonous substances.

Celphos poisonings seen in 24 cases (11.4%) were also reported in the pediatric age group. Use of celphos was also seen in few reported intentional poisonings. Celphos poisoning was associated with high mortality, corroborating with the results noted by Sharma et al who stated that amongst 30 admitted patients of celphos poisoning, 14 did not survive.[3] Plant based poisonings seen in 8 cases (3.8%), mainly from rural background including opioids and dhatura poisonings were also noted. A few cases of food poisoning reported to the emergency department were included in the study. Rat poisoning was seen in 6 cases (2.8%). it was mainly unintentional.

After understanding the etiology of the poisonings, it was of utmost importance to see the clinical profile and the presentation of these poisonings. The chief complains of the major poisonings were noted and their frequencies were studied. The presenting features of the major poisonings studied were aligned on the basis of their frequency.

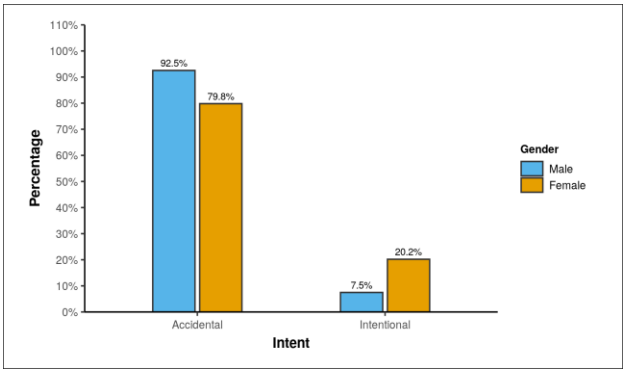

Figure 1: Accidental versus intentional poisoning.

Table 1: Correlation between age and outcome.

Age (years)	Outcome		Wilcoxon-Mann-Whitney U Test	
	Discharged	Died	W	P value
Mean (SD)	7.14 (5.40)	10.19 (6.01)	1313.00	0.010
Median (IQR)	5 (3-12)	9 (4-17)		
Min – max	1-17	2-17		

Table 2: Chief presenting complaints of the patients.

Chief complaints	Frequency	Percentage
Loose stools, vomiting	50	23.47
Difficulty in breathing	39	18.31
Dull lethargic drowsy	22	10.33
Altered consciousness	14	6.57
No significant complaint	12	5.63
Difficulty in swallowing, speaking	11	5.16
Blood in vomit	11	5.16
Dizziness	11	5.16
Excessive secretion	10	4.69
Pain	6	2.82
Anxiety, tachycardia	6	2.82
Tremor	6	2.82
Cough	5	2.35
Fever	4	1.88
Dilated pupils	4	1.88
Difficulty in walking	2	0.94

There was a weak negative correlation between duration of stay (days) and age (years), and this correlation was statistically significant (rho= -0.18, p=0.010). The duration of stay (days) ranged from 1–15 with a mean of 4.73 days. The median (IQR) of duration of stay was 4.00 days. It was found that children with the mean age of 5.40 had a longer hospital stay than children with mean age of 6.01 and more.

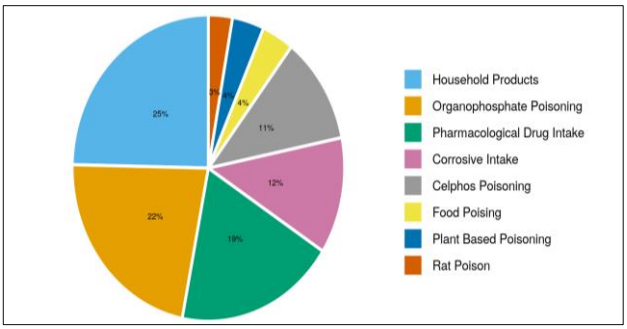

Figure 2: Distribution of participants on the basis of etiology.

Table 3: Correlation between age and need for mechanical ventilation.

Age (years)	Need for mechanical ventilation		Wilcoxon-Mann-Whitney U Test	
	Yes	No	W	P value
Mean (SD)	8.60 (5.69)	10.19 (6.01)	6456.50	0.008
Median (IQR)	6 (4-15)	9 (4-17)		
Min – max	1-17	1-17		

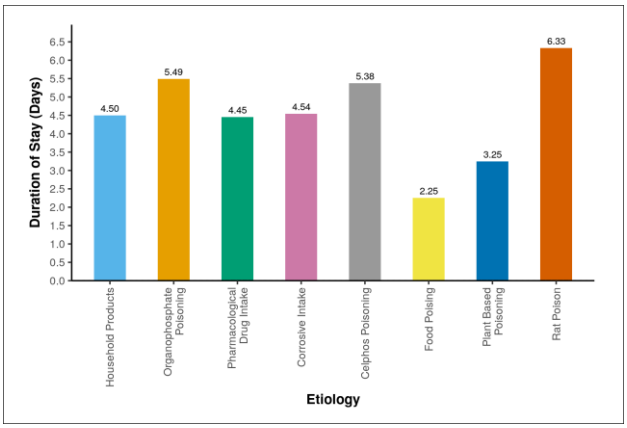

Figure 3: Distribution of duration of stay of study participants.

Age of the participants was significantly correlated with the outcome of the poisoning. Younger children had a better chance of survival in the cases of poisoning as compared to older children.

Need for mechanical ventilation in the patients was evaluated and it was found that 83 (39.3%) of the patients needed mechanical ventilation while 122 (60.7%) had no need of mechanical ventilation. More number of older children required mechanical ventilation as compared to the younger age group. Among poisons, organophosphorus and celphos poisoning included the

maximum number of patients requiring mechanical ventilation (55.3% and 54% respectively).

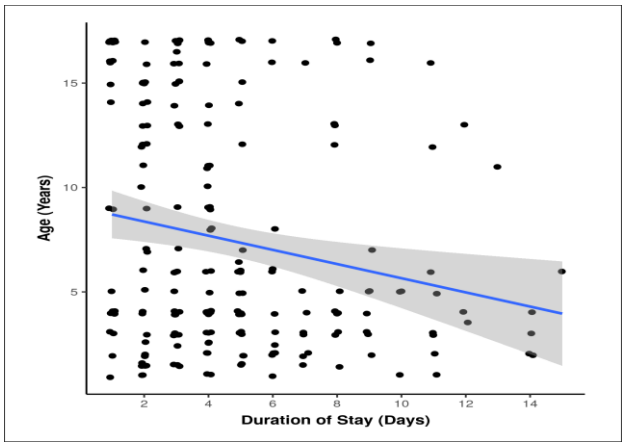

Figure 4: Correlation between duration of stay and age.

Table 4: Correlation between duration before admission and outcome.

Variables	Duration before admission (hours) versus outcome
Spearman r	
R	-0.3445
95% confidence interval	-0.4614 to -0.2158
P value	
P (two-tailed)	<0.0001*

*Significant

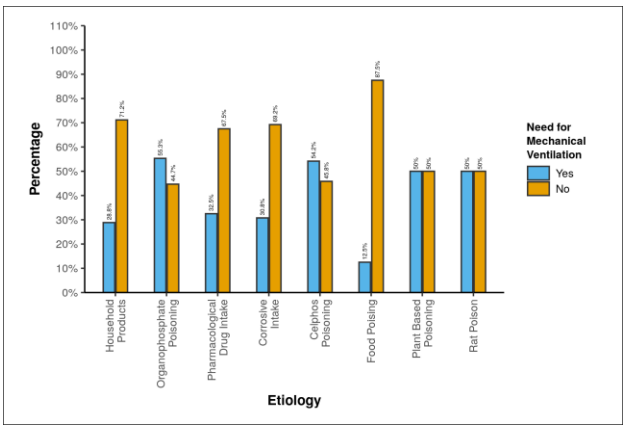

Figure 5: Mechanical ventilation versus etiology.

Multiple factors influence the outcome of poisonings including the route amount and duration of exposure, the time interval between exposure and availability of healthcare facilities and the management protocol followed.

A significant correlation was seen between the time elapsed after exposure to poison and outcome with longer duration before admission was associated with higher mortality.

197 of the admitted patients were discharged while 14 of the admitted patients could not survive. Maximum mortality was seen in patients coming with celphos poisoning, with a mortality rate of 54.17%. All of them required mechanical ventilation. Best survival rates were observed with household products, pharmacological drug intake, food and plant-based poisoning.

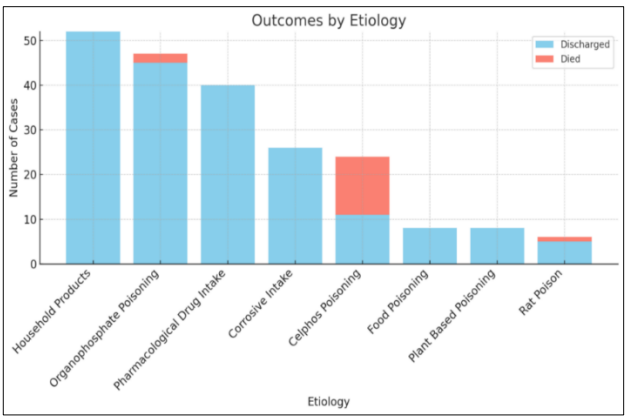

Figure 6: Outcome of admitted patients.

Understanding the clinical profile, its presentation, management protocol and outcome will help us identify these poisonings earlier and significantly reduce morbidity and mortality.

DISCUSSION

Poisoning is a preventable cause of morbidity and mortality. Understanding the clinical profile, its presentation, management protocol and outcome will help us identify poisonings earlier and significantly improve the outcomes. Studies show that most poisoning incidents involve oral ingestion, occurring at home and often unintentionally. In countries which are classified as developing, rapid industrial growth and changing living conditions, without a corresponding rise in education status and awareness, significantly contribute to poisoning from industrial chemicals, medications, pesticides, and insecticides. This change in trend was noted in the study done by Jha et al.[4]

A lot of factors influence the outcome of poisonings including the route amount and duration of exposure, the time interval between exposure and availability of healthcare facilities and the management protocol followed. In most cases of poisoning females were more in number like the study done by Grabska et al while in our study males outnumbered females.[5] Among the 39 cases examined in our study, the incidence was higher in males (53.8%) compared to females (46.2%). This finding aligns with a study conducted in Mangalore by Ramesh et al, which reported that 75.4% of poisoning cases occurred in

males. Similarly, a study by Maharani et al produced comparable results.[6-8]

The mean age of the study participants in our study was very different from the study done by Ramawat et al in wherein 74% of the participants were under 5 years old.[9] Our results were comparable to the study done by Palimar et al where the most affected age group was 1-5 years (38.82%).[4] Most of the cases of poisoning were seen in developing countries and the lower socio-economic status. In our study it was seen that lower middle class was most frequently affected class. This was comparable to the results shown by Sultana et al wherein incidence of lower socio-economic strata was higher than upper socio-economic strata.[10] But this contradicted the study by Arpitha et al where in most of the individuals belonged to the upper-lower class and were residents of urban areas.[11] Time of presentation after exposure to poisoning was of utmost importance as early presentation had better chances of survival and better management as per protocol. Our study noted that earlier presentation to the emergency department had a significant impact on survival. It was similar to the study done by Srinivas et al where it was found that the highest number of patient fatalities occurred when admission to the hospital was delayed by more than 8 hours after exposure.[12]

In our study we noted that 86.3% of the participants had accidental exposure or ingestion of the poison while 13.7% of the participants had exposure which was intentional. The intent was mostly suicidal or after emotional disturbance due to a disturbed household or personal relationships. In a similar study by Fernando et al out 277 patients admitted for poisoning 73.6% were considered intentional poisonings.[7] In another study done by Kumar et al it was stated that accidental poisoning accounted for the major part of admissions in the emergency setting (94.67%).[12] In our study, 167 of the 211 enrolled participants had normal PT/INR while 44 had a deranged PT/INR profile. We studied the arterial blood gas of the 211 patients and it was noted that 55% had normal arterial blood gas reports while 45% had a deranged arterial blood gas report. The average duration of stay in our study was 4.73 days.

The need for mechanical ventilation in the 211 poisoning patients was evaluated and results were in sync with the study conducted by Datta et al who found that the need for mechanical ventilation was observed in 36% of the patients admitted for organophosphate poisoning.[13] The clinical profile depended on the intake of poison and the time of presentation of the child to the emergency ward. We noted that household products including kerosene, petrol, diesel, naphthalene balls, and vermillion were the most common cause of poisoning across all age groups. Our results were similar to the deductions of Kumar et al and Ghosh et al who noted that household products were the major cause of poisoning in the pediatric age group.[12,14] Jayashree et al also noted that hydrocarbons and household products also accounted for the majority of the poisonings.[15] It was contradictory to the study done by Jha et al at RIMS Ranchi wherein pesticides including organophosphates, carbamates and organochlorides emerged as the leading cause of poisoning in the age group 0-4 years.[4] This was mainly due to their easy availability and widespread access.

Qazi et al stated that organophosphorus compounds were the most common cause of poisoning across all age groups in their study conducted at GMC, Jammu.[16] We noted that organophosphates were the second most common cause of poisoning across all age groups. Pharmacological drug intake was a major cause of poisoning in children. Children consumed medicines mimicking their parents and elderly of the household. Some children also had overdose of the medications they were already on including anti-epileptics. Common over the counter medications like paracetamol when given in toxic doses caused the child to land up in poisoning. Corrosive substance like acid and alkali intake was seen mostly unintentionally. The damage caused by corrosive substances depends mainly on the nature of the substance that is alkaline or acidic and the amount of substance consumed. Plant based poisons including dhatura and opioid poisoning was seen in a few cases mainly from rural background due to unintentional intake of dhatura seeds by children. A few cases of rodenticide poisoning were also reported. As noted by Sharma et al who observed that amongst 30 admitted patients of celphos poisoning, 14 did not survive, we also found a higher rate of mortality in patients admitted with celphos poisoning.[3] One of the most important steps in maintaining children's health is to increase information and awareness about the various types of poisoning and how to prevent them through seminars, media, television, schools, and health centers. This was noted by Agarwal et al.[17] The duration before which the child got to the hospital had a great impact on the mortality of the child since lesser duration improved the chances of survival.

Limitations

The study had a small sample size hence the findings might not be generalizable to the broader population. The study was conducted at a single centre. Children presenting to a hospital may not represent all cases of poisoning and intoxication, particularly mild cases that might not seek hospital care. We did limited follow-up so there is chance of missing long-term outcomes or complications arising from poisoning.

CONCLUSION

Poisoning in children is a major, largely preventable medical emergency, leading to significant morbidity and mortality. Accidental poisoning was far more common than intentional poisoning. Males had a higher incidence of accidental poisoning while females were leading in intentional poisoning.

Resource limited countries like India, it is important to have prior information on poisoning and their presentation in terms of different toxidromes so that the frequently occurring poisonings can be dealt at grass root level and initial stabilization and management can be initiated at the earliest. Understanding the clinical profile of common pediatric poisonings will thus improve the outcomes significantly.

Basic first aid and early access to healthcare facilities will help in reducing the morbidity and mortality of these poisonings significantly.

Recommendations

Although strict norms by government have ensured reduced sale of petrol and diesel products in canisters, there is still prevalence of keeping diesel and petrol at homes for use in agricultural, farming and cooking purpose. Naphthalene balls kept to keep away bugs in storage containers are also consumed by children and are very detrimental to their health.

Medications should be kept in sealed containers away from the reach of children.

Careful administration of medicines like anti-epileptics, anti-diabetics, anti-psychotics is of utmost importance. Parental education plays a great role in these poisonings and these accidents can be controlled to a great extent by spreading awareness to the caretakers.

Information about basic toxidromes and their management and source control should be disseminated among medical workers at all levels to ensure better patient outcomes.

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