

Incidence Patterns, Severity, And Outcomes of Acute Poisoning Cases Presenting to a Tertiary Care Emergency Department

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Abstract:

Background: Acute poisoning is a major public health concern, contributing to significant morbidity and mortality, particularly in developing countries. Emergency departments frequently encounter poisoning cases, with patterns varying by age, gender, and type of poison.

Aim: To evaluate the incidence patterns, severity, and outcomes of acute poisoning cases presenting to a tertiary care emergency department.

Methodology: A hospital-based observational study was conducted at Department of Medicine, Nalanda Medical College and Hospital, Patna, India, over 12 months. A total of 120 patients aged >11 years presenting with acute poisoning were enrolled. Data on demographics, poisoning type and mode, time to hospital, clinical severity, and outcomes were collected using a structured questionnaire and analyzed using SPSS.

Results: The majority of cases were young adults (21–30 years, 35%), with males predominating (60%). Intentional self-poisoning accounted for 73.3% of cases. Organophosphorus compounds (38.3%) and alkalis (23.3%) were the most common poisons. Most patients (43.3%) arrived within 2–6 hours of exposure. Poisoning severity was mild to moderate in 80% of cases. Overall, 81.7% recovered, 11.6% experienced complications, and 6.7% died. Recovery rates were higher in accidental (93.8%) than intentional cases (77.3%).

Conclusion: Acute poisoning predominantly affects young adults, with intentional ingestion of readily available chemicals being most common. Early hospital presentation and prompt management result in favorable outcomes, highlighting the need for preventive strategies, public education, and integrated medical-psychological interventions.

Keywords: Acute poisoning, incidence, severity, outcomes, emergency department, organophosphorus, self-harm.

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Introduction

A major and persistent threat to public health on a global scale remains that of poisoning, which is responsible for a large number of deaths and illnesses globally [1]. In recent years, there has been a steady rise in the number of deaths related to poisoning due to changes in human day-to-day behaviours, increased industrialisation, and agricultural methods, as well as the broadening of access to these poisons. Of the many different forms of physical injury that people experience; poisoning is the one of the most common, as it sits between death by falls, burns, deaths via drowning, and other forms of either accidental or intentional injury [2]. Poisoning is a significant issue for both Emergency Room and Public Health Services, as it is often seen in a variety of ways in Emergency Room departments worldwide.

The majority of visits to Emergency Rooms due to poisoning are due to intentional self-poisoning (or suicide) [3]. Although data on the true incidence of poisoning is difficult to determine as many incidences of poisoning are under-reported, incorrectly classed or inadequately monitored by any uniform method, it is obvious that the ease with which people can access a wide variety of toxic substances, including: prescription medications, pesticides, domestic cleaning chemicals and industrial chemicals significantly increases the chance of someone experiencing a poisoning incident [4]. Access to a wide variety of toxic substances is becoming increasingly frequent in Low/Middle Income countries and the chances of people being poisoned, either

intentionally or unintentionally, due to their availability has also increased.

For emergency physicians, toxicologists, and public health practitioners, it is important to be knowledgeable about how to manage poisoning situations; therefore, understanding how poisoning occurs is very useful in developing the medical care of those who have been poisoned [5]. It is also important to recognize that the way poisoning occurs varies widely; thus, there are substantial differences in how poisoning occurs in regions and times and among social and economic groups. The differences in the different ways poisoning occur are primarily related to the following factors: health conditions/health practices (socioeconomic), occupational exposure, culture, mental health, and legal regulations concerning toxic substances. This means that the availability of epidemiological data regarding poisonings for each specific region is very important for the effective planning, prevention, and appropriate utilization of medical resources associated with poisonings. In addition, the use of epidemiological data can help to inform policy measures to reduce the number of people who become exposed to highly toxic substances and to improve their recovery from those exposures.

Many studies have evaluated how poisoning happens to individuals using a variety of methods, such as hospital-based studies, multicenter studies, and poison control center surveillance [7]. Based on the results of these studies, it is clear that there are very different experiences of how poisoning happens between developed and developing countries. Developed countries tend to associate poisoning with intentional exposure (deliberate poisoning), often through medication, alcohol, and household products such as cleaning agents and/or household chemicals [8]. Conversely, developing countries have higher rates of poisoning from agricultural chemicals, especially pesticides, largely due to the availability of those pesticides and the lack of controls on their use [9].

Acute poisoning cases include suicide and represent an important aspect of acute poisoning; young adults comprise most of the demographic affected by these types of cases. Self-poisoning is one of the most prevalent means of committing suicide worldwide [10]. The method of self-poisoning is prevalent in all regions of the world as one of the most common forms of suicide and self-harm, whereas it appears to be the predominant means of suicides and self-harms in many developing countries and some developing countries. An impulsive act involving the deliberate ingestion of substances that are highly toxic and readily available, particularly, pesticides, makes up a large majority of unnecessary deaths and long-term disabilities related to self-poisoning cases [11]. This is a significant problem in many Asian countries, where the ingestion of pesticides is a

significant cause of annual suicide deaths and a considerable public health problem [12]. Comparative statistics show that in many Asian countries the percentage of deaths by poisoning, especially pesticide poisonings, are much higher than in Western countries. For example, in the province of China, the case fatality rate for pesticide art poisonings has been documented as high as 5.5% [13]. In India, over 85% of all poison-related deaths are due to pesticide poisonings, whereas in both Sri Lanka and Pakistan, pesticide case fatality rates have been reported as high as 10%, with some pesticides case demonstrating case fatality rates in excess of 50%. Because of high rates of unintentional injurious exposures to household products, there is an urgent need to improve poison control and education, especially in underdeveloped countries to prevent deaths from unintended poisoning.

In India, poisoning is one of the leading reasons for visits to hospital emergency rooms; it displays common trends present across the South Asian region and in the socioeconomic environment. This study examines the high rates of accidental poisoning that occur in Pakistan with a focus on the population of people of Asian heritage. Chemicals used around the home, medicine and pesticide use continue to be a major health risk in communities where victims were poorly educated as to when to report an injury, were poorly educated on safe storage methods, or have limited access to treatment.

Different types of poisoning (i.e., acute vs. chronic) are distinguished by the manner in which they present to the consumer and to healthcare providers. Acute poisoning typically occurs in predictably dangerous circumstances, allowing for relatively rapid diagnosis and treatment. Chronic poisoning is frequently much more difficult to recognize. Chronic poisoning is typically diagnosed in an individual with a prolonged exposure to a toxic substance and symptoms that are less specific than that seen in acute poisoning [15]. The difficulty in diagnosing chronic poisoning highlights the importance of early diagnosis and treatment as well as an epidemiological approach to the recognition of poisoning patterns.

The important effects of poisoning on emergency medical treatment and the high numbers of deaths and illnesses due to poisoning (especially in less-developed parts of the world) suggest a need for more regional data on the incidence and severity of acute poisoning in a tertiary care emergency department. An examination of acute poisoning cases presenting to a tertiary care emergency department will allow us to identify current trends and at-risk populations, as well as outcomes associated with poisoning. This information is necessary for developing preventive strategies, improving protocols for managing emergencies, and developing public health initiatives to

decrease the burden of poisoning on poor and vulnerable populations.

Methodology

Study Design: This was a hospital-based observational descriptive study conducted to evaluate the incidence patterns, severity, and outcomes of acute poisoning cases presenting to a tertiary care emergency department.

Study Area: The study was carried out in the Department of Medicine, Nalanda Medical College and Hospital (NMCH), Patna, Bihar, India.

Study Duration: The study was conducted over a period of 12 months from February 2024 to January 2025.

Sample Size: A total of 120 patients with acute poisoning were included in the study.

Study Population: The study population comprised consecutive patients aged more than years who presented with acute poisoning and were admitted to the Emergency Department of NMCH during the study period.

Data Collection: Data collection was carried out prospectively for all eligible patients presenting with acute poisoning to the Emergency Department of Nalanda Medical College and Hospital, Patna, Bihar, during the study period. After screening for inclusion and exclusion criteria and obtaining informed consent from the patient or their legal guardian, information was collected using a pre-designed and pre-tested structured questionnaire. Data were obtained through direct interviews with patients or accompanying attendants when the patient was unable to respond, along with a review of emergency case records and treatment charts. The collected information included demographic details, type and mode of poisoning, intent of poisoning, time interval between exposure and hospital arrival, clinical severity at presentation, therapeutic interventions provided, and patient outcomes. Efforts were made to ensure completeness and accuracy of data, and all information was recorded confidentially and used exclusively for research purposes.

Inclusion Criteria

- Patients aged >11 years
- Patients presenting with acute poisoning
- Patients admitted to the Emergency Department
- Patients (or legal guardians) who provided informed consent

Exclusion Criteria

- Snake bite cases
- Food poisoning cases
- Dog bite cases
- Poisoning due to fumes or gases
- Patients who were not admitted to the emergency department
- Patients who did not provide consent

Procedure: All eligible patients presenting to the emergency department with acute poisoning were screened based on inclusion and exclusion criteria. After obtaining informed consent, data were recorded using the structured questionnaire. Patients received standard emergency medical care as per hospital protocols. The type of poison was identified based on patient history, clinical features, and available evidence (containers, prescriptions, or reports).

Due to easy availability of medications with or without prescription, a wide range of drugs were reported. Organophosphorus compounds were the most commonly involved agents, likely due to their widespread household availability, followed by alkaline substances.

Statistical Analysis: The collected data were entered into Microsoft Excel and subsequently analyzed using the Statistical Package for Social Sciences (SPSS). Descriptive statistical methods were employed to summarize demographic and clinical variables. Continuous variables were expressed as mean, mode, and standard deviation, while categorical variables were presented as frequencies and percentages. Inferential statistical analysis was performed using Pearson's Chi-square test and likelihood ratio to assess associations between categorical variables. Correlation analysis and contingency coefficient were applied for cross-tabulation of relevant variables to evaluate the strength of associations. Graphical representations of data were generated using Microsoft Excel. A p-value of less than 0.05 was considered statistically significant."

Result

Table 1 shows the age-wise distribution of 120 acute poisoning cases. The majority of patients were aged 21–30 years, accounting for 42 cases (35%), followed by 12–20 years with 28 cases (23.3%), and 31–40 years with 26 cases (21.7%). Patients aged 41–50 years and above 50 years comprised 14 (11.7%) and 10 (8.3%) cases, respectively. Overall, Table 1 indicates that young adults and adolescents formed the largest proportion of acute poisoning cases in this study.

Age Group (Years)	Number of Cases (n)	Percentage (%)
12–20	28	23.3
21–30	42	35
31–40	26	21.7
41–50	14	11.7
>50	10	8.3
Total	120	100

Table 2 presents the gender distribution of 120 study participants. Males constituted the majority with 72 cases (60%), while females accounted for 48 cases

(40%). Overall, Table 2 indicates a higher prevalence of poisoning among male participants in this study population.

Gender	Number of Cases (n)	Percentage (%)
Male	72	60
Female	48	40
Total	120	100

Table 3 shows the mode of poisoning among 120 study subjects. Intentional poisoning (self-harm) was the predominant mode, reported in 88 cases (73.3%), while accidental poisoning occurred in 32

cases (26.7%). Overall, Table 3 indicates that the majority of poisoning cases were intentional rather than accidental.

Mode of Poisoning	Number of Cases (n)	Percentage (%)
Intentional (Self-harm)	88	73.3
Accidental	32	26.7
Total	120	100

Table 4 presents the distribution of types of poisons consumed among 120 cases. Organophosphorus compounds were the most common, involved in 46 cases (38.3%), followed by alkalis in 28 cases (23.3%) and drug overdose in 22 cases (18.3%). Rat poison accounted for 14 cases (11.7%), while other

types of poison were reported in 10 cases (8.4%). Overall, Table 4 indicates that chemical agents, particularly organophosphorus compounds and alkalis, were the predominant substances involved in poisoning incidents.

Type of Poison	Number of Cases (n)	Percentage (%)
Organophosphorus compounds	46	38.3
Alkalis	28	23.3
Drug overdose	22	18.3
Rat poison	14	11.7
Others	10	8.4
Total	120	100

Table 5 shows the time interval between poison intake and hospital arrival among 120 cases. A total of 34 patients (28.3%) reached the hospital within 2 hours, 52 patients (43.3%) arrived between 2–6 hours, and another 34 patients (28.4%) presented

after more than 6 hours. Overall, Table 5 indicates that the majority of patients (43.3%) sought medical care within 2–6 hours of poisoning, while prompt (<2 hours) and delayed (>6 hours) arrivals were equally represented.

Time Interval	Number of Cases (n)	Percentage (%)
< 2 hours	34	28.3
2–6 hours	52	43.3
> 6 hours	34	28.4
Total	120	100

Table 6 presents the severity of poisoning at the time of presentation among 120 cases. Mild poisoning was observed in 44 patients (36.7%), moderate poisoning in 52 patients (43.3%), and severe poisoning

in 24 patients (20%). Overall, Table 6 indicates that most patients presented with mild to moderate poisoning, while one-fifth of cases were severe at admission.

Severity	Number of Cases (n)	Percentage (%)
Mild	44	36.7
Moderate	52	43.3
Severe	24	20
Total	120	100

Table 7 summarizes the clinical outcomes of 120 acute poisoning cases. A majority of patients, 98 cases (81.7%), recovered fully, while 14 patients (11.6%) experienced complications. There were 8

deaths (6.7%) reported. Overall, Table 7 indicates that most cases of acute poisoning had favorable outcomes, with a relatively low mortality rate.

Outcome	Number of Cases (n)	Percentage (%)
Recovered	98	81.7
Complications	14	11.6
Death	8	6.7
Total	120	100

Table 8 shows the association between the mode of poisoning and patient outcomes among 120 cases. Of the 88 patients with intentional poisoning, 68 (77.3%) recovered, while 6 (6.8%) died. In contrast, among the 32 patients with accidental poisoning, recovery was higher at 30 patients (93.8%), with 2

deaths (6.2%). Overall, out of 120 patients, 98 recovered and 8 died. Table 8 indicates that recovery rates were higher in accidental poisoning compared to intentional poisoning, although the mortality rates were similar between the two groups.

Mode of Poisoning	Recovered n (%)	Death n (%)	Total
Intentional	68 (77.3)	6 (6.8)	88
Accidental	30 (93.8)	2 (6.2)	32
Total	98	8	120

Discussion

The findings from our research of patients with acute poisoning who went to a tertiary care emergency department show that most of these patients were in the age range of 21-30 years old with 35% of cases being in this age group, and other affected groups were made up of 12-20 years (23.3%) and 31-40 years (21.7%). This trend is consistent with earlier studies that indicate that the majority of poisonings arise among adolescents and young adults as they have increased risks of intentional self-harm related to psychosocial pressures, family disputes or financial insecurity (Spiller et al., 2020; Thakali et al., 2022) [16,17]. However, some studies recorded lower peak ages and indicated the age group 11-25 years contributed to 70.2% of poisoning cases, indicating potential geographical variances regarding initial exposure to poisoning risk. Data indicating male predominance was identified in the current study (60%) and is consistent with data from Pakistan that indicated that men are at a higher risk of exposure (Amir et al., 2019)[18], while data from other countries

such as rural India and Egypt reported higher numbers of women requiring medical care for unintentional self-harm, primarily through intentional self-poisoning (Gonzalez-Urdiales et al., 2021; Kasemy et al., 2022)[19,20]. The variations in gender distributions could reflect cultural, social, or productivity-related factors that contribute to the likelihood of a person experiencing exposure to toxic substances.”

In our cohort, 73.3% of individuals who intentionally self-poisoned were categorized as intentional self-poisoning cases. Accidental poisoning represented 26.7% of our overall cohort. The pattern of high intentional self-poisoning as the most prevalent cause of poisonings also corresponds with worldwide trends where the majority of individuals presenting acutely to hospital for poisoning are due to self-harm (Mathew et al., 2019) [21]. Our group findings regarding suicidal intent associated with poisonings due to domestic violence and psychiatric diagnoses such as depression are similar to the findings of other studies from Nepal and China (Thakali et al., 2022) [17]. On the other hand, some reports

from Africa, such as Ethiopia, report a significantly greater proportion of accidental poisonings in pediatric populations due to environmental factors and age compared to our study (Tefera & Teferi, 2020) [22].

In terms of the types of poisons taken, the most common type of poisons taken were organophosphates (38.3%), followed by alkalis (23.3%), overdose of drugs (18.3%), and rat poison (11.7%). These trends appear to correlate with previous research from the South Asian region where organophosphate formulations are used extensively in agricultural communities (Sinha et al., 2022) [23]. In our study, the incidence of organophosphate poisoning was 34%, compared with the highest prevalence of 46% (Amir et al., 2019) [18] in cases recorded by Pakistan's National Poisoning Control Centre, but less than the prevalence found in Nepal (25%). We found 23.3% of those who registered at shoe clinics were found to be re-exposed to alkaline poisoning compared to other local studies which only showed 4–5% of cases as alkaline poisoning (Sinha et al., 2022) [23]. This suggests that households and industrial chemical exposure have changed.

A key factor in patient outcomes is the time taken to present to a hospital. In this study, 43.3% of patients were admitted to hospital between 2 and 6 hours. The remaining patients were admitted either after the first hour (28.3%) or passed six hours (28.4%). As per our findings, early hospital presentation did not impact mortality rates which supports previous studies that suggest quick response by hospitals leads to better recovery rates but will not alleviate severity of a patient's exposure to poison. During this research, severity of presentation at admission was characterised as mostly mild to moderate (36.7% suffering mild, 43.3% - moderate cases) with only 20% suffering from severe. The majority of fatal outcomes associated with acute poisoning occur worldwide (Spiller et al., 2020) [16]. Respiratory depression was found in about half of patients in similar studies, and in similar studies have been found that 32–33% of patients needed mechanical ventilation. Given the potential for risk of CNS depressants and organophosphate toxicity, respiratory depression confirms that such risks are ascribed to risks associated with CVDs.

In our study, the majority of patients had successful outcomes with 81.7% of patients fully recovering from their poisoning, while 11.6% experienced complications, and 6.7% suffered mortality. Overall, patients presented for treatment earlier than patients who were admitted after intentional poisoning; 93.8% of patients with accidental poisonings fully recovered compared to 77.3% of patients who were admitted after intentional poisonings. This finding may suggest that patients who deliberately ingested poisons may have used larger doses, or more lethal agents, and is in keeping with data from Egypt and

Pakistan where the mortality rate was between 5%–7% (Zaki et al., 2019) [24]. The mortality rate in this study is higher than that in Ethiopia (1.5%), but lower than that of multiple studies from India and China reporting case fatality rates of 11%–12% (Jun-Hua et al., 2021) [25]. The differences noted above likely reflect differences in the poisons consumed (i.e., agent type), accessibility to health care (i.e., use of emergency (ER) services), and availability of critical care resources (e.g., mechanical ventilation) across the three studies, thus indicating cultural, economic, and political differences between the countries studied.

Overall, our results support the global trend that young adults are most commonly affected by accidents or by self-harm related to their health. Differences in gender, type of poison, and resultant mortality demonstrate the impact of various factors, including cultural values and economic resources. Increasing awareness of the signs and symptoms of poisoning, timely access to hospital care (e.g., use of emergency departments), and coordinated psychosocial interventions can increase positive outcomes, reduce cases of re-poisoning, and even attempt to decrease the prevalence of acute poisoning in future. These findings highlight the ongoing need for public health strategies focusing on mental health support, safe storage of toxic agents, and community education to mitigate the burden of acute poisoning in tertiary care settings.

Conclusion

The investigation into the acute poisoning patients presenting at a tertiary care emergency department has identified a unique demographic and clinical profile of the patients, showing that the demographic of the patients is primarily young adults, especially males and are more likely to have ingested the poison intentionally as a means of self-harm; organophosphates were the most commonly associated toxins, along with strong alkalis and drug overdose as they tend to be easily accessible to the community; the majority of the patients arrived at the emergency room within a few hours of exposure to the toxins, indicating how essential is early intervention; although most patients were classified as moderately poisoned at presentation, many patients experienced a life-threatening degree of toxicity; the majority of patients had a good prognosis; however, some patients did have complications or died as a result of the poisoned condition, especially in cases of severe toxicity and intentional ingestion, demonstrating the necessity for preventive measures, public awareness, rapid response systems, and integrated psychological assistance services to decrease the incidence and optimally restore the health of patients after acute poisoning.

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