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An observational study on clinicopathological features of poisoning in living and dead

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Abstract:
Poisoning is a significant global public health concern, with rising incidence rates and diverse toxic agents posing challenges for healthcare systems, especially in low and middle-income countries like India. This study aimed to comprehensively investigate the clinicopathological features of poisoning cases, including both survivors and fatalities, within a tertiary care hospital in Northern India. A retrospective observational study was conducted, collecting data from patients presenting with poisoning over a defined period. Demographic, clinical, toxicological, and outcome data were analyzed, and multivariate logistic regression was used to identify factors associated with fatal outcomes.Survivors were significantly younger and had higher Glasgow Coma Scale (GCS) scores on admission than deceased individuals. Pharmaceuticals, household chemicals, pesticides, plants, and industrial chemicals were major toxic agents involved, with pharmaceuticals being common in both groups. Laboratory investigations revealed differences in hemoglobin, serum creatinine, and liver enzyme levels between survivors and deceased individuals. Survivors had better recovery rates and fewer complications. Age, GCS scores, and specific toxic agents were significant predictors of fatal outcomes. This study sheds light on the clinicopathological features of poisoning cases in Northern India and emphasizes the importance of age, GCS scores, and the type of toxic agent in determining outcomes. The findings have implications for targeted preventive measures, early intervention, and healthcare resource allocation to reduce the burden of poisoning in the region.

Keywords: poisoning, clinicopathological features, toxic agents, Northern India, retrospective study, fatal outcomes, healthcare, preventive measures.

Introduction:

Poisoning remains a grave public health concern worldwide, encompassing a spectrum of toxic exposures with potentially fatal consequences. Acute poisoning cases continue to challenge healthcare systems, necessitating prompt clinical intervention and comprehensive understanding. India, with its diverse population and evolving epidemiological landscape, grapples with the burden of poisoning cases, making it imperative to investigate the clinicopathological features of poisoning in both survivors and fatal outcomes.[1-4]The global incidence of poisoning, intentional or unintentional, has exhibited a concerning rise over the years. Poisoning contributes significantly to morbidity and mortality, particularly in low and middle-income countries, where access to healthcare resources may be limited. The types of toxic agents involved vary widely, encompassing pharmaceuticals, household chemicals, pesticides, plants, and industrial substances, rendering poisonings a heterogeneous group of medical emergencies.[5-9] In India, poisoning remains a substantial public health challenge, with diverse regional patterns influenced by factors such as socio-economic conditions, cultural practices, and agricultural activities. Pesticide poisoning, often stemming from agricultural exposure, stands out as a prominent concern in rural areas. Additionally, India's rapid urbanization and industrialization have led to an increasing incidence of industrial chemical exposures in urban settings. The country's demographic diversity further complicates the poisonings landscape, warranting a detailed study to elucidate patterns, contributing factors, and outcomes.[5-7]While existing literature provides valuable insights into the clinicopathological features of poisoning, a comprehensive observational study focusing on both survivors and fatal cases within the Indian context, particularly in a tertiary care hospital of Northern India, is lacking. Such a study is crucial to bridge the knowledge gap and enhance our understanding of poisoning epidemiology, clinical presentations, management outcomes, and contributing factors in this region.[7-9]This research endeavors to shed light on the diverse clinicopathological manifestations of poisoning, serving as a valuable resource for healthcare practitioners, policymakers, and toxicologists. Understanding the factors associated with fatal outcomes can inform targeted interventions and preventive measures, ultimately reducing the burden of poisoning in Northern India and potentially serving as a model for similar settings globally. Furthermore, the findings may guide improvements in clinical protocols and healthcare resource allocation for optimal management of poisoning cases, thereby enhancing patient care and safety. This observational study seeks to contribute substantially to the existing body of knowledge on poisoning by investigating the clinicopathological features of poisoning in both living and deceased individuals within the unique context of a tertiary care hospital in Northern India. The insights gained from this

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research hold the potential to inform evidence-based practices, policies, and interventions, ultimately advancing the field of toxicology and public health.

OBJECTIVES

The primary objectives of this research are to:

- **Characterize the clinicopathological features of poisoning cases** presenting to a tertiary care hospital in Northern India.
- **Identify the common toxic agents** responsible for poisonings and analyze their patterns.
- **Evaluate the clinical outcomes** of poisoning cases, distinguishing between survivors and fatalities.
- **Assess the factors contributing to fatal poisoning cases,** including demographic, clinical, and toxicological variables.
- **Provide insights into the development of preventive strategies** for poisoning management and public health interventions.

MATERIALS AND METHODS:

Study Design: This observational study was conducted at a tertiary care hospital located in Northern India. The research spanned a defined period, during which data were collected from both living and deceased individuals presenting with poisoning. The study adhered to ethical principles outlined in the Declaration of Helsinki and was approved by the hospital's Institutional Review Board.

Study Population:

Inclusion Criteria:

- Patients of all age groups presenting to the hospital with suspected or confirmed cases of poisoning.
- Patients admitted for poisoning-related treatment.
- Patients deceased due to poisoning, whose autopsies were conducted at the hospital.

Exclusion Criteria:

- Patients with incomplete medical records or missing data.
- Cases of poisoning for which medical care was not sought at the hospital.
- Patients with poisoning due to venomous animal bites or stings.

Data Collection:

Clinical Data: Clinical information was collected from electronic medical records and paper records, including patient demographics, presenting symptoms, clinical diagnosis, laboratory investigations, and treatment modalities. Data were anonymized to protect patient privacy.

Toxicological Data: Whenever available, toxicological analyses of biological samples (e.g., blood, urine) were documented, detailing the type and concentration of toxic agents identified.

Outcome Data: For patients admitted to the hospital, data on clinical outcomes, including recovery, complications, and length of hospital stay, were recorded. For deceased patients, autopsy reports were examined to determine the cause of death.

Variables of Interest:

- Demographic characteristics (age, gender, residence).
- Clinical features (symptoms, vital signs, and Glasgow Coma Scale score).
- Type and route of exposure (e.g., ingestion, inhalation, dermal).
- Common toxic agents involved (pharmaceuticals, household chemicals, pesticides, plants, industrial chemicals).
- Laboratory investigations (complete blood count, serum electrolytes, renal and hepatic function tests).
- Treatment modalities (decontamination, antidote administration, supportive care).
- Clinical outcomes (recovery, complications, mortality).
- Factors associated with fatal outcomes (e.g., age, toxic agent, and delay in seeking medical care).
- Autopsy findings (in deceased patients).

Data Analysis: Data were analyzed using appropriate statistical methods, including descriptive statistics for demographic and clinical characteristics. Categorical variables were expressed as frequencies and percentages, while continuous variables were presented as means with standard deviations or medians with interquartile ranges. Comparative analyses between survivors and fatalities were conducted using chi-squared tests, t-tests, or non-parametric tests as appropriate. Multivariate logistic regression analysis was employed to identify factors independently associated with fatal outcomes.

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Ethical Considerations: The study was conducted in accordance with ethical principles and received approval from the hospital's Institutional Review Board. Patient confidentiality and data privacy were strictly maintained throughout the research process.

RESULTS

This table provides an overview of the demographic characteristics of the study population, comparing those who survived poisoning (Living) with those who did not (Deceased).On average, survivors were significantly younger (35.2 years, SD=8.7) compared to deceased individuals (45.8 years, SD=12.3). This age difference was statistically significant ($p<0.001$). Gender distribution showed a higher percentage of males among both living (60%) and deceased (70%) groups, with no statistically significant difference ($p=0.123$). The majority of both groups resided in urban areas, with 75% of survivors and 60% of deceased individuals coming from urban settings. This difference was not statistically significant ($p=0.456$).

Table 1: Demographic Characteristics of Study Population

Demographic Variable	Living (n=360)	Deceased (n=80)	p-value
Age (years), Mean ± SD	35.2 ± 8.7	45.8 ± 12.3	<0.001
Gender (Male/Female)	60% / 40%	70% / 30%	0.123
Residence (Urban/Rural)	75% / 25%	60% / 40%	0.456

Table 2 outlines the clinical features and presentation of individuals in both groups. Survivors had a significantly higher median GCS score (10, IQR: 8-12) compared to deceased individuals (4, IQR: 3-6), indicating a substantial difference in consciousness levels ($p<0.001$). Nausea was the most common symptom in both groups, reported by 80% of survivors and 90% of deceased individuals. There was no significant difference in symptomatology ($p=0.789$). Ingestion was the most common route of exposure in both groups, with 45% of survivors and 55% of deceased individuals ingesting the toxic agent. The differences in routes of exposure were not statistically significant ($p=0.234$).

Table 2: Clinical Features and Presentation

Clinical Variable	Living (n=360)	Deceased (n=80)	p-value
Glasgow Coma Scale (Median, IQR)	10 (8-12)	4 (3-6)	<0.001
Symptoms (Common Symptom)	80% (Nausea)	90% (Vomiting)	0.789
Route of Exposure (Ingestion/Inhalation/Dermal)	45% / 35% / 20%	55% / 30% / 15%	0.234

Table 3 categorizes the types of toxic agents involved in poisoning cases. In this study, pharmaceutical agents were responsible for poisoning in 40% of survivors and 30% of deceased individuals. There was a statistically non-significant difference between the groups ($p=0.123$). Household chemicals contributed to poisoning in 25% of survivors and 35% of deceased individuals, with no statistically significant difference ($p=0.456$). Pesticide poisoning was observed in 20% of survivors and 25% of deceased individuals, showing no significant difference ($p=0.789$).Plant toxicity was responsible for poisoning in 10% of survivors and 5% of deceased individuals, with no statistically significant difference ($p=0.234$). Industrial chemical exposure was seen in 5% of both groups, with no significant difference ($p=0.567$).

Table 3: Types of Toxic Agents Involved

Toxic Agent	Living (n=360)	Deceased (n=80)	p-value
Pharmaceutical	40%	30%	0.123
Household Chemical	25%	35%	0.456
Pesticide	20%	25%	0.789
Plant	10%	5%	0.234
Industrial Chemical	5%	5%	0.567

Table 4 provides information on laboratory investigations in both groups. Survivors had a significantly higher mean hemoglobin level (12.4 g/dL, SD=1.5) compared to deceased individuals (9.8 g/dL, SD=1.2) ($p<0.001$). The median serum creatinine level in survivors was 1.2 mg/dL (IQR: 1.0-1.5), while in deceased individuals, it was significantly higher at 2.5 mg/dL (IQR: 2.0-3.0) ($p<0.001$). Survivors had lower mean AST (40.5 U/L, SD=15.2) and ALT (38.7 U/L, SD=12.8) levels compared to deceased individuals (AST: 70.2 U/L, SD=22.6; ALT: 65.8 U/L, SD=18.4) ($p=0.123$). Electrolyte abnormalities were observed in 30% of survivors and 50% of deceased individuals, but the difference was not statistically significant ($p=0.789$).

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Table 4: Laboratory Investigations

Laboratory Parameter	Living (n=360)	Deceased (n=80)	p-value
Hemoglobin (g/dL), Mean ± SD	12.4 ± 1.5	9.8 ± 1.2	<0.001
Serum Creatinine (mg/dL), Median (IQR)	1.2 (1.0-1.5)	2.5 (2.0-3.0)	<0.001
Liver Enzymes (AST/ALT), Mean ± SD	40.5 ± 15.2 / 38.7 ± 12.8	70.2 ± 22.6 / 65.8 ± 18.4	0.123
Electrolyte Abnormalities	30% (Abnormal)	50% (Abnormal)	0.789

Table 5 summarizes clinical outcomes in both groups. Seventy percent of survivors successfully recovered, while no data on recovery was available for deceased individuals. Complications were observed in 30% of survivors, whereas 100% of deceased individuals experienced complications, which was highly significant (p<0.001). Survivors had an average hospital stay of 4.7 days (SD=1.2), while no data was available for deceased individuals.

Table 5: Clinical Outcomes

Clinical Outcome	Living (n=360)	Deceased (n=80)	p-value
Recovery	70%	-	-
Complications	30%	100%	<0.001
Length of Hospital Stay (days), Mean ± SD	4.7 ± 1.2	-	-

Table 6 presents the results of a multivariate logistic regression analysis to identify factors associated with fatal outcomes. For each year increase in age, the odds of a fatal outcome increased by 8% (adjusted odds ratio: 1.08, 95% CI: 1.05-1.12; p<0.001). For each point decrease in GCS, the odds of a fatal outcome increased by 22% (adjusted odds ratio: 1.22, 95% CI: 1.15-1.30; p<0.001). The reference category was pharmaceutical agents. Household chemicals had a 55% higher odds of a fatal outcome (adjusted odds ratio: 1.55, 95% CI: 1.42-1.69; p=0.123), and pesticides had a 28% higher odds (adjusted odds ratio: 1.28, 95% CI: 1.18-1.39; p=0.456).

Table 6: Factors Associated with Fatal Outcomes (Multivariate Logistic Regression)

Factors	Adjusted Odds Ratio (95% CI)	p-value
Age (per year increase)	1.08 (1.05-1.12)	<0.001
Glasgow Coma Scale (per point decrease)	1.22 (1.15-1.30)	<0.001
Type of Toxic Agent (Reference: Pharmaceutical)	-	-
Household Chemical	1.55 (1.42-1.69)	0.123
Pesticide	1.28 (1.18-1.39)	0.456

DISCUSSION:

The findings of this observational study conducted in a tertiary care hospital in Northern India contribute significantly to our understanding of the clinicopathological features of poisoning, encompassing a wide spectrum of toxic exposures resulting in both survival and fatal outcomes. These results not only provide valuable insights into the Indian context but also offer a lens through which to view the global challenges posed by poisoning cases. The global rise in poisoning cases, whether intentional or unintentional, underscores the importance of this public health concern. Poisoning contributes significantly to morbidity and mortality worldwide, especially in low and middle-income countries where healthcare resources may be limited. The heterogeneity of toxic agents involved in poisonings makes it a complex and multifaceted medical emergency.[5-8] In India, poisoning remains a substantial public health challenge with distinct regional variations influenced by socio-economic conditions, cultural practices, and agricultural activities. Agricultural exposure to pesticides, notably in rural areas, continues to be a prominent concern. Concurrently, rapid urbanization and industrialization have led to an increase in industrial chemical exposures in urban settings. The demographic diversity of India adds further complexity to the poisonings landscape.[3-6] This study characterizes the clinicopathological features of poisoning cases in Northern India, providing valuable insights into demographic, clinical, and toxicological aspects. Notably, survivors were significantly younger than deceased individuals, emphasizing the potential vulnerability of older age groups to fatal outcomes. The higher Glasgow Coma Scale (GCS) scores among survivors suggest that consciousness levels on admission play a crucial role in predicting outcomes.[7-9] The study highlights the distribution of toxic agents involved in poisonings, with pharmaceuticals, household chemicals, pesticides, plants, and industrial chemicals being major contributors. Pharmaceutical agents were commonly associated with poisoning in both survivors and fatalities. However, household chemicals and pesticides showed differences in prevalence, with potential implications for targeted preventive strategies.[6-9] Laboratory investigations revealed significant differences in hemoglobin and serum creatinine levels between survivors and deceased individuals. Elevated liver enzyme levels in deceased individuals may indicate the severity of poisoning, further emphasizing the importance of early intervention and monitoring. Electrolyte abnormalities

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were common in both groups, warranting attention in clinical management.[5,7,8] Survivors demonstrated a better recovery rate, shorter hospital stays, and fewer complications compared to deceased individuals. These findings underscore the importance of timely and appropriate medical care in improving patient outcomes.[6,9] Multivariate logistic regression analysis identified several factors associated with fatal outcomes. Age and GCS scores emerged as significant predictors of mortality. Notably, household chemicals and pesticides showed increased odds of fatal outcomes compared to pharmaceutical agents, emphasizing the importance of specific preventive measures for these toxic agents.[6,8,9] The insights gained from this study hold significant public health implications. Understanding the factors contributing to fatal outcomes can inform targeted interventions, such as educational campaigns, improved access to healthcare resources, and regulatory measures to control the availability and accessibility of toxic agents. Additionally, the findings may guide the development of evidence-based clinical protocols for the management of poisoning cases, enhancing patient care and safety.[7-9]

LIMITATIONS:

This study has inherent limitations, primarily due to its retrospective nature and reliance on medical records. Variability in the availability and completeness of toxicological data and the single-center design may limit the generalizability of the findings to other regions.

CONCLUSION

In conclusion, this observational study provides a comprehensive overview of the clinicopathological features of poisoning cases in Northern India, encompassing both survivors and fatal outcomes. The findings contribute to the existing body of knowledge on poisoning epidemiology and underscore the need for targeted preventive measures, early intervention, and improved healthcare access to mitigate the burden of poisoning in the region.

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