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Predictors of Mortality in Acute Poisoning Patients Presenting to a Tertiary Care Emergency Department

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ABSTRACT

Background: Acute poisoning is a prevalent medical emergency, a significant morbidity and mortality cause in low- and middle-income nations. High-risk patients finding themselves in a critical care facility require prompt intervention to enhance utilization of critical care resources and best patient outcomes.

Objective: To identify the independent predictors of in-hospital mortality in the patients who arrive at the tertiary care emergency department with acute poisoning.

Methods: It was a prospective observational study that was conducted at the Emergency Department of Lady Reading Hospital, Peshawar, between June 2023 and May 2024. Enrolled were the patients aged 12 years and above who have confirmed or suspected acute poisoning. Demographic statistics, clinical characteristics, and laboratory values were registered at presentation. The patients were treated until they died or discharge. The independent predictors of mortality were determined by logistic regression analysis.

Results: 312 patients were enrolled (178 (57.1) were male). The total mortality was 14.7%. When analyzing in multivariate, the independent predictors of mortality were: Glasgow Coma Scale 8 or less (AOR 5.84), delayed presentation (AOR 4.12), hypotension (AOR 3.76), metabolic acidosis (AOR 3.21), and requiring mechanical ventilation (AOR 6.48).

Conclusion: Presentation-based simple bedside and laboratory parameters can be used to anticipate mortality in acute poisoning. These predictors may help optimize future outcomes by providing timely consideration of care escalation and by allocating resources more effectively when they are identified early in an emergency department.

Keywords: *Acute poisoning; Mortality; Predictors; Emergency department; Pakistan*

1. INTRODUCTION

Acute poisoning is one of the significant public health issues of the world and one of the common causes of emergency department (ED) visits, especially in low- and middle-income countries (LMICs) (Mottla et al., 2023; Cowans et al., 2023; Mottla et al., 2023; Salem et al., 2024). According to the estimates of the World Health Organization, unintentional poisoning deserves almost one-hundred and ninety thousand deaths each year globally, but an even more significant amount is caused by deliberate self-harm using toxic substances (WHO, 2019). Acute poisoning causes significant morbidity and mortality rates in young adults in South Asia, with Pakistan being one of the main causes. To a great extent, these causes are related to the easy access to pesticides, pharmaceuticals, and household chemicals (Safdar et al., 2021; Qureshi et al., 2021; Ahmed et al., 2022).

Epidemiology of poisoning is different in different regions and socioeconomic contexts. Pharmaceutical overdoses and recreational drug toxicity are more common in high-income nations, but agricultural chemicals, specifically organophosphates and carbamates, are most frequently used agents in LMICs (Mottla et al., n.d.;). In Pakistan, pesticides are readily available and are often used in deliberate self-poisoning, particularly in young people with psychosocial stressors, including unemployment, conflict in the family, and mental illnesses (Dabholkar et al., 2023; Khan, 2024; Dabholkar et al., 2023).

Even with the improved supportive care and treatment in toxicology, deaths due to acute poisoning are still unreasonably high in most resource-constrained locations (Kight, 2023). Afterference, absence of specialized toxicology facilities, and insufficient intensive care facilities have a strong impact. Premortem mortality predictors are therefore critical factors to examine immediate triage, risk prioritization, and effective management of scarce critical care resources in overcrowded emergency departments (Shumet et al., 2022; Salem et al., 2024).

Some clinical and biochemical factors related with unfavorable outcomes in patients who were poisoned have been identified previously. They are depressed level of consciousness, hypotension, metabolic acidosis, respiratory failure, and requirement of mechanical ventilation (Sharif et al., 2021; Ramadori, 2023; Hilal et al., 2021). The Glasgow Coma Scale (GCS), specifically, has been extensively researched as an inoffensive and effective bedside measure to gauge neurological deficiency and presume mortality in a toxicological crisis (Zaghary et al., 2021). On the same note, blood gas abnormalities like severe acidosis in the arteries indicate hypoxia in the tissue and mitochondrial damage by toxic agents and are closely correlated with negative outcomes (Gil et al., 2021).

Nevertheless, the majority of data available are country-specific or toxin-related, and they are mostly of high-income nations. Pakistan has a relative dearth of prospective studies, which are based in hospitals, and which are thorough in assessing demographic, clinical, and laboratory predictors of mortality in a large range of poisoning agents (Khan et al., 2023). Furthermore, there may be regional variations in healthcare access and referral patterns alongside treatment protocols; hence, locally produced evidence is necessary in both presentation and outcome.

One of the largest tertiary care hospitals in Khyber Pakhtunkwah and with a high number of poisoning cases both rural and urban is Lady Reading Hospital (LRH), Peshawar (Ul Baqi et al., 2023). The emergency department is used as a major referral unit when dealing with critically ill patients such as those with severe toxic exposures. The determination of mortality predictors in this context can offer some useful information to the clinicians and policymakers who need to enhance emergency care and poisoning prevention measures.

Thus, the aim of the current paper was to determine independent predictors of as in-hospital mortality in patients who arrived with acute poisoning cases at the emergency department of a tertiary care hospital in Peshawar. This study formulates an evidence-based approach to early risk stratification by applying demographic variables, clinical presentation features, and crucial laboratory parameters. Finally, the better understanding of high-risk patients could enable providing timely interventions, utilizing intensive care resources better, and help to minimize preventable acute poisoning-related deaths in Pakistan and other LMIC contexts.

2. METHODOLOGY

This paper is a proposed prospective observational study that would be carried out in the Emergency Department of Lady Reading Hospital, Peshawar, a high level of tertiary care referral hospital in Khyber Pakhtunkhwa, Pakistan. It postponed the study to a period between June 2023 and May 2024. The major aim was to determine clinical, demographic, and laboratory predictors of mortality in patients who presented with acute poisoning.

The study involved all patients who burdened in to the emergency department with a known or suspected history of acute poisoning and were older than 12 years. Chronic poisoning patients, adverse drug reactions, food poisoning patients, snake or insect envenomation patients and patients presented dead to the hospital were excluded. With informed consent, the patient or next of kin was informed and consent obtained before admission. The Institutional Review Board of Lady Reading Hospital obliged the study with ethical approval.

A structured proforma was used to gather data which included demographic variables (age, sex, residence), clinical variables (type of poison, route of exposure, time elapsed since ingestion, intent of poisoning, Glasgow Coma Scale score, vital signs at presentation), and lab variables (arterial blood gas values, serum electrolytes, renal function tests) were measured. The management information such as ventilatory support, vasopressor, and placement in the intensive care unit were documented as well. Follow-up of patients with admission followed all the way to discharge or in-hospital death.

In-hospital mortality was used as the primary outcome measure. The data were also keyed in and analyzed with SPSS version 26. Baseline characteristics were summarized using descriptive statistics. Frequencies and percentages were used to express categorical variables and mean, standard deviation, and median with interquartile range were used to express continuous variables. Variables related to mortality were identified through chi-square test (categorical variables) and independent t-test or Mann Whitney U test (continuous variables) of univariate analysis. The variables that had a p-value of less than 0.20 during

the univariate analysis were then inputted into a multivariate logistic regression model to identify independent predictors of mortality. A p-value less than 0.05 was deemed as statistically significant.

3. RESULTS

The patients enrolled in the study between June 2023 and May 2024 were 312 in number and represented cases of acute poisoning. The average age of the patients was 29.622 ages with the most patients aged 1835 years. The proportion of males was slightly higher, 178 (57.1) males and 134 (42.9) females. It was predominantly intentional poisoning (68.6%), and organophosphate compounds were the most strongly involved.

The total in-hospital mortality percentage was 14.7 (n = 46). The deaths were considerable among patients who showed on with late hospital arrival, low Glasgow Coma Scale (GCS), metabolic acidosis, hypotension, and patients who needed mechanical ventilation or admission to the ICU.

Table 1. Demographic Characteristics of Acute Poisoning Patients (n = 312)

Variable	Frequency (n)	Percentage (%)
Age (years)		
<18	42	13.5
18–35	168	53.8
>35	102	32.7
Gender		
Male	178	57.1
Female	134	42.9
Residence		
Urban	186	59.6
Rural	126	40.4
Intent of Poisoning		
Intentional	214	68.6
Accidental	98	31.4

Figure 1. Demographic Characteristics of Acute Poisoning Patients (n = 312)

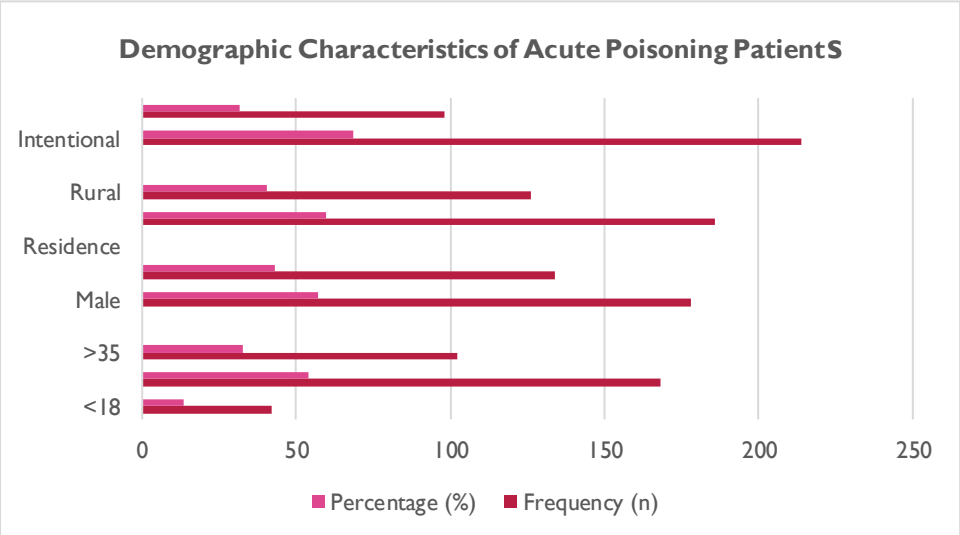


Table 2. Clinical Characteristics at Presentation

Clinical Variable	Frequency (n)	Percentage (%)
Time to hospital >6 hours	144	46.2
GCS ≤ 8	58	18.6
Hypotension on arrival	74	23.7
Respiratory distress	96	30.8
Metabolic acidosis	82	26.3
Mechanical ventilation required	64	20.5
ICU admission	88	28.2

Figure 2. Clinical Characteristics at Presentation

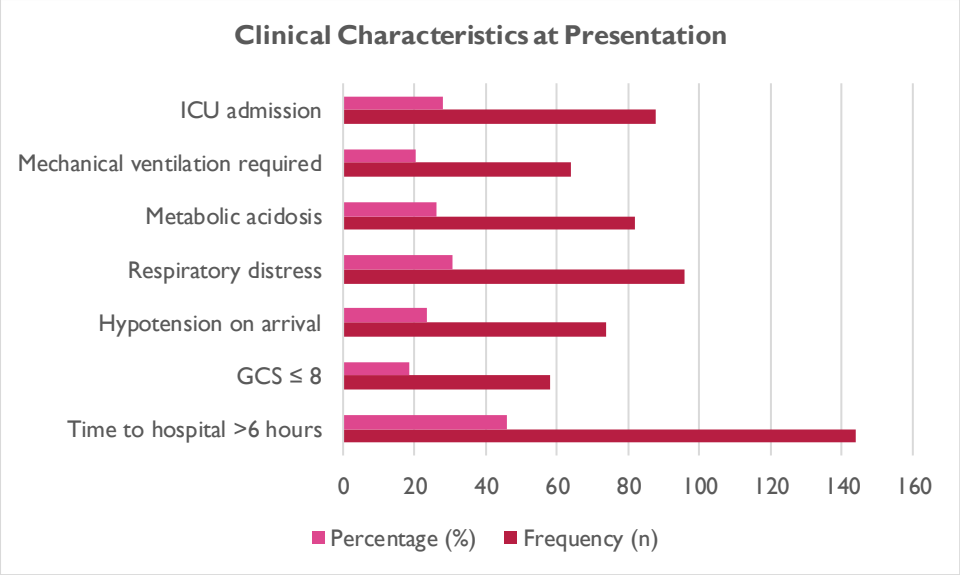


Table 3. Types of Poisoning Agents Identified

POISONING AGENT	FREQUENCY (N)	PERCENTAGE (%)
ORGANOPHOSPHATES	118	37.8
PHARMACEUTICALS	74	23.7
CORROSIVES	46	14.7
RODENTICIDES	38	12.2
UNKNOWN SUBSTANCES	36	11.5

Table 4. Comparison of Survivors and Non-Survivors

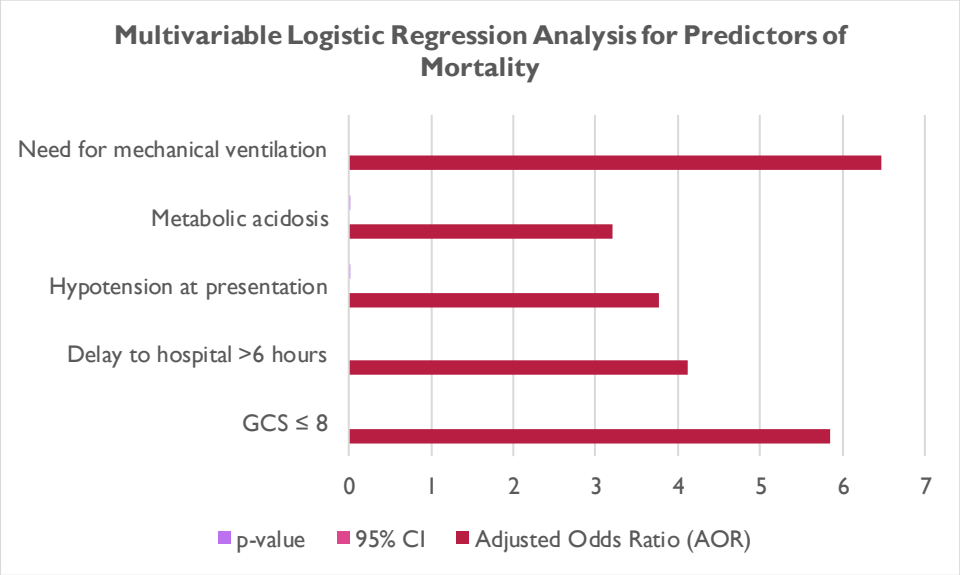
Variable	Survivors (n = 266)	Non-Survivors (n = 46)	p-value
Mean age (years)	28.4 ± 11.8	36.2 ± 13.6	0.001
GCS ≤ 8	28 (10.5%)	30 (65.2%)	<0.001

Delay >6 hours	102 (38.3%)	42 (91.3%)	<0.001
Hypotension	44 (16.5%)	30 (65.2%)	<0.001
Mechanical ventilation	32 (12.0%)	32 (69.6%)	<0.001
Metabolic acidosis	48 (18.0%)	34 (73.9%)	<0.001

Table 5. Multivariable Logistic Regression Analysis for Predictors of Mortality

Predictor	Adjusted Odds Ratio (AOR)	95% CI	p-value
GCS ≤ 8	5.84	2.71–12.56	<0.001
Delay to hospital >6 hours	4.12	1.88–9.01	<0.001
Hypotension at presentation	3.76	1.69–8.34	0.001
Metabolic acidosis	3.21	1.45–7.11	0.004
Need for mechanical ventilation	6.48	2.91–14.43	<0.001

Figure 5. Multivariable Logistic Regression Analysis for Predictors of Mortality



Low GCS score, delayed presentation, hypotension, metabolic acidosis, and requirement for mechanical ventilation emerged as independent predictors of mortality in patients with acute poisoning presenting to the emergency department.

4. DISCUSSION

This research found some of the significant predictors of mortality in patients who present with acute poisoning to a tertiary care emergency department. The entire in-hospital mortality rate of 14.7% in our cohort is comparable to other low- and middle-income states, where there are worse outcomes, and poorer results are attributed to delayed presentation and scarce critical care resources (Kortz, 2023; Mottla et al., 2023). Conversely, research in wealthy contexts reports significantly lower mortality, usually less than 5 per cent, which signifies previously superior care and stronger toxicology services (Cowans et al., 2023).

The low Glasgow Coma Scale (GCS ≤ 8) at presentation was one of the most significant predictors of mortality in our study. A depressed level of consciousness is a well-known indicator of severe toxicity and has always been linked to higher risk of respiratory failure and mortality (Zaghary et al., 2021; Gil et al., 2021). Our results support the significance of early neurological evaluation in the triage of poisoned patients and prioritization of patients, who must have their airways protected and closely monitored urgently.

Another independent predictor of death was delay in presentation (>6 hours). Correspondingly, it has been noted in the case of organophosphate and pharmaceutical poisonings, in which late arrival to the hospital reduces the efficacy of decontamination and antidotal treatment (Safdar et al., 2021; Dabholkar et al., 2023). Delays associated with lack of awareness, unawareness, and pre-treatment by untrained practitioners tend to contribute to poor outcomes in survival in Pakistan and other South Asian environments (Qureshi et al., 2021).

We also discovered that presentation hypotension was a considerable predictor of death. Shock is symptomatic of systemic toxicity and multiorgan involvement. Past researches demonstrated that hypotension in patients with poisoning is associated with myocardiological depression, extreme metabolic changes, and increased mortality in the ICU (Sharif et al., 2021). Early aggressive hemodynamic resuscitation is vital in such patients.

Metabolic acidosis became one of the strong predictors of mortality within our cohort. The phenomenon of acidosis speaks of poor tissue circulation, impaired mitochondrial functioning, and intense toxin overload. The same findings can be characterised in the literature on pesticides and drug poisoning, where acute acidosis is cloned as an indicator of a bad outcome (Hilal et al., 2021; Gil et al., 2021). Early risk stratification can thus be facilitated by routine arterial blood gas examination on arrival.

Mechanical ventilation prediction was the most predictive of mortality in multivariate analysis. It aligns with previous studies which have shown that intubation among patients with tissue poisoning is a frequent indicator of severe respiratory failure, aspiration and central nervous system suppression (Ramadori, 2023; Shumet et al., 2022). Ventilation is life-saving but indicates the severity of intoxication and the existence of such complications as ARDS or aspiration pneumonia.

The most typical agents in the poisoning of our population were the organophosphates, as they are prevalent and widely used in agriculture. The trend is similar to other literature in South Asia and Middle East (Safdar et al., 2021; Dabholkar et al., 2023). The fact that these agents are highly lethal highlights the immediate necessity of the increased control of pesticides and the centrally important role of intervention in the area of public health.

Strengths and Limitations

One of the strengths of this study is that it was prospectively designed and extensively examined clinical and laboratory predictors. It is however limited by the fact that it is a single center study and therefore may limit generalizability. Moreover, precise measurement of ingested poison was not made in most instances, and no follow up on post-discharge results were measured.

5. IMPLICATIONS

We provide evidence that early presentation, prompt neurological check, hemodynamic stability, and prompt ICU care are critical in the minimization of acute poisoning mortality. Stratification of risk based on such simple bedside data like GCS, blood pressure, ABG results, and ventilatory need is able to assist clinicians to identify high-risk patients early and better allocate resources to such patients in crowded emergency departments.

6. CONCLUSION

Acute poisoning continues to drive contentious emergency cases and avertable deaths in resource constrained environments. This paper shows that even basic, easily accessible clinical and laboratory measures can be trusted to determine patients who are at high risk of death when presented. The independent predictors of mortality in our cohort were a low Glasgow Coma Scale, delayed hospital arrival, hypotension, metabolic acidosis, and mechanical ventilation requirement. These results emphasize the paramount role of early identification, urgent stabilization, and prompt enhancement of care in severely poisoned patients. Emergency department protocols that incorporate a planned risk stratification on the basis of these parameters could enhance procedure of triage and efficient usage of intensive care facilities. Moreover, it is necessary to improve the burden of poisoning-related deaths in Pakistan and other nations with low- and middle-income by implementing public health strategies that reduce the access to highly toxic agents and enhance the early referral systems..

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