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Presentations of Acute Poisoning and use of Triage Vital Signs as Predictors of Poisoning-related Fatality: findings from a Hospital-based Prospective Study

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ABSTRACT

Introduction: Poisoning is a leading cause of emergency department visits and hospital admissions worldwide. In Nepal, poisoning-related mortality is rapidly increasing, posing a significant public health challenge.

Objectives: This study aims to evaluate the clinico-demographic profile, assess triage parameters at presentation, and determine their utility in predicting the outcomes of acute poisoning cases at a tertiary care hospital in Nepal.

Methodology: All patients presenting to the emergency department with acute poisoning during the study period were enrolled. Data on demographics, clinical features, triage parameters, poison types, intubation requirement and outcomes were collected using a semi-standardized proforma. Primary outcomes were survival and mortality; secondary outcomes included admission details and complications.

Results: A total of 1,003 patients were evaluated, with a female-to-male ratio of 1.7:1. The predominant age group was 20–30 years. Suicidal intent accounted for 92.2% of cases. The average time from poisoning to hospital arrival was 5.07 ± 4.08 hours. Organophosphates were the most common poisons. Intubation was required in 9% of cases. Complications occurred in 17.5%, and overall mortality was 6.3%. Abnormal respiratory rate (RR), oxygen saturation (SpO_2), and Glasgow Coma Scale (GCS) scores correlated strongly with poor outcomes.

Conclusion: Acute poisoning primarily involves agricultural chemicals, Young adults with home-makers and students comprising most cases, with suicidal attempts at home presenting mainly with gastrointestinal symptoms. Abnormal triage vital signs are significant predictors of poor clinical outcomes.

Introduction

Acute poisoning poses a serious threat to health, often resulting in high morbidity and mortality. It is one of the leading causes of presentations to hospital emergency departments and intensive care units.[1] Understanding the epidemiology of poisoning—and how it changes over time—is essential for both emergency physicians and public health practitioners. According to the World Health Organization (WHO), thousands of people worldwide died from unintentional poisoning in 2012, with the highest mortality rates reported in low- and middle-income countries.[1]

The harmful consequences of poisoning are more pronounced in underdeveloped and developing countries due to weak health regulations and inadequate healthcare services.[2] Early diagnosis and prompt management are critical, as delays can lead to severe complications or even death.

We hypothesized that factors commonly associated with poor clinical outcomes-such as unstable vital signs (including decreased consciousness, respiratory distress, shock, abnormal heart rate, and abnormal body temperature) may serve as predictors of fatality in cases of acute poisoning.

In modern medical toxicology, triage parameters play a vital role in the initial assessment of urgency and are considered key components of toxic syndromes. They are also used to help predict patient outcomes. However, their effectiveness in determining the severity of poisoning remains insufficiently supported by evidence. Accurate prognostic information for critically ill patients can aid clinicians in making informed decisions, such as whether and when to escalate care to intensive interventions. From the family's perspective, clear prognostic information is essential for discussions about the benefits of intensive care, and the completeness of this information is a significant factor in family satisfaction.[3]

The prognosis of acute poisoning also depends on the nature of toxin exposure and the body's physiological ability to compensate. This study aims to evaluate the clinical and demographic profile of patients with acute poisoning, assess triage parameters at presentation, and determine their utility in predicting the severity and outcomes of poisoning cases at a tertiary care hospital in Nepal.

Methodology

This is a single center Cross-Sectional study done at Emergency Ward of Nobel Medical College Teaching Hospital (NMCTH), Biratnagar over the period of one year (1st Jan 2019 to 31st Dec 2019). Acute exposure refers to a single exposure, continuous exposure lasting less than eight hours, or repeated exposures occurring over a period of no more than one week.[4] All patients with history of acute poisoning of age more than 14 years with oral ingestion were included in the study. Patient or relatives not giving consent for study and with chronic poisoning (e.g. Metallic poison), food poisoning (except plant poison), snake and insect bites were excluded from the study.

We enrolled all consecutive eligible patients of "acute poisoning" in emergency ward of NMCTH, Biratnagar during the study period (1st Jan 2019 to 31st Dec 2019).The prevalence of acute adult poisoning cases in a similar study done in BPKIHS, Dharan by Bhandari et al.,[5] was 3.89%, Hence, using this value as 'p' Applying this value in the formula, n=Z2 pq/e2, where Z=1.96, p= 3.89% =0.0389, q= 1-p =1-0.0389 =0.9611, e= 50% of p = 0.01945 (as prevalence is <5%), Sample size was calculated to be 380. However, we have taken all the cases presented to emergency department during the study period, which were 1003 cases. The Ethical Clearance was taken from Institutional Review Committee (IRC), IRC no: 235/2018. Informed consent was taken from the patient or relatives for the study.

A semi-standardized Proforma was used to record the variables under study. Data on demographics, triage parameters, poison types, intubation requirement and outcomes were collected using a semi-standardized proforma. Primary outcomes were survival and mortality; secondary outcomes included admission details and complications. Collected data were entered in MS excel 2010 and converted into IBM SPSS-30 version for statistical analysis. Percentage, proportion, Mean and Standard Deviation were calculated for descriptive statistics. Graphical representation and tabulated form representation were done as necessary. Chi-square test, One-way ANOVA tests and Logistic regression analysis was done to test the significance for inferential statistics.

Results

Adult poisoning cases accounted for 3.31% of all emergency admissions. The majority of poisoning cases were in the 20–30 years age group (33.4%), with a mean age of 30.2 ± 14.02 years. There was a female predominance, with a female-to-male ratio of 1.7:1.

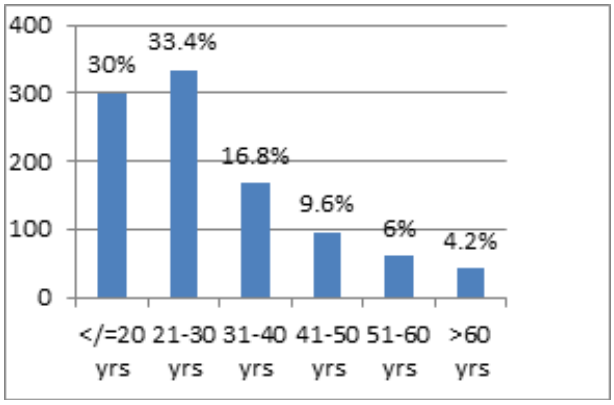

Figure 1: Age and poisoning

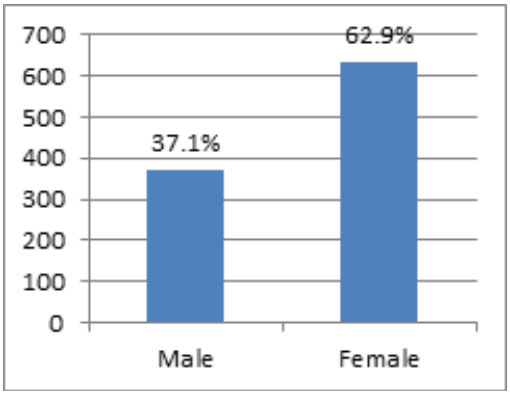

Figure 2: Gender distribution

Deliberate self-harm (DSH) incidents predominantly occurred at home, with suicidal intent being the primary motivation among cases (see Fig. 3). Organophosphates (OP), either alone or in combination, were involved in 30.4% of cases, Rat killers (RK) in 20.1%, and Organochlorine compounds (OC) in 16.7% (see Fig. 4).

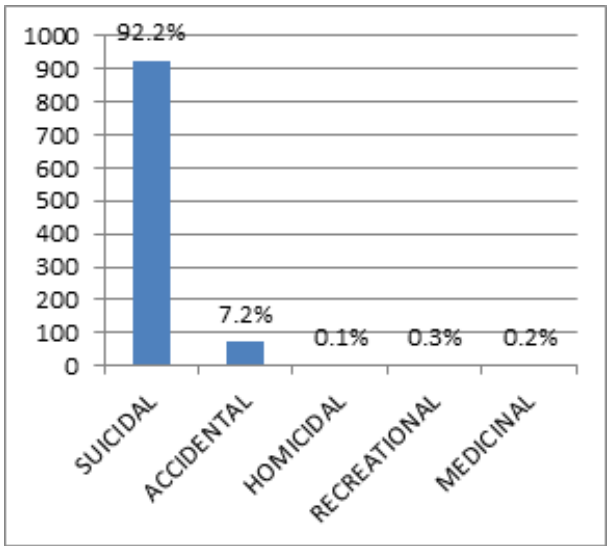

Figure 3: Reason for poison intake

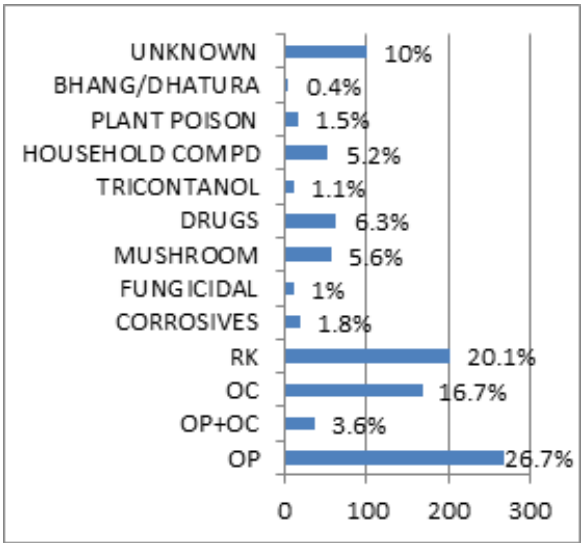

Figure 4: Type of Poison

The mean time from poisoning to hospital arrival was 5.07 ± 4.08 hours, with 60% of patients presenting to the emergency department within four hours of ingestion (see Fig. 5).

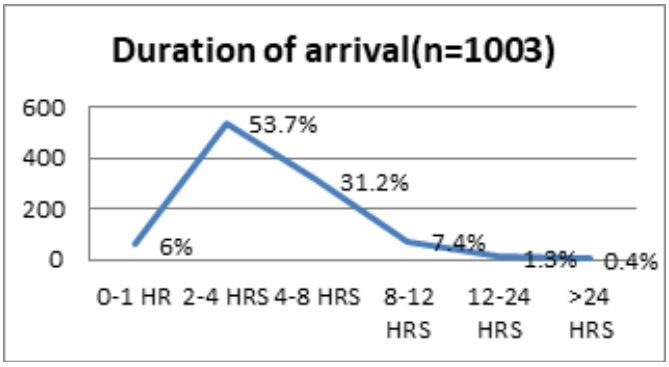

Figure 5: Duration of Arrival after intake

The predominant findings observed during triage evaluation of poisoning patients included impaired consciousness, abnormal body temperature, abnormal heart rate, shock, respiratory insufficiency, and poor oxygen saturation. Specifically, 19.2% of patients presented with impaired consciousness, defined as a Glasgow Coma Scale (GCS) score less than 13. Abnormal body temperature was noted in 6.0% of cases, including hyperthermia (body temperature ≥ 99°F) and hypothermia (body temperature < 95°F). Abnormal heart rate occurred in 20.7% of patients, comprising tachycardia (heart rate > 120 beats/min) and bradycardia (heart rate < 60 beats/min). Shock was present in 8.7% of cases, defined as a systolic blood pressure below 90 mmHg. Respiratory insufficiency was observed in 11.6%, characterized by respiratory distress requiring intubation or an abnormal respiratory rate (> 24 or < 10 breaths per minute). Poor oxygen saturation (SpO_2 < 90%) was recorded in 10.4% of patients.

The average values of the triage vital signs in the survival and fatality groups are shown in the table below:

Table1: Vital Signs at presentation.

VITAL SIGNS	SURVIVORS (n= 786) Mean (SD)	FATALITIES (n=63) Mean (SD)
HR (bpm)	89.1 (16.3)	94.7 (29.95)
RR (/min)	21.7 (2.83)	25.2 (8.19)
TEMPERATURE(°F)	98.0 (0.59)	97.2 (1.03)
SBP (mmHg)	116.1 (20.05)	86.35 (21.94)
DBP (mmHg)	72.80 (13.29)	49.36 (17.94)
AVPU disability scale	Alert=753 Response to Verbal & Painful stimulus and Unresponsiveness = 33	Alert=25 Response to Verbal & Painful stimulus and Unresponsiveness = 38
SpO2 (%)	96.47 (6.59)	74.39 (22.08)

More than 80% of patients had a Glasgow Coma Scale (GCS) score between 13 and 15, while about 19% had a GCS below 13.

Intubation was required in 9% of cases. Complications were observed in 17.5% of cases. The majority of poisoning cases survived (78.4%) were admitted in ward, while 6.2% resulted in death. The remaining patients left against medical advice, were discharged on request, referred to other facilities, or absconded.

Relationship between triage vital signs and outcomes

This study aimed to investigate the relationship between triage vital signs and final outcomes in poisoning cases. Outcomes were categorized into three groups: survivors, fatalities, and others (including patients who left against medical advice, discharged on request, absconded, or were referred). A one-way ANOVA test was performed, revealing statistically significant differences in body temperature (BT), respiratory rate (RR), systolic blood pressure (SBP), and Oxygen Saturation (SpO_2) among the groups.

The results are summarized in the table below.

Table 2: One-Way ANOVA test for Predictors of hospital associated Mortality

Triage Parameters	Survivors(n=786) (Mean ± SD)	Fatalities(n=63) (Mean ± SD)	Others (n=154) (Mean ± SD)	p value
Heart Rate/minute	89.09 ± 16.32	94.7± 29.95	89.76± 16.37	0.05
Respiratory rate/ minute	21.72 ± 2.84	25.19 ± 8.19	21.91 ± 3.03	0.00
Body Temperature (°F)	98.05 ± 0.59	97.19 ± 1.03	97.95 ± 0.29	0.00
Systolic Blood Pressure (mmHg)	116.16 ±20.05	86.35±21.94	113.38 ± 20.83	0.00
Oxygen Saturation (SpO2) (%)	96.47 ±6.59	74.4 ±22.08	96.0 ± 5.79	0.00

We then aimed to find out the predictors of outcomes among the triage parameters (RR, Heart Rate, Body Temperature, SBP, SPO2, and GCS). Binary Logistic Regression was used for identifying predictors of mortality.

The cut-off values of triage vital signs were taken as Heart rate (<60/min & >100/min), Respiratory Rate (RR <10/min & >24/min), Temperature (T<95°F and >99°F), Systolic BP (SBP <90 mmHg & > 140 mmHg), GCS (< 13), patient not Alert at presentation and Oxygen Saturation (SpO2 <90 %) as abnormal findings.

All variables were included in the initial analysis to assess their significance. The final model showed that the abnormal RR, GCS and SpO2 were significant and could predict the poor outcomes.

Table 3: Logistic Regression Analysis of Predictors associated with hospital related Mortality

Variables	Odds Ratio (CI 95%)	P-value
RR (<10/min or >24/min)	13.52 (6.12 – 29.83)	0.000
GCS (GCS<13)	2.71 (1.18 – 6.20)	0.018
SpO2 (<90%)	2.92 (1.17- 7.27)	0.021

The result showed that respiratory rate at triage had OR=13.52(95% CI, 6.13-29.84), Poor GCS i.e. GCS<13 had OR=2.71(95% CI, 1.18-6.21) and SpO2 had OR=2.92(95% CI, 1.17-7.27) showed significant results while abnormal body temperature had more than threefold higher odd of mortality (OR=3.52), abnormal SBP had more than twofold higher odd of mortality (OR=2.14), and abnormal heart rate had more than one fold higher odd of mortality (OR=1.32) but these were not statistically significant.

Discussion

In our study, the triage parameters, respiratory rate at triage had Odds Ratio (OR)=13.52(95% CI, 6.13-29.84), Poor GCS i.e. GCS<13 had OR=2.71(95% CI, 1.18-6.21) and SpO2 had OR=2.92(95% CI, 1.17-7.27) showed significant results while the odds ratios for abnormal body temperature (BT), systolic blood pressure (SBP), and heart rate (HR) were 3.5, 2.14, and 1.32, respectively. Although these results were not statistically significant, abnormal findings were associated with an increased risk of poor outcomes.

Bhandari et al.[5] reported a significant difference between mortality and non-mortality groups in mean arterial pressure (MAP) (n = 1399, p < 0.001), oxygen saturation (SpO_2) (n = 1399, p < 0.001), and state of consciousness (n = 1399, p < 0.001) based on chi-square tests.

Lee et al.[6] identified several significant predictors of poisoning-related fatalities, including age ≥ 61 years (OR 4.3; 95% CI: 2.6–7.1), male gender (OR 2.5; 95% CI: 1.5–4.3), suicide attempt (OR 6.3; 95% CI: 2.5–15.7), history of chronic or major diseases (OR 2.7; 95% CI: 1.6–4.5), abnormal vital signs (such as decreased Glasgow Coma Scale score, abnormal body temperature, shock, abnormal heart rate, and respiratory insufficiency), and exposure to specific agents including paraquat, organophosphates, carbamates, potassium cyanide (KCN), carbon monoxide (CO), and hypnotics or sedatives.

A study by Yu et al.[7] demonstrated a J-shaped relationship between odds ratios for in-hospital mortality and vital signs including systolic blood pressure (SBP), body temperature (BT), heart rate (HR), and respiratory rate (RR). Patients with SBP greater than 190 mmHg or less than 100 mmHg exhibited more than a twofold increase in the odds of in-hospital mortality. An initial body temperature below 34°C or above 38°C was associated with a sevenfold and twofold increase in mortality odds, respectively. A triage heart rate below 50 beats per minute or above 120 beats per minute correlated with increased mortality risk. Additionally, respiratory rates below 12 breaths per minute (OR = 27.2) or above 28 breaths per minute (OR = 7) were linked to significantly higher odds of in-hospital mortality.

In a study by Jayashree et al.,[8] multiple logistic regression analysis revealed that hypotension at the time of admission was the strongest independent predictor of mortality (adjusted OR: 5.59; 95% CI: 1.38–22.63; p = 0.016).

Assaf et al.[9] recognized several key factors—heart rate, systolic blood pressure, respiratory rate, type of poisoning agent, blood pH, use of mechanical ventilation, and dopamine therapy—as significant indicators of patient prognosis.

In a study by Louriz et al.[10] on prognostic factors in acute aluminum phosphide poisoning (AAIPP), several variables were significantly associated with outcomes, including APACHE II score (p = 0.01), low Glasgow Coma Scale (GCS) score (p = 0.022), shock (p = 0.0003), ECG abnormalities (p = 0.015), acute renal failure (p = 0.026), low prothrombin time (p = 0.020), hyperleucocytosis (p = 0.004), use of vasoactive drugs (p < 0.001), and mechanical ventilation (p = 0.003).; Multivariate logistic regression analysis showed that mortality in AAIPP was independently associated

with the presence of shock (OR = 3.82; 95% CI: 1.12–13.38; p = 0.036) and altered mental status (OR = 3.26); 95% CI: 1.18–8.99; p = 0.022).

In a study by Yu-Hui Hu et al.[11] examining features and prognostic factors in elderly patients with acute poisoning presenting to the Emergency Department in Taipei, three clinical predictors of mortality were identified: herbicide poisoning, hypotension, and respiratory failure at presentation.

In the study by Rajbanshi et al., [12] patient survivals was significantly influenced by age, time to hospital presentation, Glasgow Coma Scale (GCS) score, Sequential Organ Failure Assessment (SOFA) score, need for mechanical ventilation, and duration of ICU stay, hepatic failure, and coagulopathy.

In a study conducted by Lund et al. [13] in Oslo, factors associated with hospitalization included gamma-hydroxybutyric acid (GHB) intoxication, respiratory depression, paracetamol poisoning, reduced consciousness, and suicidal ideation.

The distribution of vital signs recorded at triage revealed a significant difference between the mortality and survivor groups, with patients who died presenting with poor Glasgow Coma Scale (GCS) scores and abnormal vital signs.

A considerable proportion of patients (15.3%) left against medical advice (LAMA), absconded, or were discharged on request, making their outcomes unverifiable. Similar findings were reported by Bhandari et al. (mortality rate 5.5%, LAMA 12%) and Maskey et al. (mortality rate 6.9%, LAMA 19.4%). [5, 14]

Triage plays a crucial role in categorizing patients based on the urgency and timeliness of care, especially in resource-limited settings. [15] This process involves measuring simple parameters such as heart rate, systolic blood pressure, respiratory rate, and body temperature, combined with patient history. [16] These vital signs can serve as early warning indicators and predictors of mortality. [17, 18, 19] However, few studies have evaluated triage parameters as outcome predictors specifically in poisoning cases, and most have focused on single toxic agents.[7, 20, 21]

Conclusion

Acute poisoning cases frequently present to our emergency department, accounting for 3.3% of total visits. The majority of patients are young adults aged 20–30 years, with home-makers and students most commonly affected. Organophosphorus compounds are the most commonly involved toxic agents, with suicide being the leading motive for exposure. Abnormal triage vital signs strongly correlate with poor outcomes. The overall mortality rate was 6.2%.

Limitations of the Study

Single hospital setting, No lab confirmation of toxins, Confounding by toxin-specific vitals, Lack of external validation are the limitations of the study. Overall, while the study offers valuable insight into using triage vital signs for risk stratification, these limitations mean the findings should be applied cautiously and ideally validated in larger, multi-site, and more varied contexts.

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Conflict of Interest: None

Financial Disclosures: None

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