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CORRELATION OF BEDSIDE LACTATE LEVELS WITH MORTALITY AND PHYSIOLOGICAL PARAMETERS IN ACUTE POISONING: A COLLABORATIVE STUDY BETWEEN MEDICINE AND COMMUNITY MEDICINE

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ABSTRACT

Background

Acute poisoning remains an important medical emergency, particularly in regions where pesticides and household chemicals are easily available. Early identification of high-risk patients can support timely management. Bedside lactate measurement provides a quick indication of tissue hypoxia and illness severity, but local evidence on its usefulness in poisoning cases is limited.

Methodology

This observational study was conducted in the Medicine Department Cat D Hospital, Katlang, from January 2024 to January 2025. A total of 72 patients with acute poisoning were included. Clinical details, socio-demographic features, and physiological parameters were recorded at admission. Bedside lactate levels were measured on arrival. Outcomes such as ICU admission, ventilatory support, hospital stay, and mortality were noted. Data were analyzed using appropriate statistical tests, with $p < 0.05$ considered significant.

Results

Most patients were young adults aged 21–40 years, and the majority belonged to rural areas. Organophosphate poisoning was the most common type. Higher lactate levels were strongly associated with low blood pressure, low oxygen saturation, tachypnea, reduced GCS scores, and poor outcomes. Patients with lactate ≥4 mmol/L showed a significantly higher mortality rate compared to those with lower levels. Increased ICU admissions and ventilatory support were also seen in this group.

Conclusion
Bedside lactate measurement serves as a useful prognostic marker in acute poisoning. Elevated lactate at admission reflects physiological deterioration and is linked with greater risk of serious complications and death. Early lactate testing may assist in identifying patients needing urgent intensive care in resource-limited environments.

Key Words
Acute poisoning, bedside lactate, organophosphate, mortality, prognosis, emergency medicine, Pakistan

INTRODUCTION

Acute poisoning continues to be a frequent cause of emergency admissions in many developing regions, including Pakistan. The burden is often higher in rural communities where agricultural chemicals, household agents, and medications are easily accessible. Individuals in the younger age group are commonly affected, with many exposures related to impulsive self-harm, stress, and limited mental-health awareness. Rapid assessment and early risk identification play an important role in improving survival and reducing complications [1-3].

Lactate is produced when tissues do not receive adequate oxygen, leading to anaerobic metabolism. Elevated blood lactate levels have been recognized as a marker of shock, severe illness, and poor perfusion in a variety of medical conditions. Measuring lactate at the bedside offers a rapid and simple tool for assessing the clinical status of patients. In poisoning cases, several toxins interfere with oxygen delivery or cellular metabolism, resulting in raised lactate levels. Therefore, lactate measurement may help clinicians judge the seriousness of poisoning, prioritize care, and plan appropriate treatment [4-6].

Despite increasing attention to lactate monitoring in emergency medicine, limited local data exist regarding its role in predicting outcomes in poisoning cases in this region. Understanding this association may support early clinical decisions and strengthen emergency care practices. This study evaluates bedside lactate levels in patients with acute poisoning and examines their relationship with physiological deterioration and hospital outcomes.

METHODOLOGY

This was a hospital-based observational study carried out in the Department of Medicine, in collaboration with the Department of Community Medicine, at Cat D Hospital, Katlang. The study was conducted over a period of twelve months, from January 2024 to January 2025. All patients presenting with acute poisoning who fulfilled the inclusion criteria were enrolled after obtaining informed consent from the patient or their attendant. Ethical approval for the study was obtained from the Institutional Review Board of Cat D Hospital, Katlang. Confidentiality of patient information was maintained, and data were used solely for academic and research purposes. Consent was taken prior to enrollment, and emergency treatment was provided to all patients without delay or discrimination.

A total of 72 patients with acute poisoning were included in this study. The sample size was based on the number of eligible patients presenting during the study period.

Inclusion Criteria

- Patients aged 12 years and above
- Confirmed history or strong clinical suspicion of acute poisoning from any substance
- Patients presenting within 24 hours of exposure
- Patients who consented to participate

Exclusion Criteria

- Chronic poisoning cases
- Patients with known metabolic disorders affecting lactate levels (e.g., severe liver disease, metabolic acidosis of known cause)
- Patients who refused consent
- Brought-dead cases

Detailed clinical history was taken from each patient or attendant, including information about the substance ingested, route of exposure, and intention (suicidal or accidental). Socio-demographic details such as age, gender, residence, and time taken to reach the hospital after exposure were recorded.

On arrival, all patients were examined and baseline vital parameters were noted, including pulse rate, blood pressure, respiratory rate, oxygen saturation, and level of consciousness assessed using the Glasgow Coma Scale (GCS). Standard emergency management was initiated as per hospital protocol.

A bedside lactate level was measured at the time of admission using a point-of-care lactate analyzer. Lactate values were recorded in mmol/L for each patient. For analysis, patients were categorized based on lactate levels (<4 mmol/L and ≥4 mmol/L).

Patients were monitored throughout their hospital stay. The following outcomes were recorded:

- Need for ICU admission
- Requirement of mechanical ventilation
- Duration of hospital stay
- Final outcome (survived or died)

Data were entered and analyzed using a standard statistical software package. Quantitative variables (such as lactate level, vital signs, and hospital stay) were presented as mean ± standard deviation. Categorical variables (such as gender, intent, and outcome) were expressed as frequencies and percentages. Comparison between survivors and non-survivors was carried out using the chi-square test for categorical variables and the independent t-test for continuous variables. A p-value of <0.05 was considered statistically significant.

RESULTS

In this study of 72 poisoning cases, the mean age of participants was 31.4 ± 12.8 years. The majority were in the 21–40-year age group (61.1%). Males constituted 63.9% of the study sample, while females accounted for 36.1%. Most patients were from rural areas (69.4%). Suicidal poisoning was the most common intent (77.8%), followed by accidental poisoning (19.4%). Only 2.8% cases were due to other causes.

Table 1: Socio-Demographic Characteristics of Patients (n = 72)

Variable	Category	Frequency (n)	Percentage (%)
Age (years)	Mean ± SD	**31.4 ± 12.8**	—
Age group	<20	10	13.9
	21–40	44	61.1
	>40	18	25.0
Gender	Male	46	63.9
	Female	26	36.1
Residence	Rural	50	69.4
	Urban	22	30.6
Intent of poisoning	Suicidal	56	77.8
	Accidental	14	19.4
	Others	2	2.8

Organophosphate poisoning (44.4%) was the most common type, followed by drug overdose (19.4%) and other pesticides (13.9%). Alcohol and methanol poisoning contributed to 11.1% of cases. Oral ingestion was the predominant route (90.3%). The mean duration between exposure and hospital arrival was 3.2 ± 1.8 hours. In addition to clinical and physiological findings, community-related characteristics were noted. Most cases were from rural areas (69.4%), indicating higher pesticide access and agricultural exposure. Suicidal intent was the leading cause of poisoning (77.8%), reflecting psychosocial and mental-health related factors in the community. A significant proportion reached the hospital within 3.2 ± 1.8 hours of exposure, showing varied health-seeking behavior and access to emergency care. Organophosphate compounds, commonly used in rural farming communities, accounted for the majority of cases (44.4%). These findings highlight the public-health importance of poison availability, need for mental-health awareness, safe chemical storage practices, and strengthening primary emergency response systems in the community.

Table 2: Poisoning Profile of Study Participants

Variable	Category	Frequency (n)	%
Type of poison	Organophosphate	32	44.4
	Drug overdose	14	19.4
	Pesticides (other)	10	13.9
	Alcohol/Methanol	8	11.1
	Others/Unknown	8	11.1
Route	Oral	65	90.3
	Dermal/Inhalation	7	9.7
Time to hospital (hrs)	Mean ± SD	**3.2 ± 1.8**	—

Patients who survived had more stable physiological parameters on admission compared to those who died. Non-survivors had significantly higher heart and respiratory rates and lower systolic blood pressure, GCS, and oxygen saturation. The differences were statistically significant ($p < 0.01$ for all).

Table 3: Comparison of Clinical Parameters Between Survivors and Non-Survivors

Parameter	Survivors (n=60) Mean ± SD	Non-Survivors (n=12) Mean ± SD	p-value
Heart Rate (beats/min)	98.5 ± 16.2	118.3 ± 18.9	**0.001**
Systolic BP (mmHg)	111.2 ± 14.8	92.4 ± 12.6	**0.002**
Respiratory Rate/min	22.6 ± 4.8	29.1 ± 5.6	**<0.001**
GCS Score	12.3 ± 2.1	7.4 ± 2.9	**<0.001**
Oxygen Saturation (%)	94.1 ± 3.8	86.9 ± 5.3	**<0.001**

Mean lactate levels were markedly higher among non-survivors (6.1 ± 1.8 mmol/L) compared to survivors (2.8 ± 1.1 mmol/L), showing a strong association with mortality ($p < 0.001$). Mortality was significantly higher in patients with lactate ≥4 mmol/L.

Table 4: Lactate Levels Among Survivors and Non-Survivors

Variable	Survivors (n=60)	Non-Survivors (n=12)	p-value
Mean lactate (mmol/L)	**2.8 ± 1.1**	**6.1 ± 1.8**	**<0.001**
Lactate ≥ 4 mmol/L	12 (20%)	11 (91.7%)	**<0.001**

Among those who died, need for ICU admission and ventilatory support was significantly higher. Survivors had longer hospital stays compared to non-survivors, which suggests early deaths in severe cases.

Table 5: Hospital Outcomes in Survivors vs Non-Survivors

Outcome	Survivors (n=60)	Non-Survivors (n=12)	p-value
ICU Admission	18 (30%)	11 (91.7%)	**<0.001**
Mechanical Ventilation	9 (15%)	10 (83.3%)	**<0.001**
Mean Hospital Stay (days)	4.9 ± 2.3	2.1 ± 1.2	**0.004**

Lactate levels showed a significant negative correlation with systolic blood pressure, GCS, and oxygen saturation, and a positive correlation with respiratory rate. These findings highlight lactate as a marker of physiological deterioration.

Table 6: Correlation Between Lactate and Physiological Parameters

Parameter	Correlation (r)	p-value
Systolic BP	–0.52	**<0.001**
Respiratory Rate	+0.48	**<0.001**
GCS Score	–0.59	**<0.001**
Oxygen Saturation	–0.51	**<0.001**

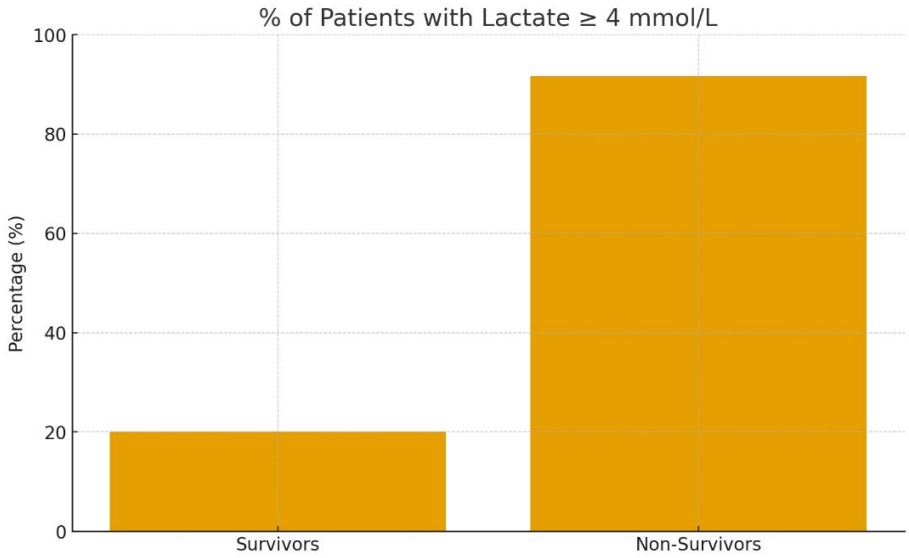

Figure 1 Bar graph shows that patients with lactate ≥ 4 mmol/L were far more common among non-survivors (91.7%) compared to survivors (20%). This highlights the strong relationship between high lactate levels and mortality in acute poisoning cases.

DISCUSSION

This study explored the relationship between bedside lactate levels, physiological parameters, and outcomes in patients presenting with acute poisoning at a Cat D Hospital, Katlang. The findings demonstrated that patients with higher lactate levels on admission were more likely to require intensive care, mechanical ventilation, and had a higher risk of mortality. Elevated lactate strongly corresponded with deranged vital signs, especially hypotension, tachypnea, reduced oxygen saturation, and lower GCS scores. These observations highlight the value of early lactate measurement as a rapid and useful marker of severity in poisoning cases [7-9].

The majority of patients in this study were young adults, particularly those aged 21–40 years, which echoes trends seen in several national and international studies where most poisoning victims belong to the productive age group. This pattern may reflect social stressors, financial pressures, and limited coping strategies among younger individuals. A predominance of males and rural residents

was also noted, similar to earlier observations from South Asian regions where agricultural communities are highly exposed to pesticides and toxic chemicals [10-12]. The high proportion of suicidal poisoning suggests an underlying psychosocial burden deserving greater public health attention. Limited mental-health awareness and easy access to toxic substances likely play a contributory role.

Organophosphate compounds were the most common agents, again aligning with reports from agricultural districts of Pakistan and neighbouring countries where pesticides remain widely available. This may reflect inadequate regulation of hazardous chemicals and lack of secure storage practices in rural households. The average time to hospital presentation (around three hours) indicates delayed access to care, which can worsen physiological status and explains, in part, the elevated lactate levels observed in critical cases. Timely referral systems and community-level emergency preparedness could potentially reduce such delays [13-15].

In this study, non-survivors had significantlyhigher lactate levels than survivors, and mortality sharply increased above 4 mmol/L. This finding aligns with earlier toxicology and emergency medicine research where lactate has been shown to predict poor outcomes due to tissue hypoxia, shock, and metabolic stress following toxin exposure [16-18]. The strong negative association between lactate and systolic blood pressure, GCS, and oxygen saturation also supports the concept that rising lactate reflects physiological deterioration. A positive association with respiratory rate is consistent with compensatory hyperventilation during metabolic acidosis. From a clinical perspective, bedside lactate testing may help triage patients earlier, identify those requiring aggressive support, and aid decision-making in resource-limited settings [19, 20].

While these findings correspond with existing literature, they also emphasize local realities. Limited awareness about poison safety, restricted mental-health support, and delayed hospital arrival continue to contribute to the burden of poisoning. Based on field experience during data collection, relatives often reported hesitation in seeking early care, either due to social stigma or distance from medical facilities. This suggests a need for structured community-level education, better regulation of pesticide sales, and strengthening of primary emergency services.

CONCLUSION

This study demonstrates that bedside lactate measurement is a valuable indicator of severity and mortality in acute poisoning cases. Higher lactate levels were associated with poorer physiological status, greater need for ICU care and ventilation, and increased fatality. Young adults from rural areas were most affected, with organophosphate compounds being the leading agent. These findings point toward both clinical and public-health priorities: early risk assessment using lactate at hospital arrival and preventive strategies focusing on pesticide control, safe storage, mental-health awareness, and timely access to emergency services. Incorporating lactate testing into routine emergency assessment may assist clinicians in identifying high-risk patients and improving outcomes.

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