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Original Research Article

Evaluating the use of APACHE II Score in Acute Organophosphorus Poisoning: A Prospective and Retrospective Observational Study

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Conflict of interest: Nil

Abstract:

Background: Organophosphorus compounds (OPCs) are widely used pesticides and a major cause of poisoning-related mortality in India. Severe toxicity results from acetylcholinesterase inhibition leading to cholinergic crisis. Reliable prognostic markers are essential for early risk stratification. The Acute Physiology and Chronic Health Evaluation II (APACHE II) score is extensively used in ICUs, but its utility in OPC poisoning remains incompletely defined.

Aim: To evaluate the predictive accuracy of the APACHE II score in assessing severity and clinical outcomes of organophosphorus poisoning.

Methods: A prospective and retrospective observational study was conducted in the Department of Medicine, Jorhat Medical College & Hospital, including 75 adults with confirmed OPC poisoning. Clinical parameters, laboratory variables, and APACHE II score calculated within 24 hours of ICU admission were analyzed. Outcomes were compared between survivors and non-survivors.

Results: Of 75 patients, 52% survived and 48% died. Most were males (64%) and 18–30 years old. Triazophos (26.7%) and acephate (20%) were the most frequent agents. Significant predictors of mortality included elevated temperature (p=0.010), lower GCS (p=0.048), high respiratory rate (p=0.005), metabolic acidosis (pH; p=0.019), elevated creatinine (p=0.033), hyponatremia (p=0.011), and higher APACHE II score (p=0.009). No significant association was noted with age, MAP, heart rate, hematocrit, or time to admission.

Conclusion: APACHE II is a reliable prognostic tool in organophosphorus poisoning, correlating significantly with mortality risk. Temperature dysregulation, respiratory distress, acidosis, and electrolyte abnormalities emerged as key clinical predictors. Early scoring may facilitate timely triage and targeted interventions.

Keywords: Organophosphorus poisoning, APACHE II, mortality prediction, cholinergic crisis, ICU scoring systems.

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Introduction

Organophosphorus compounds (OPCs) are potent cholinesterase-inhibiting pesticides responsible for substantial morbidity and mortality worldwide. India, particularly rural regions, bears a disproportionate burden due to easy availability, agricultural dependence, and high rates of deliberate self-poisoning.

OPCs inhibit acetylcholinesterase, leading to accumulation of acetylcholine at muscarinic, nicotinic, and central nervous system receptors. Resultant cholinergic overstimulation produces respiratory failure, the leading cause of death. Predicting outcomes early is crucial. APACHE II is a validated ICU scoring system incorporating physiological variables, GCS, and chronic health assessment. This study evaluates its prognostic performance in acute OPC toxicity.

Materials and Methods

Study design: Prospective and retrospective observational study.

Setting: Jorhat Medical College & Hospital.

Sample size: 75 patients.

Outcome measures: Survival vs non-survival; predictors of mortality.

Results

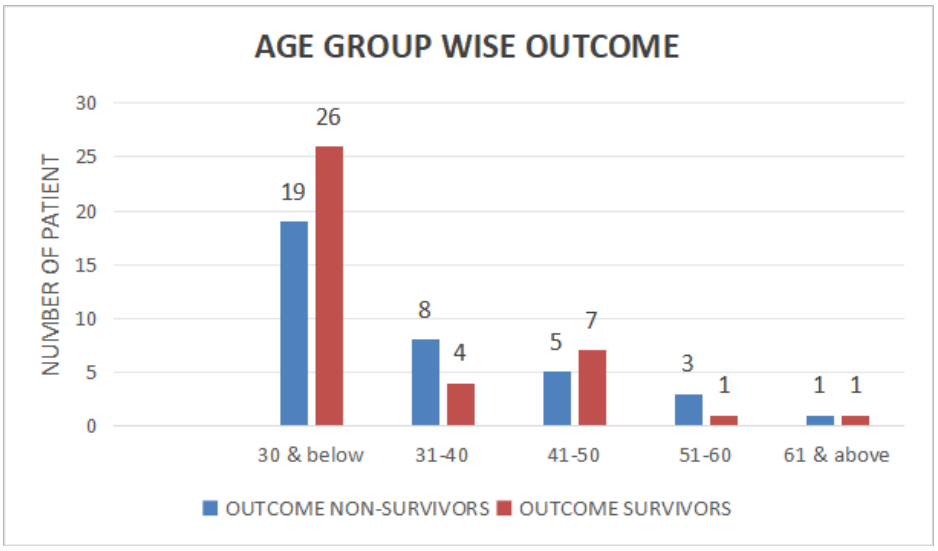

Figure 1: Age Group Wise Outcome of Survivors and Non Survivors in Op Poisoning

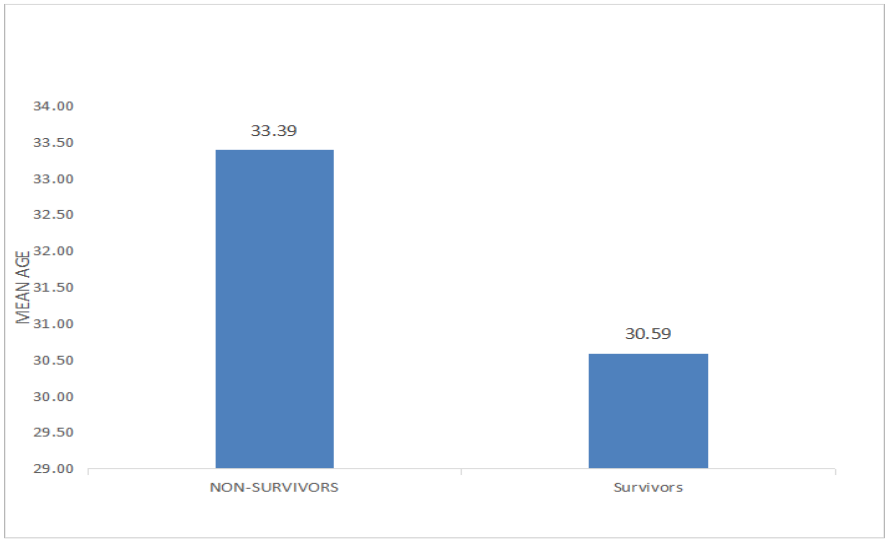

Figure 2: Mean Age of Survivor and Non Survivors in Op Poisoning

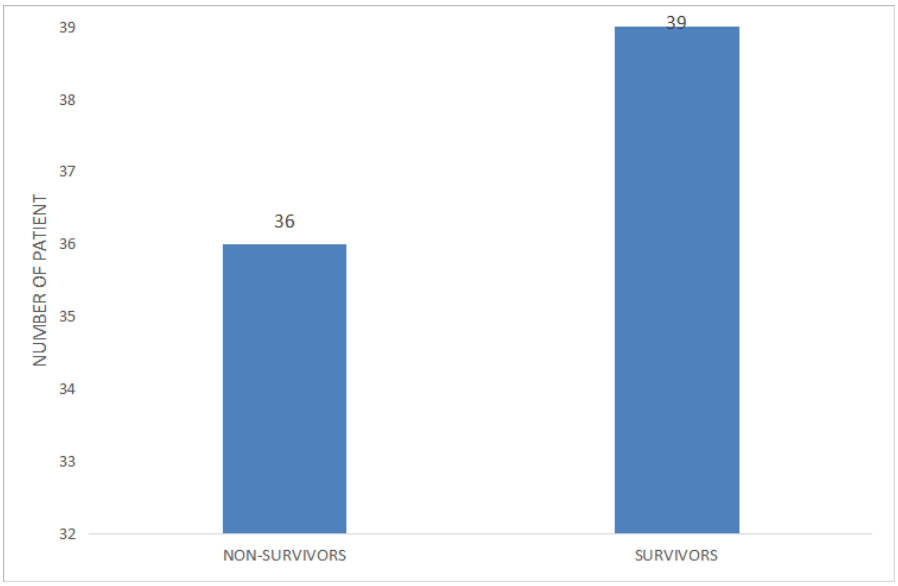

Figure 3: Gender Wise Outcome of Survivors and Non Survivors in Op Poisoning

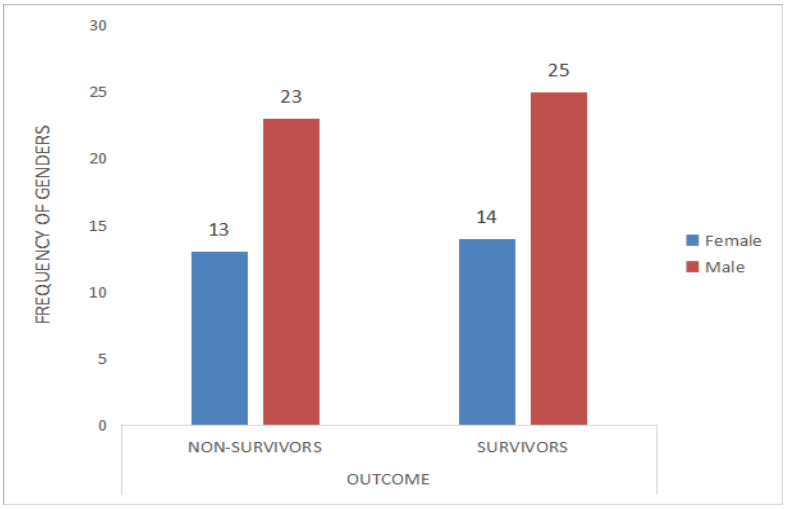

Figure 4: Number of Patient in Survivor and Non Survivors

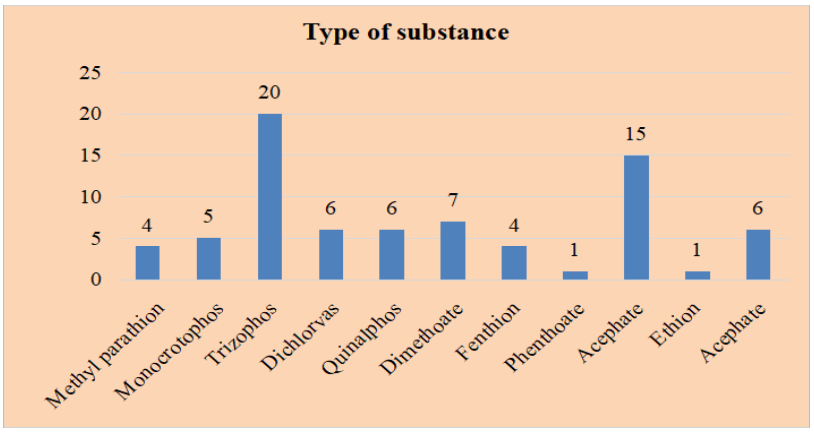

Figure 5: Frequency and Types of Substance Consumed

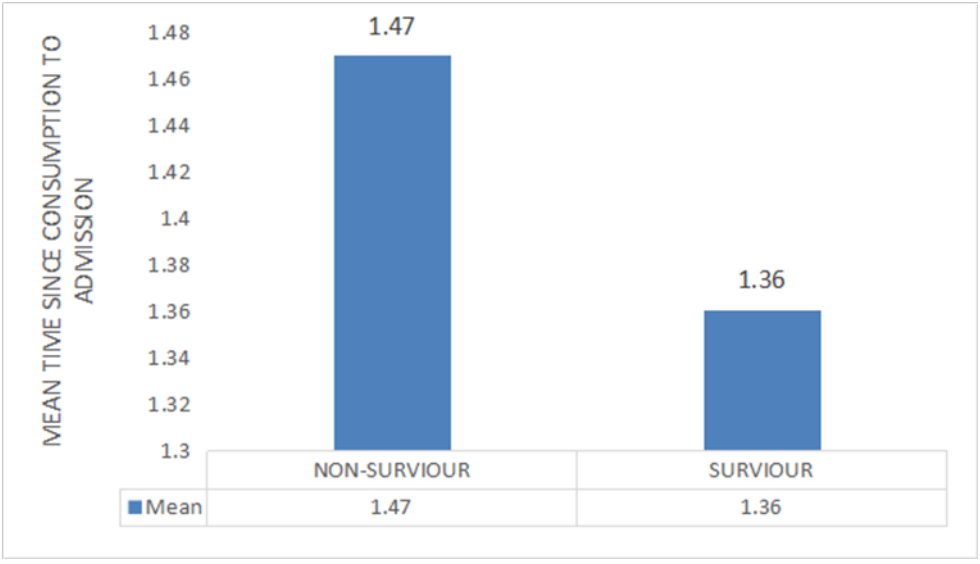

Figure 6: Time Elapse since Consumption to Admission in Non Survivors and Survivors in Op Poisoning

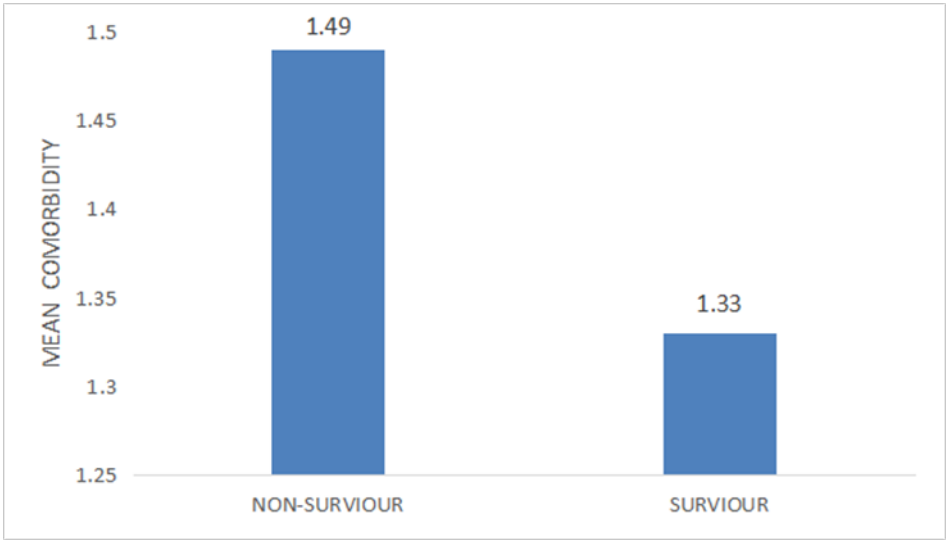

Figure 7: Chronic Health History in Survivors and Non Survivors in Op Poisoning

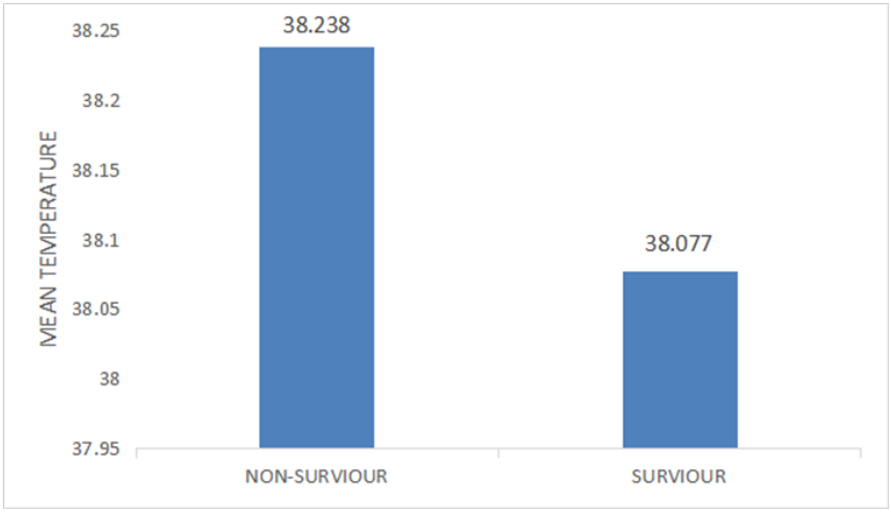

Figure 8: Mean Body Temperature of Survivors and Non Survivors in Op Poisoning

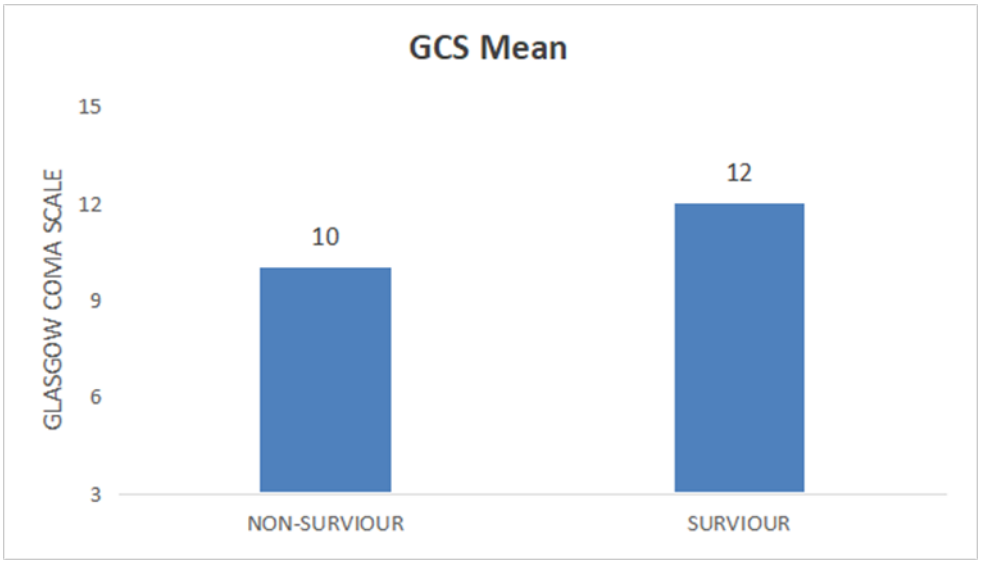

Figure 9: Glasgow Coma Scale in Survivors and Non Survivors in Op Poisoning

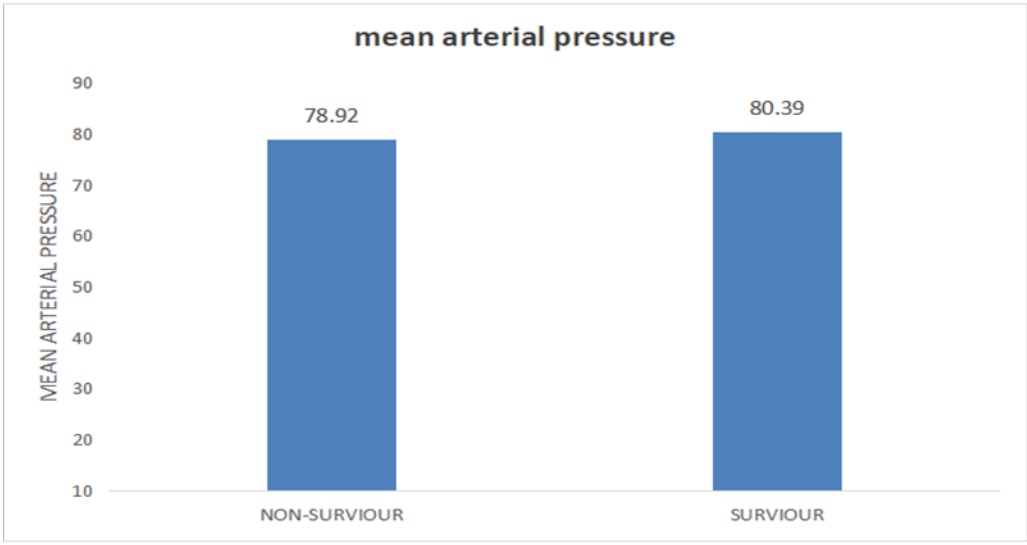

Figure 10: Mean Arterial Pressure of Survivors and Non Survivors in Op Poisoning

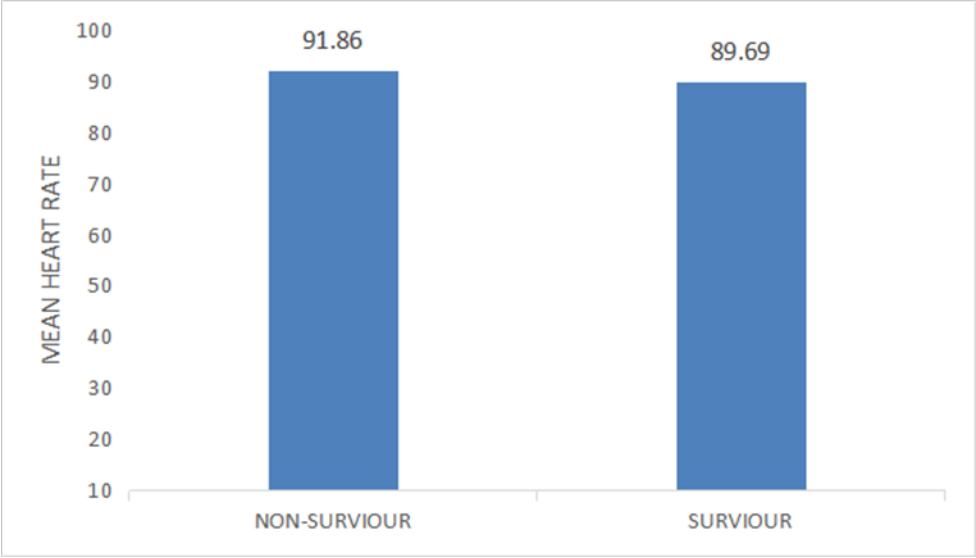

Figure 11: Heart Rate of Survivors and Non Survivors in Op Poisoning

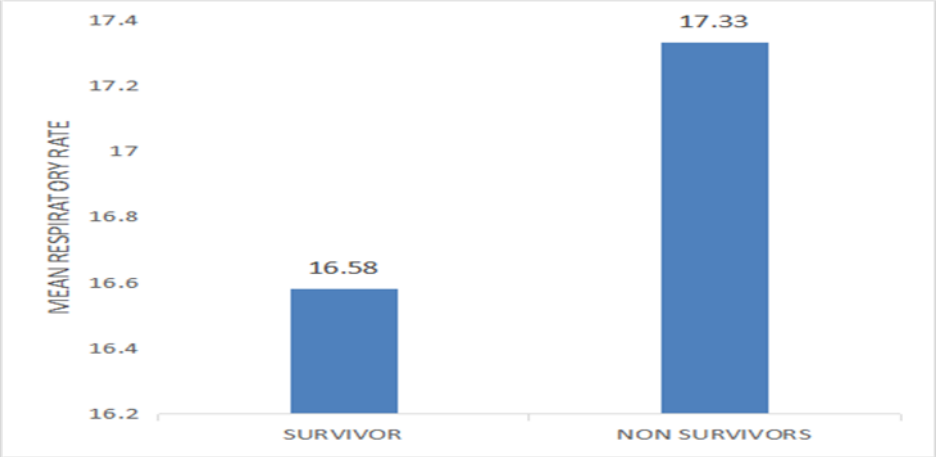

Figure 12: Respiratory Rate of Survivors and Non Survivors in Op Poisoning

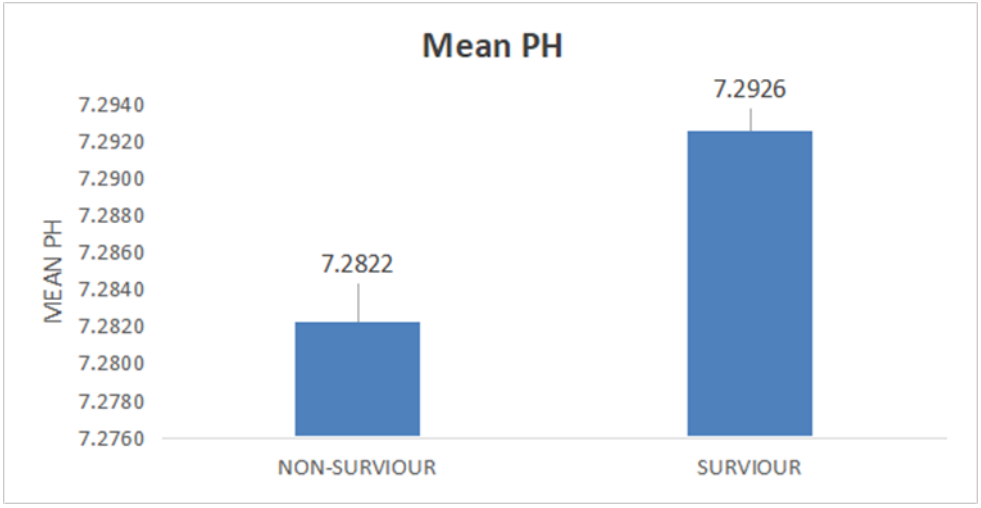

Figure 13: pH Of Survivors and Non Survivors in Op Poisoning

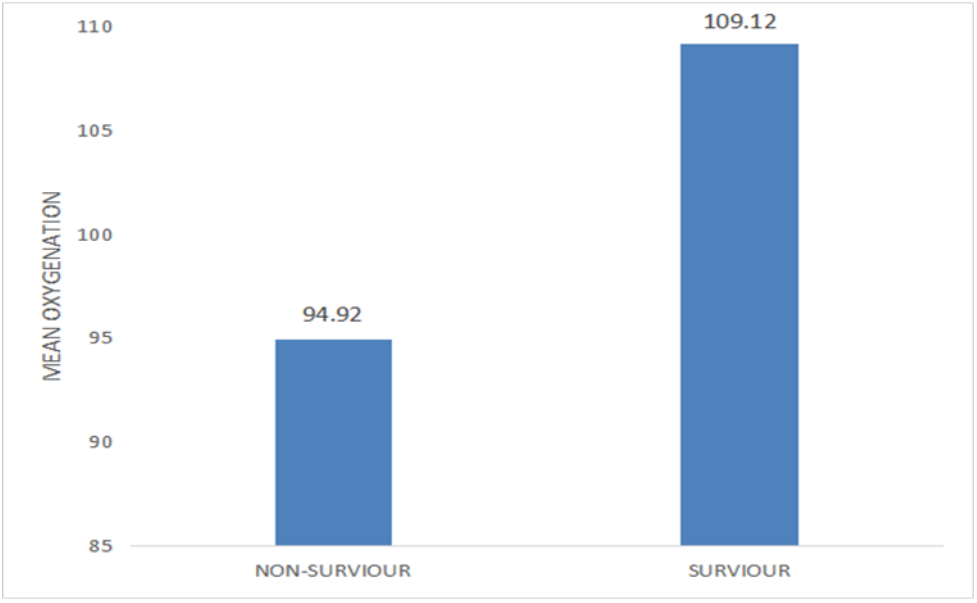

Figure 14: Oxygenation of Survivors and Non Survivors in Op Poisoning

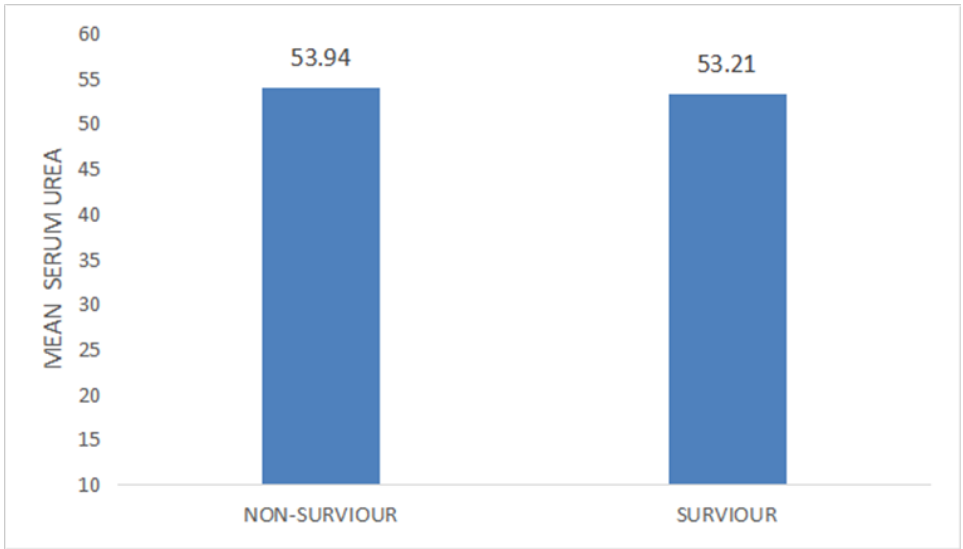

Figure 15: Serum Urea of Survivors and Non Survivors in Op Poisoning

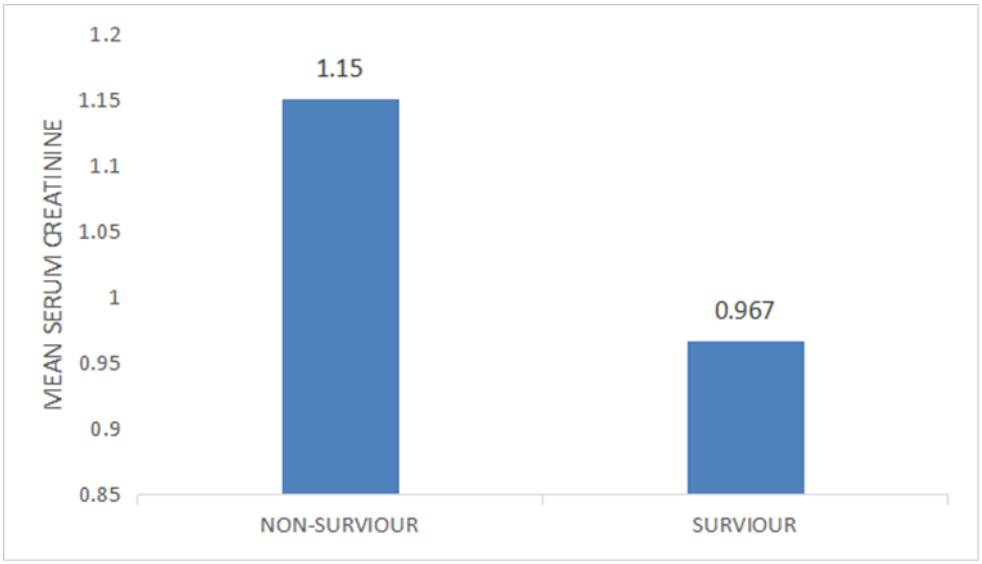

Figure 16: Serum Creatinine of Survivors and Non Survivors in Op Poisoning

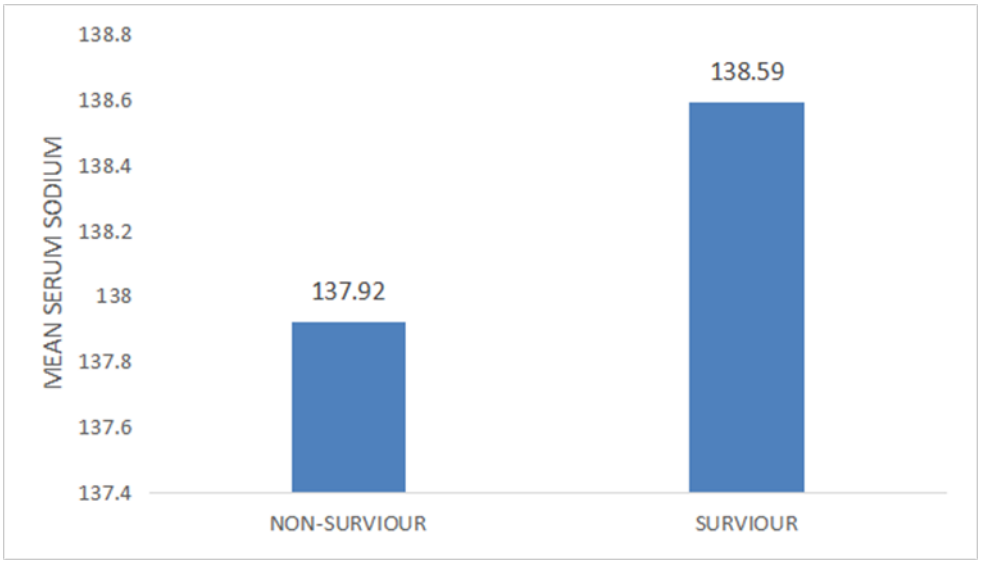

Figure 17: Serum Sodium of Survivors and Non Survivors in Op Poisoning

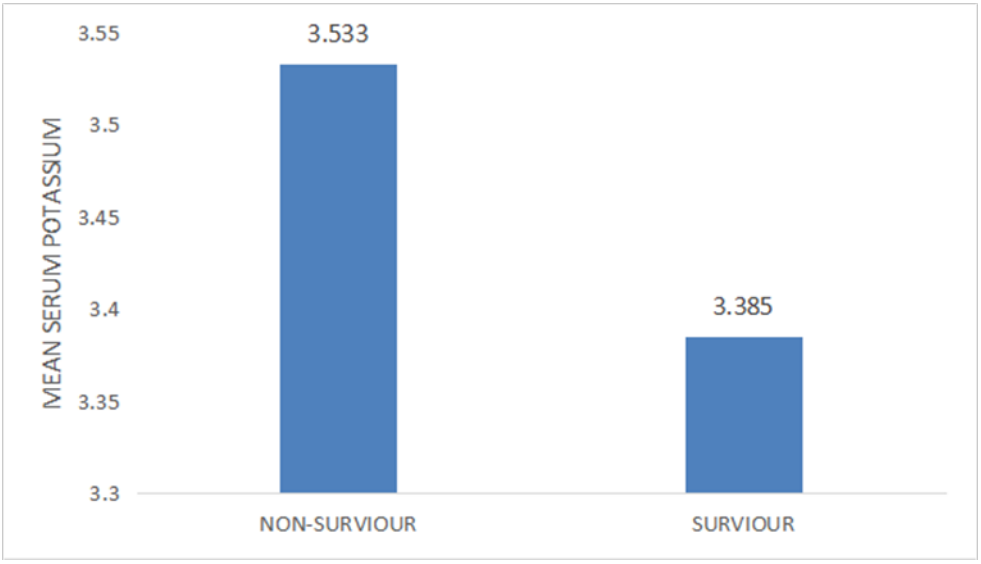

Figure 18: Serum Potassium of Survivors and Non Survivors in Op Poisoning

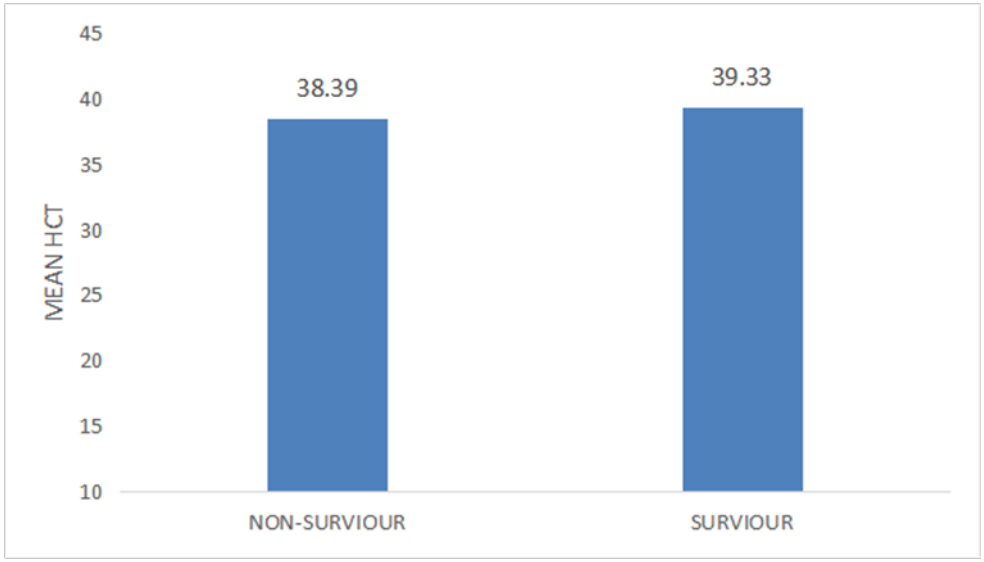

Figure 19: Hematocrit of Survivors and Non Survivors in Op Poisoning

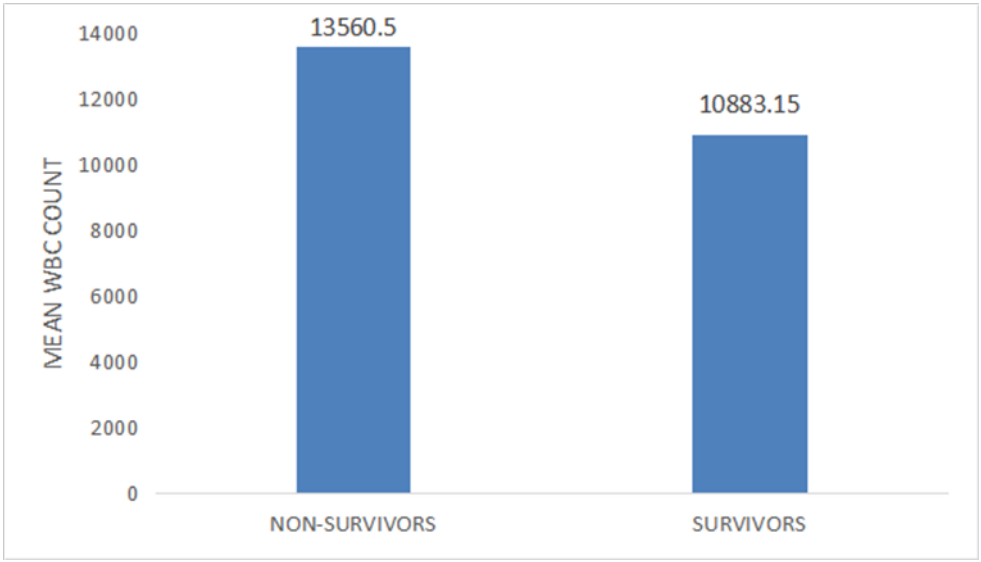

Figure 20: Wbc Count of Survivors and Non Survivors in Op Poisoning

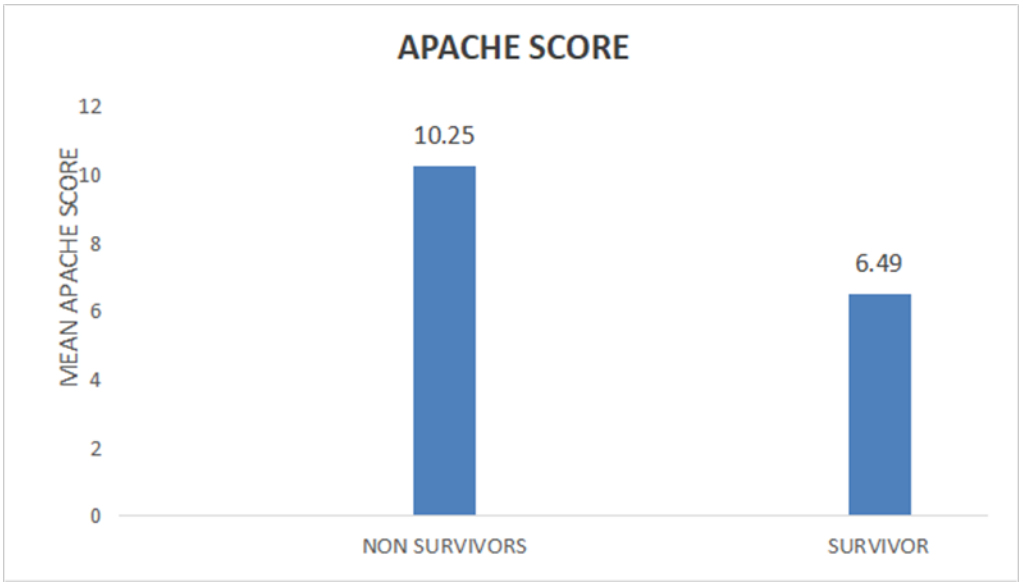

Figure 21: Apache Ii Score of Survivors and Non Survivors in Op Poisoning

Demographics:

- Mean age: 18–30 years predominantly
- Males: 64%
- Agents: triazophos (26.7%), acephate (20%)

Outcome:

- Survivors: 39 (52%)
- Non-survivors: 36 (48%)

Significant Predictors: Temperature (p=0.010), GCS (p=0.048), respiratory rate (p=0.005), pH (p=0.019), creatinine (p=0.033), sodium (p=0.011), APACHE II score (p=0.009).

Discussion

Organophosphorus compound (OPC) poisoning remains a significant public health problem in India, particularly in rural and agrarian regions, owing to easy accessibility of pesticides and their frequent use in deliberate self-harm. Despite advances in supportive care and antidotal therapy, mortality remains substantial, largely due to respiratory failure, delayed presentation, and complications such as metabolic derangements and multiorgan dysfunction. Early identification of high-risk patients is therefore crucial for optimizing management and allocating intensive care resources. In this context, the present study evaluated the prognostic utility of the APACHE II scoring system in patients with acute OPC poisoning.

Demographic and Epidemiological Profile: In the present study, the majority of patients belonged to the 18–30 year age group, with a male predominance (64%). This demographic pattern is consistent with several Indian and international studies, which report a higher incidence of OPC poisoning among young adult males, reflecting psychosocial stressors, occupational exposure, and impulsive self-harm behavior in this age group. The predominance of compounds such as triazophos and acephate further highlights the role of commonly available agricultural pesticides in rural settings.

Although younger age groups constituted the majority of cases, age itself did not show a statistically significant association with mortality in this study. This finding is in agreement with previous observations that physiological derangements at presentation, rather than chronological age alone, play a more decisive role in determining outcomes in acute OPC poisoning.

Clinical and Physiological Predictors of Mortality: The present study identified several physiological parameters that were significantly associated with mortality, including elevated body temperature, lower Glasgow Coma Scale (GCS), higher respiratory rate, metabolic acidosis (low pH), elevated serum creatinine, and hyponatremia. These findings are pathophysiologically plausible and clinically relevant.

Hyperthermia in OPC poisoning may reflect severe cholinergic crisis, increased muscle activity, secondary infections, or systemic inflammatory response, all of which are markers of severe toxicity. Lower GCS scores indicate central nervous system involvement and correlate with the need for airway protection and mechanical ventilation. Respiratory rate emerged as a strong predictor, underscoring the central role of respiratory failure—due to bronchorrhea, bronchospasm, respiratory muscle weakness, and central respiratory depression—as the leading cause of mortality in OPC poisoning.

Metabolic acidosis observed in non-survivors likely reflects hypoxia, lactic acidosis, and shock, and has been consistently reported as an adverse prognostic marker in previous studies. Renal dysfunction, as evidenced by elevated serum creatinine, may result from hypoperfusion, rhabdomyolysis, or direct toxic effects, and signifies evolving multiorgan failure. Hyponatremia, another significant predictor in this study, may be secondary to inappropriate antidiuretic hormone secretion, fluid shifts, or renal impairment, and has been associated with worse outcomes in critically ill patients.

APACHE II Score and Outcome Prediction: The most important finding of the present study is the significant association between higher APACHE II scores and mortality ($p = 0.009$). APACHE II, which integrates acute physiological variables, GCS, age, and chronic health status, was originally developed for general ICU populations. Its strong correlation with mortality in OPC poisoning, as demonstrated in this study, reinforces its applicability in toxicological emergencies.

Patients who did not survive had significantly higher APACHE II scores compared to survivors, indicating greater physiological derangement at admission. This finding is consistent with earlier studies that have reported APACHE II as a reliable predictor of mortality, need for mechanical ventilation, and length of ICU stay in OPC poisoning. Unlike single-parameter predictors, APACHE II offers a comprehensive assessment of disease severity by capturing the cumulative burden of systemic dysfunction. Importantly, several individual components of APACHE II—such as GCS, respiratory rate, pH, temperature, and creatinine—were themselves significantly associated with mortality in this study. This internal consistency further validates the score's prognostic relevance in OPC poisoning.

Comparison with Other Prognostic Tools: Although several scoring systems such as SOFA, SAPS, and Poison Severity Score (PSS) have been studied in OPC poisoning, APACHE II remains

one of the most widely used and validated ICU scoring systems.

Its relative simplicity, widespread familiarity, and ability to be calculated within the first 24 hours of admission make it particularly suitable for resource-limited settings. While OPC-specific scoring systems may offer theoretical advantages, APACHE II provides a practical and effective tool for early risk stratification.

Clinical Implications: The findings of this study have important clinical implications. Early calculation of the APACHE II score in patients with OPC poisoning can aid clinicians in identifying high-risk individuals who may benefit from early intensive monitoring, aggressive respiratory support, and timely interventions. It may also assist in prognostication, counseling of relatives, and rational allocation of ICU resources in high-burden settings.

Limitations: Despite its strengths, the study has certain limitations. The sample size was relatively small and derived from a single center, which may limit generalizability. The inclusion of both prospective and retrospective data may introduce variability in data completeness. Additionally, serial APACHE II scoring was not performed, which could have provided insights into dynamic changes in severity and prognosis.

Summary: In summary, the present study demonstrates that the APACHE II score is a reliable and effective prognostic tool in acute organophosphorus poisoning. Its strong association with mortality, along with the identification of key physiological predictors such as respiratory distress, metabolic acidosis, renal dysfunction, and electrolyte imbalance, underscores its value in early risk stratification and clinical decision-making.

Conclusion

APACHE II is a valuable scoring system for predicting severity and outcomes in OPC poisoning. It should be integrated into early management.

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