Original Research Article

A Cross Sectional Study of Patients with Alleged Paraquat Poisoning Admitted in a Tertiary Care Hospital, in Relation to Presenting Features and Outcomes

Priyanka Saha[1], Sumit Sarkar[2], Sandipan Banik[3], Sandipan Mondal[4], Smarajit Banik[5]

[1]Medical Officer (Specialist), Department of Pathology, Mal Super Speciality Hospital, Jalpaiguri, West Bengal, India – 735221.
[2]Medical Officer (Specialist), Department of Medicine, Jalpaiguri Government Medical College and Hospital, Jalpaiguri, West Bengal, India – 735101.
[3]Assistant Professor, Department of Medicine, Jalpaiguri Government Medical College and Hospital, Jalpaiguri, West Bengal, India – 735101.
[4]Medical Officer (Specialist), Department of Medicine, Jalpaiguri Government Medical College and Hospital, Jalpaiguri, West Bengal, India – 735101.
[5]Professor and Head, Department of Medicine, Jalpaiguri Government Medical College and Hospital, Jalpaiguri, West Bengal, India - 735101.

Abstract:

Introduction: Paraquat is a widely used herbicide associated with high morbidity and mortality following ingestion. Early recognition and prompt management are critical, yet clinical presentations can be variable. Understanding the presenting features and outcomes of paraquat poisoning is essential for improving patient care.

Aims: This study aims to conduct a comprehensive analysis of patients admitted with alleged paraquat poisoning to a tertiary care hospital, focusing on their presenting features, clinical course, and outcomes. By identifying key determinants of mortality and morbidity, the study seeks to inform clinical practices and public health strategies to mitigate the impact of paraquat poisoning

Methods: This was a hospital-based cross-sectional observational study conducted over a period of one year at Jalpaiguri Medical College and Hospital. A total of 46 patients admitted with alleged paraquat poisoning were included in the study. Data were collected on demographic variables such as age and gender, as well as clinical features including oral ulcers, acute kidney injury, abdominal pain, and respiratory symptoms such as hemoptysis and shortness of breath. Laboratory parameters and clinical severity scores were also recorded to assess the extent of organ involvement and predict outcomes. The study aimed to evaluate the relationship between these variables and patient outcomes, including discharge or mortality, to identify key clinical and laboratory predictors of prognosis in paraquat poisoning.

Results: In this study of 46 patients with alleged paraquat poisoning, 40 (87%) were discharged and 6 (13%) expired. Most patients were aged 21–30 years (30.4%), followed by 11–20 years (26.1%) and 31–40 years (23.9%), with no significant association between age or gender and outcome. Clinically, oral ulcers were common (93.5%) but not linked to mortality. In contrast, acute kidney injury (63%) and respiratory symptoms such as hemoptysis and shortness of breath (15.2%) were significantly associated with death. Abdominal pain was reported in 47.8% of patients but showed no significant correlation with outcomes. Patients who expired had higher mean [parameter] values (16.0 ± 5.66) compared to those discharged (10.88 ± 6.52).

Conclusion: Paraquat poisoning continues to be associated with significant morbidity and mortality. Early identification of high-risk patients based on presenting features and laboratory parameters may improve outcomes. Public health measures to prevent accidental and intentional exposure, coupled with standardized management protocols, are essential.

Keywords: Paraquat poisoning, herbicide toxicity, cross-sectional study, clinical features, outcomes, tertiary care hospital.

Introduction

Paraquat poisoning remains a significant public health concern globally, particularly in developing countries where its accessibility and affordability contribute to its frequent use in suicides and accidental ingestions [1]. Paraquat (N,N′-dimethyl-4,4′-bipyridinium dichloride) is a non-selective contact herbicide known for its rapid action and high toxicity. Despite its effectiveness in weed control, paraquat has been banned in several countries due to its lethal potential and lack of a specific antidote [2]. In India, paraquat poisoning is a pressing issue, with numerous cases reported annually. A study from a tertiary care hospital revealed that out of 288 patients admitted in 2022, over 200 succumbed to the poisoning, highlighting the high mortality rate associated with this condition [3]. The clinical presentation of paraquat poisoning is diverse, ranging from initial symptoms such as oral mucosal ulceration and gastrointestinal distress to severe manifestations like acute respiratory distress syndrome (ARDS), acute kidney injury, and multi-organ failure [4].

The pathophysiology of paraquat toxicity involves the generation of reactive oxygen species (ROS), leading to oxidative stress and subsequent cellular damage. The lungs, due to their high oxygen content and selective accumulation of paraquat, are particularly susceptible, often resulting in progressive pulmonary fibrosis and respiratory failure, which are leading causes of death in affected individuals [5]. Other organs, including the kidneys and liver, can also be affected, contributing to the multi-system involvement observed in severe cases [6]. Management of paraquat poisoning is primarily supportive, focusing on preventing further absorption and mitigating organ damage. Early interventions such as activated charcoal administration, if performed within a few hours of ingestion, and extracorporeal treatments like hemodialysis or hemoperfusion have been explored, though their efficacy remains debated [7].

Immunosuppressive therapies, including corticosteroids and cyclophosphamide, have been investigated with mixed results, and their role in improving survival outcomes is still uncertain [8].

Given the high fatality rate and the lack of a definitive antidote, understanding the clinical features, risk factors, and outcomes associated with paraquat poisoning is crucial for improving patient management and outcomes [9].

This study aims to conduct a comprehensive analysis of patients admitted with alleged paraquat poisoning to a tertiary care hospital, focusing on their presenting features, clinical course, and outcomes. By identifying key determinants of mortality and morbidity, the study seeks to inform clinical practices and public health strategies to mitigate the impact of paraquat poisoning [10].

Materials and Methods

Study Design: Hospital-based cross-sectional observational study.

Place of study: Jalpaiguri Medical College and Hospital.

Period of study: 1 Year.

Study Variables:

- Age
- Gender
- Clinical Features
- Laboratory Parameters and Clinical Scores
- Oral ulcer
- Kidney injury
- Abdominal pain
- Hemoptysis and shortness of breath

Sample Size: 46 patients admitted with alleged paraquat poisoning.

Inclusion:

- Patients of all ages and genders admitted with alleged paraquat poisoning.
- Patients presenting within of ingestion.
- Patients or attendants who gave informed consent for the study.

Exclusion Criteria:

- Patients with poisoning due to substances other than paraquat.
- Patients with incomplete clinical records or missing data.
- Patients who left against medical advice before assessment or treatment.
- Pregnant women or patients with known terminal illnesses unrelated to paraquat poisoning.

Statistical Analysis: All collected data were entered into a Microsoft Excel spreadsheet and analyzed using SPSS version 27.0 (IBM Corp., Armonk, NY, USA). Continuous variables were summarized as mean ± standard deviation (SD) or median with interquartile range (IQR), depending on data distribution, while categorical variables were presented as frequencies and percentages. Comparisons between groups were performed using the Chi-square test or Fisher's exact test for categorical variables and independent t-test or Mann–Whitney U test for continuous variables. A p-value of <0.05 was considered statistically significant. Graphs and tables were generated using GraphPad Prism version 5 to illustrate key findings and trends.

Results

Table 1: Demographic Profile and Outcomes

Demographic Profile and Outcomes		Discharged	Expired	Total	P-value
Age in group	11-20	10 (25%)	2 (33.3%)	12 (26.1%)	0.9345
	21-30	12 (30.0%)	2 (33.3%)	14 (30.4%)	
	31-40	10 (25%)	1 (16.7%)	11 (23.9%)	
	41-50	5 (12.5%)	1 (16.7%)	6 (13%)	
	≥51	3 (7.5%)	0 (0.0%)	3 (6.5%)	
	Total	40 (100%)	6 (100%)	46 (100%)	
Gender	Female	18 (45%)	2 (33.3%)	20 (43.5%)	0.5908
	Male	22 (55%)	4 (66.7%)	26 (56.5%)	
	Total	40 (100%)	6 (100%)	46 (100%)	

Table 2: Clinical Features and Their Association with Outcomes

Clinical Features		Discharged	Expired	Total	P-value
Oral ulcer	No	3 (7.5%)	0 (0.0%)	3 (6.5%)	0.4877
	Yes	37 (92.5%)	6 (100%)	43 (93.5%)	
	Total	40 (100%)	6 (100%)	46 (100%)	
Kidney injury	No	17 (42.5%)	0 (0.0%)	17 (37%)	0.0443
	Yes	23 (57.5%)	6 (100%)	29 (63%)	
	Total	40 (100%)	6 (100%)	46 (100%)	
Hemoptysis and shortness of breath	No	39 (97.5%)	0 (0.0%)	39 (84.8%)	<0.0001
	Yes	1 (2.5%)	6 (100%)	7 (15.2%)	
	Total	40 (100%)	6 (100%)	46 (100%)	
Abdominal pain	No	23 (57.5%)	1 (16.7%)	24 (52.2%)	0.0618
	Yes	17 (42.5%)	5 (83.3%)	22 (47.8%)	
	Total	40 (100%)	6 (100%)	46 (100%)	

Table 3: Laboratory Parameters and Clinical Scores

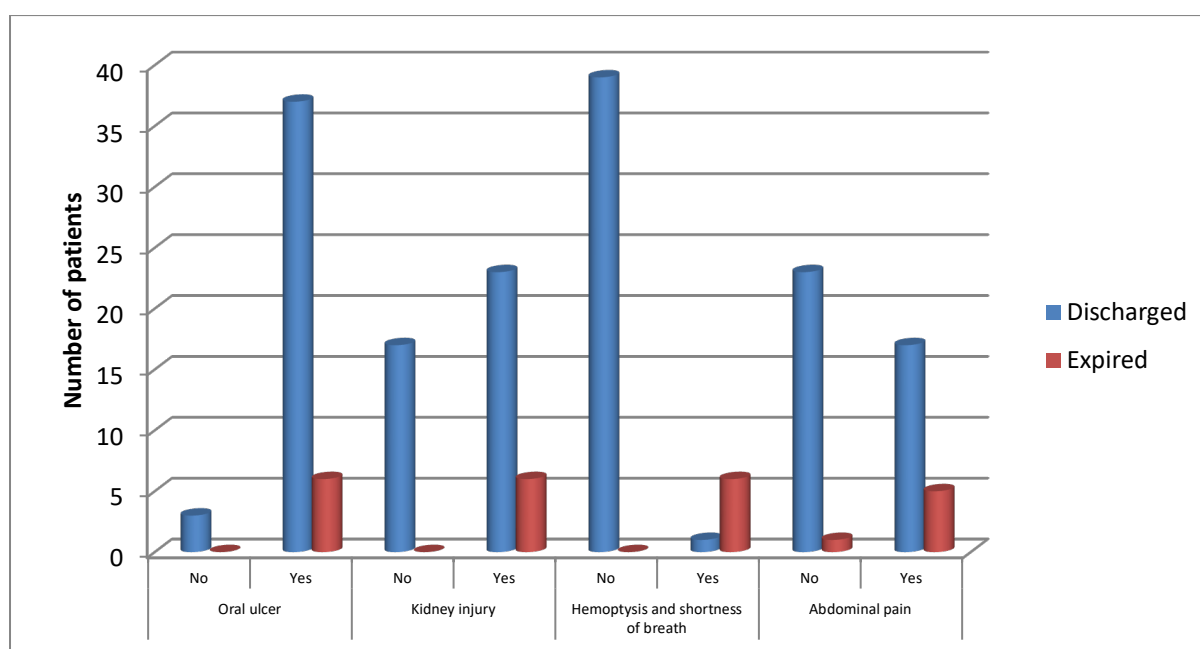|		Mean	Std Dev
Laboratory Parameters	Discharged	30.9	13.5037
	Expired	26.8333	10.3811
Clinical Scores	Discharged	10.875	6.5249
	Expired	16	5.6569

Figure 1: Clinical Features and Their Association with Outcomes
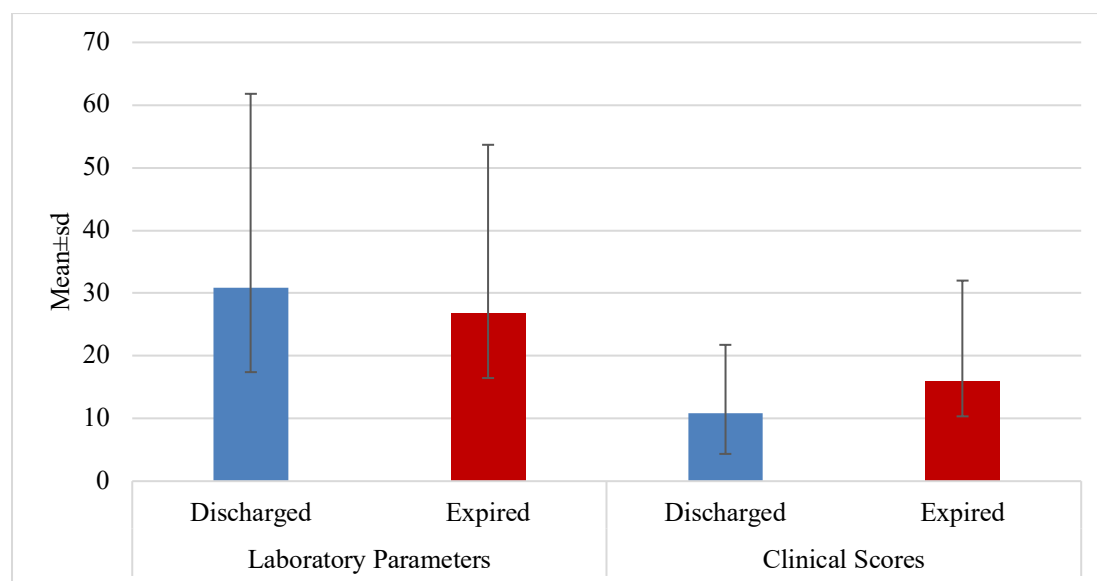
Figure 2: Laboratory Parameters and Clinical Scores

A total of 46 patients with alleged paraquat poisoning were included in the study, of whom 40 (87%) were discharged and 6 (13%) expired. The age distribution showed that most patients were between 21–30 years (30.4%), followed by 11–20 years (26.1%) and 31–40 years (23.9%). Mortality was highest in the 11–20 and 21–30 year age groups (33.3% each), but the association between age and outcome was not statistically significant (p = 0.9345). Regarding gender, 26 patients (56.5%) were male and 20 (43.5%) were female. Mortality was slightly higher among males (15.4%) compared to females (10%), but this difference was not statistically significant (p = 0.5908).

Among the 46 patients studied, oral ulcers were present in 43 (93.5%), with no significant association between the presence of oral ulcers and outcome (p = 0.4877). Acute kidney injury was observed in 29 patients (63%), and all six deaths occurred in this group, indicating a significant association between kidney injury and mortality (p = 0.0443). Respiratory symptoms, including hemoptysis and shortness of breath, were reported in 7 patients (15.2%), and all six fatalities had these symptoms, showing a highly significant correlation with mortality (p < 0.0001). Abdominal pain was present in 22 patients (47.8%), with 5 of the 6 deaths reporting this symptom; however, the association with outcome did not reach statistical significance (p = 0.0618).

The mean age of discharged patients was 30.9 ± 13.50 years, while that of patients who expired was 26.83 ± 10.38 years. Regarding discharged patients had a mean value of 10.88 ± 6.52 compared to 16.0 ± 5.66 in those who expired. This suggests that higher levels were associated with poorer outcomes.

Discussion

This study analyzed the clinical features and outcomes of patients with alleged paraquat poisoning admitted to a tertiary care hospital. The findings revealed that age and gender did not significantly influence mortality outcomes. However, the presence of acute kidney injury (AKI), respiratory symptoms such as hemoptysis and shortness of breath, and elevated clinical severity scores were strongly associated with increased mortality.

The age distribution in this study indicated that the majority of patients were between 21–30 years (30.4%) and 11–20 years (26.1%). Mortality was highest in these age groups (33.3% each), but the association between age and outcome was not statistically significant (p = 0.9345). Similarly, gender did not significantly affect mortality, with a slightly higher mortality rate observed in males (15.4%) compared to females (10%), though this difference was not statistically significant (p = 0.5908) [1]. These findings are comparable to other studies. Goyal et al. (2024) found that the majority of patients were male (84%) and that the overall mortality rate was 88%, with age not being a significant predictor of outcomes [2]. AKI was observed in 29 patients (63%), with all six deaths occurring in this group, indicating a significant association with mortality (p = 0.0443) [3]. This aligns with Gheshlaghi et al. (2022), who reported elevated creatinine levels as a strong predictor of mortality in paraquat poisoning [4]. Respiratory symptoms, including hemoptysis and shortness of breath, were reported in 7 patients (15.2%), and all six fatalities had these symptoms, showing a highly significant correlation with mortality (p < 0.0001) [5]. This is consistent with Elenga et al. (2018), who noted that pulmonary complications, particularly pulmonary fibrosis, are major causes of

death in paraquat poisoning. Abdominal pain was present in 22 patients (47.8%), with 5 of the 6 deaths reporting this symptom; however, the association with outcome did not reach statistical significance (p = 0.0618) [6]. This suggests that while abdominal pain is common, it may not be a reliable predictor of mortality.

The mean clinical severity score for discharged patients was 10.88 ± 6.52, compared to 16.0 ± 5.66 for those who expired, suggesting that higher severity scores were associated with poorer outcomes [7]. Tajai et al. (2023) reported similar findings, noting that elevated severity scores correlated with increased mortality in paraquat poisoning [8].

In conclusion, while age and gender did not significantly influence mortality, the presence of AKI, respiratory symptoms, and higher clinical severity scores were strongly associated with poor outcomes. These findings emphasize the importance of early recognition and aggressive management of these clinical features to improve survival in paraquat poisoning. Further studies are warranted to develop effective prognostic tools and management strategies [9, 10].

Conclusion

Paraquat poisoning continues to be associated with high morbidity and mortality, with outcomes largely influenced by the severity of organ involvement rather than age or gender.

In this study, acute kidney injury and respiratory symptoms such as hemoptysis and shortness of breath were strongly associated with mortality, while oral ulcers and abdominal pain were less predictive. Higher clinical severity scores also correlated with poorer outcomes, highlighting the importance of early assessment and close monitoring.

References

1. Elenga N, et al. "Clinical features and prognosis of paraquat poisoning in French Guiana." Medicine (Baltimore). 2018;97(13):e0303.
2. Goyal P, et al. "A Study of Paraquat Poisoning Presentation, Severity, Management and Outcome in a Tertiary Care Hospital: Is There a Silver Lining in the Dark Clouds?" Indian J Crit Care Med. 2024;28(8):741-747.
3. Delirrad M, et al. "Clinical features and prognosis of paraquat poisoning." J Med Toxicol. 2015;11(2):130-135.
4. Yi R, et al. "Retrospective study of clinical features and prognosis of paraquat poisoning." Medicine (Baltimore). 2019;98(19):e15542.
5. Srinitha B, et al. "Clinical profile and outcomes of acute kidney injury due to paraquat poisoning." Kidney Int Rep. 2025;10(1):123-130.
6. Tajai P, et al. "Predicting mortality in paraquat poisoning through clinical features." J Pharm Pract Res. 2023;53(6):595-602.
7. Kaur H, et al. "Evaluation of treatment outcomes and risk factors of clinical non-improvement in patients with paraquat poisoning." J Appl Pharm Sci. 2025;15(6):156-165.
8. Jose N, et al. "Paraquat poisoning; an experience from a tertiary care hospital." J R I P. 2023;10(2):45-50.
9. Ramamoorthi K, et al. "Boon or Bane? A Retrospective Study of Paraquat Poisoning." MJDY. 2023;16(1):1-6.
10. Kaur H, et al. "A study on Clinical features and management of Paraquat poisoning." ResearchGate. 2024.
11. Yadla M, et al. "Paraquat-associated Severe Acute Kidney Injury—Study of 60 Cases." Journal of Renal and Hepatic Disorders. 2022.
12. Yadav RK, et al. "Acute paraquat poisoning complicated by acute kidney injury." Annals of Medicine and Surgery. 2023.
13. Zhang M, et al. "Factors associated with refusing hemoperfusion in patients with paraquat poisoning." Journal of the Royal Medical Services. 2024.
14. Liu HL, et al. "Prediction of early mortality in patients with paraquat poisoning." Clinical Toxicology. 2013.
15. Kolilekas L, et al. "Severe paraquat poisoning: A long-term survivor." Respirology. 2006.
16. Affah S, et al. "Incidence and outcome of acute kidney injury in paraquat poisoning." Journal of Clinical and Experimental Nephrology. 2017.
17. Elenga N, et al. "Clinical features and prognosis of paraquat poisoning in French Guiana." Medicine (Baltimore). 2018.
18. Goyal P, et al. "A Study of Paraquat Poisoning Presentation, Severity, Management and Outcome in a Tertiary Care Hospital." Indian Journal of Critical Care Medicine. 2024.
19. Tajai P, et al. "Predicting mortality in paraquat poisoning through clinical features." Journal of Clinical Toxicology. 2023.
20. Gheshlaghi F, et al. "Prediction of mortality and morbidity following paraquat poisoning." BMC Pharmacology & Toxicology. 2022.