

Use of Neutrophil Lymphocyte Ratio and Serum Amylase as Early Predictors of Mortality in Paraquat Poisoning: A Case Report and Literature Review

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Abstract: *Worldwide annually there are around 385 million cases of acute pesticide poisoning reported (which includes herbicide, rodenticide and insecticides) with fatalities of 11,000 cases approximately. In India, herbicide like Paraquat is commonly used. The case fatality rate is high and till now there is a lack of evidence based recommendation of management of Paraquat Poisoning. Here we report a case of 42 years old female with acute Paraquat poisoning who was found to have elevated levels of serum Amylase, increased Neutrophil-Lymphocyte ratio and Leucocytosis with normal renal and hepatic functions. Subsequently patient died and post mortem report revealed enlarged and bulky pancreas. This case report and review article we study the relation of serum amylase and Neutrophil-Lymphocyte ratio in acute Paraquat poisoning and how simple and easily available tests like Complete Blood Count and Pancreatic Enzymes help in predicting prognosis of such cases.*

Keywords: Serum Amylase, Neutrophil-Lymphocyte ratio, Leucocytosis, Paraquat Poisoning

1. Introduction

Paraquat Dichloride (N, N'-dimethyl-4,4'-bipyridinium dichloride) is a widely used herbicide, third most commonly used herbicide in the world, but it is also highly toxic and is used frequently to commit suicide mostly in the developing countries (1). Mortality from Paraquat poisoning depends on the amount of Paraquat in blood, plasma level of more than 0.2mg/ml after 24 hours of ingestion and 0.1mg/ml at 48 hours are usually associated with high mortality (2). Mortality rate can vary from 60 to 80%. Paraquat toxicity is attributed to its Redox activity generating Reactive Oxygen Species (ROS) which are highly reactive to cellular macromolecules. Additionally it also causes Endoplasmic Reticulum Induction, Inflammation, Apoptosis and Mitochondrial death (3). Paraquat causes both local and systemic toxicity. It is accumulated in the vital organs of the body causing pulmonary fibrosis, Hepatic necrosis, Renal tubular necrosis, Cardiac failure. It also causes corrosive injury to the gastrointestinal tract leading to bloody diarrhea, vomiting, dehydration and electrolyte disturbances. Patients developing Multi organ Dysfunction (MODS) have very grave prognosis and they usually succumb to death within few hours to few days (4).

Many parameters have been studied to prognosticate the outcome of poisoning from Paraquat. Here we discuss about Serum Amylase and Leukocyte value with Neutrophil Lymphocyte Ratio as an early prognostic marker for mortality from Paraquat poisoning. Few studies have reported Hyperamylasemia in cases of severe Paraquat poisoning, but

clinical signs and symptoms of Pancreatic injury is rare. Hence, Hyperamylasemia with or without Pancreatic injury as a prognostic marker in Paraquat poisoning has not been studied extensively.

Complete Blood Count (CBC) is the most widely done investigation in the Emergency Department for all Poisoning patients, the test is quick and inexpensive, however very few studies have reported CBC and its application as a prognostication parameter in poisoning cases. Deng-Chuang-Zhou et al in their study, reported Leukocyte count, Neutrophil count and Neutrophil Lymphocyte Ratio as a strong prognostic factor for predicting 30 days mortality (5).

In this study, we report two cases of Paraquet poisoning and we present a review of literature of Hyperamylasemia and High Leukocyte count and High Neutrophil Lymphocyte Ratio as prognostic factors for detecting early mortality in cases of Paraquat poisoning.

2. Case Report

A 42 years old female presented to the Emergency Department with alleged history of consumption of Paraquat Dichloride (40ml liquid form) in an attempt to commit suicide. Two hours post consumption, she presented to the hospital with complains of 4 episodes of vomiting and abdominal pain. On presentation to the Emergency Department, patient was drowsy but arousable, obeying commands. She was haemodynamically stable, Blood Pressure was 100/80 mm of

Hg, Pulse Rate 68 beats per minute with Respiratory Rate of 20 per minute. Systemic examination revealed epigastric tenderness. Gastric Lavage was done followed by administration of activated charcoal 60gm (1gm/kg). ABG showed Normal anion gap metabolic acidosis. Patient was started on symptomatic treatment with intra venous fluids, analgesics, INJ N-Acetyl Cysteine 150mg/kg, INJ Dexamethasone 8mg and empirical antibiotic. Relevant investigations were sent which revealed Leucocytosis, high Neutrophil Lymphocyte ratio, elevated Serum Amylase level (1216 U/L) with normal liver and renal functions. Gradually patient's blood pressure dropped to 80/60mm of Hg, patient was started on inotrope infusions after giving adequate fluid bolus. Repeat ABG showed worsening of metabolic acidosis. Patient was intubated in view of severe metabolic acidosis and refractory shock. Subsequently patient went into asystole, and even after adequate resuscitative efforts, patient could not be revived. The body was sent for post mortem which revealed enlarged and bulky pancreas.

3. Discussion and Review of Literature

Paraquat is a bipyridinium herbicide which is highly toxic and widely used in India. Acute poisoning is still a major public health problem, ingestion being the most common route of poisoning. It can cause multi organ failure leading to very high mortality and morbidity, the 90 days survival rate has been shown to be 40.95% in some studies.

There is marked increase in neutrophil count after Paraquat poisoning but the underlying molecular mechanism is not clear. Some studies have suggested that ingestion of Paraquat causes activation of pro inflammatory cytokines within hours that rapidly promote influx of neutrophils extensively. Secondly when large concentration of Paraquat accumulates, through redox cycling, toxic reactive oxygen species are generated which reduce neutrophil apoptosis significantly.

Zhou, D C et al., in their retrospective Cohort study on prognostic value of hematological parameters in patients with Paraquat poisoning including 202 patients admitted from January 2010 to December 2015 reported that acute Paraquat poisoning can cause leukocytosis with neutrophilia. They concluded that NLR, Leucocyte and Neutrophil counts have shown to have excellent prognostic value to the prediction of 30-day mortality (5).

Cao ZX et al., in their retrospective study, enrolling 105 patients with acute Paraquat poisoning admitted from May 2012 to May 2018 concluded that low NLR was a valuable early predictor of 90-day survival (6).

Jun Wang et al., in their research article showed that Leucocytes, Neutrophil count and NLR were up regulated remarkably in non survivors of acute Paraquat poisoning (7).

Table 1

Neutrophil-Lymphocyte Ratio	Sensitivity	Specificity
Study 1 (5)	86.7	83.51
Study 2 (6)	77.4	79.1
Study 3 (7)	71.43	93.33

Many studies have reported pancreatic injury after Paraquat poisoning, however it is not clear how often the pancreatic injury occurs and whether it has any value in prognostication. High amylase level suggests pancreatic injury. Here, we reviewed studies to establish the role of amylase as an early mortality indicator in Paraquat Poisoning.

Soontornniyomkij v et al., in their study on Fatal Paraquat poisoning: a light microscopic study in 8 autopsy cases was the first autopsy report to find evidence of pancreatic injury in Paraquat poisoning (8).

Wang l et al., in their study on A deceased case report of Paraquat ingestion induced severe pancreatic injury showed that Serum amylase and lipase were progressively increasing after several hours of ingestion and authors thought that after Acute Paraquat poisoning, pancreas can be injured and was related to death (9).

Yang,Jo et al., in their retrospective study on serum total antioxidant statuses of survivors and non survivors after acute Paraquat poisoning included 296 cases found that elevated serum amylase activity in death patient and was a significant predictor of survival using univariate analysis (10).

Lee Y. et al., in their study on Arterial lactate as a predictor of mortality in Emergency department patients with Paraquat intoxication conducted on 272 patients showed that pancreatic enzymes were higher in patients who died than those who survived (11).

Gil H W et al., in their retrospective study on the level and clinical significance of pancreatic enzymes in survivors of acute Paraquat poisoning included 34 survivors was the first study to focus on abnormal pancreatic enzymes after Paraquat ingestion showed that extent of increase in pancreatic enzymes was positively related to serum Paraquat concentration on fourth and seventh day. The authors concluded that elevation was considered to be inflammatory reaction as CT images were normal (12).

Li .Y et al., in their study on abnormal pancreatic enzymes and their prognostic role after acute Paraquat poisoning included 258 cases out of which 177 were laboratory confirmed Paraquat ingested patients within 72 hours, concluded that amylase as an independent prognostic marker and case fatality was 100% in amylase elevated group (13).

4. Conclusion

In India, Paraquat is a commonly used herbicide and one of the most common substances used for suicidal consumption. Even on minimal consumption, it has lethal consequences.

There is limited evidence for effective treatment of Paraquat toxicity. We conclude here that Leucocytosis, Neutrophilia and NLR are good prognostic factor with serum amylase as an independent prognostic marker for early predictor of mortality in patients with acute Paraquat poisoning.

survivors of acute paraquat poisoning. *Clin Toxicol (Phila)*. 47, 308-11 (2009)

[13] Li, Y. et al. Abnormal pancreatic enzymes and their prognostic role after acute paraquat poisoning. *Sci. Rep.* 5, 17299; doi: 10.1038/srep17299 (2015).

References

- [1] National Center for Biotechnology Information (2023). PubChem Compound Summary for CID 15938, Paraquat dichloride. Retrieved May 3, 2023 from <https://pubchem.ncbi.nlm.nih.gov/compound/Paraquat-dichloride>.
- [2] Allen S, Gomez M, Boylan AM, Highland KB, Germinario A, et al. (2019) Paraquat Poisoning: Survival after Oral Ingestion. *J Fam Med Dis Prev* 5:107. doi.org/10.23937/2469-5793/1510107.
- [3] Gawarammana IB, Buckley NA. Medical management of paraquat ingestion. *Br J Clin Pharmacol.* 2011 Nov;72(5):745-57. doi: 10.1111/j.1365-2125.2011.04026.x. PMID: 21615775; PMCID: PMC3243009.
- [4] Safaei Asl A, Dadashzadeh P. Acute kidney injury in patients with paraquat intoxication; a case report and review of the literature. *J Renal Inj Prev.* 2016 Aug 3;5(4):203-6. doi: 10.15171/jrip.2016.43. PMID: 27689124; PMCID: PMC5039990.
- [5] Zhou, DC., Zhang, H., Luo, ZM. *et al.* Prognostic value of hematological parameters in patients with paraquat poisoning. *Sci Rep* 6, 36235 (2016). <https://doi.org/10.1038/srep36235>
- [6] Cao ZX, Song YQ, Bai WJ, Wang WJ, Zhao Y, Zhang SL, Feng SY. Neutrophil-lymphocyte ratio as an early predictor for patients with acute paraquat poisoning: A retrospective analysis. *Medicine (Baltimore)*. 2019 Sep;98(37):e17199. doi: 10.1097/MD.00000000000017199. PMID: 31517877; PMCID: PMC6750259.
- [7] Wang J, Jiang X, Lu G, Zhou J, Kang J, Zhang JS. Identify the Early Predictor of Mortality in Patients with Acute Paraquat Poisoning. *Biomed Res Int.* 2020 Dec 31;2020:8894180. doi: 10.1155/2020/8894180. PMID: 33490262; PMCID: PMC7790583.
- [8] Soontornniyomkij, V. & Bunyaratvej, S. Fatal paraquat poisoning: a light microscopic study in eight autopsy cases. *J Med Assoc Thai.* 75, S98-S105 (1992).
- [9] Wang, L. & Qian, Y. Y. A deceased case report of paraquat ingestion induced severe pancreatic injury. *Zhong Guo Yao Wu Ying Yong He Jian Che* 1, 37-38 (2005). (in Chinese)
- [10] Yang, J. O., Gil, H. W., Kang, M. S., Lee, E. Y. & Hong, S. Y. Serum total antioxidant statuses of survivors and nonsurvivors after acute paraquat poisoning. *Clin Toxicol (Phila)*. 47, 226-9 (2009).
- [11] Lee, Y., et al. Arterial lactate as a predictor of mortality in emergency department patients with paraquat intoxication. *Clin Toxicol (Phila)*. 50, 52-6 (2012).
- [12] Gil, H. W., Yang, J. O., Lee, E. Y. & Hong, S. Y. The level and clinical significance of pancreatic enzymes in

Volume 12 Issue 5, May 2023

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