



Journal of Acute Disease

Case Report



jadweb.org

doi: 10.4103/jad.jad_117_24

Impact Factor® 0.5

Paraquat poisoning from accidental ingestion leading to fatal outcome: A case report

Chao Liu¹, Mengya Yao¹, Jiangrong Ma², Shinan Nie¹✉

¹Department of Emergency Medicine, Jinling Hospital, Affiliated Hospital of Medical School, Nanjing University, Nanjing, China

²Department of Medical Ultrasonic, Jinling Hospital, Affiliated Hospital of Medical School, Nanjing University, Nanjing, China

ABSTRACT

Rationale: Paraquat, a highly toxic bipyridyl herbicide lacking a specific antidote, poses severe risks upon ingestion. However, the diagnosis of paraquat poisoning is complicated by its nonspecific initial symptoms, particularly when a detailed exposure history is not provided.

Patient's Concern: A 33-year-old man inadvertently ingested an unknown liquid and presented to medical services a day later with complaints of ongoing nausea, vomiting, and diarrhea. The assessment revealed elevated serum creatinine, signaling acute kidney injury, initially thought due to gastroenteritis and dehydration.

Diagnosis: Acute renal insufficiency due to paraquat poisoning.

Interventions: The treatment involved fluid resuscitation and antibiotics, but his decline led to intensive care unit transfer. Subsequent chest computed tomography scans indicated lung changes indicative of paraquat poisoning. A detailed history review and comprehensive blood and urine toxicology screens confirmed the diagnosis. Subsequently, aggressive interventions such as hemoperfusion and continuous renal replacement therapy were initiated, yet there was a further decline in respiratory function, necessitating mechanical ventilation. The prognosis was poor, and ultimately, the family chose to withdraw care.

Outcomes: The patient succumbed to his illness.

Lessons: This case underscores the importance of promptly and accurately diagnosing paraquat poisoning, as its vague early signs can lead to diagnostic delays, crucial due to the condition's rapid progression. Alertness to paraquat poisoning is essential in patients with sudden gastrointestinal and renal symptoms post-exposure. Additionally, it underscores the necessity for public health measures to avert paraquat ingestion and advance therapeutic approaches.

KEYWORDS: Paraquat; Accidents; Respiratory insufficiency; Acute kidney injury; Fatal outcome.

1. Introduction

Paraquat, a highly potent and extensively applied bipyridyl herbicide, has proven to be an invaluable asset in weed management due to its broad-spectrum effectiveness. Nevertheless, its acute toxicity to humans, especially in cases of accidental or intentional ingestion, has necessitated rigorous regulatory oversight in numerous regions[1]. The toxicological characteristics of paraquat are marked by its capacity to provoke severe and frequently lethal multi-organ dysfunction, with a particular affinity for the lungs. Upon ingestion, paraquat instigates redox cycling within cellular compartments, interfering with mitochondrial complexes and precipitating a marked increase in reactive oxygen species (ROS) production. This toxic buildup of ROS promotes lipid peroxidation, leads to DNA damage, and induces cell death, collectively precipitating multi-organ failure. The high mortality rates linked

✉To whom correspondence may be addressed. E-mail: Shinan Nie: shn_nie@sina.com

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms. For reprints contact: reprints@medknow.com

©2024 Journal of Acute Disease Produced by Wolters Kluwer-Medknow.

How to cite this article: Liu C, Yao MY, Ma JR, Nie SN. Paraquat poisoning from accidental ingestion leading to fatal outcome: A case report. J Acute Dis 2024; 13(6): 216–219.

Article history: Received 9 November 2024; Revision 4 December 2024; Accepted 8 January 2025; Available online 12 January 2025

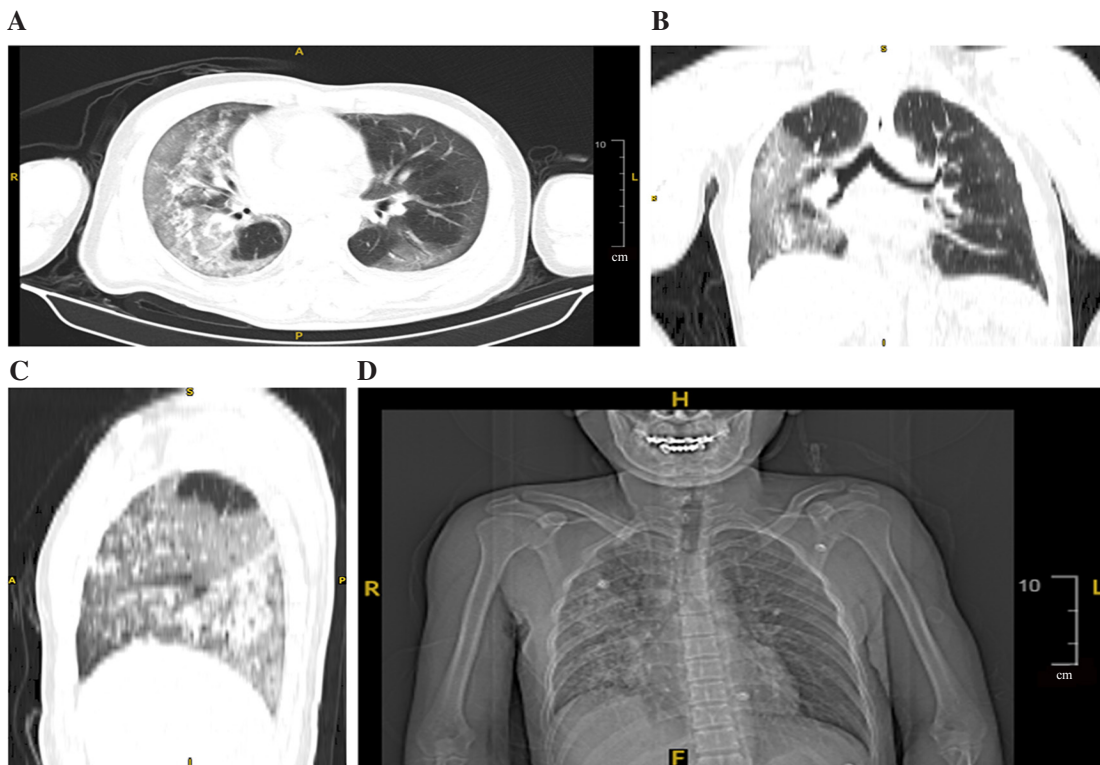


Figure 1. Images of the 33-year-old male patient's chest CT scan. A-C. Chest CT scan images demonstrate diffuse pulmonary edema in both lungs, with evidence of alveolar hemorrhage and possible local fibrosis, most notable in the right lung (A: axial view; B: coronal view; C: sagittal view). D: CT scout view shows diffuse alveolar opacities, primarily affecting the right lung, with a mediastinal shift to the right.

to paraquat poisoning underscore the criticality of addressing this medical emergency.

Strict regulatory interventions, including bans, have appreciably curtailed the incidence of paraquat poisoning. Research indicates a marked decline in paraquat poisoning incidents and related fatalities following the implementation of bans[2]. Nevertheless, enforcing these prohibitions, particularly in resource-constrained countries, and the potential for a resurgence due to existing stockpiles or illegal sales and processing, continue to be major challenges. The treatment of paraquat poisoning is still fraught with difficulties. Early intervention is pivotal for enhancing patient outcomes. Immediate gastric lavage and the administration of activated charcoal are crucial steps to minimize paraquat absorption. Although hemodialysis is frequently used to decrease paraquat concentrations and ameliorate acute kidney injury, its impact on survival rates remains a subject of debate[3].

This case highlights the tragic consequences of mistakenly ingesting paraquat as a beverage in a previously healthy 33-year-old man, underscoring the critical importance of early diagnosis, intervention, and supportive care. The report also emphasizes the need for innovative treatment approaches and comprehensive preventive strategies, including education and secure storage, to

combat the persistent threat of paraquat poisoning.

2. Case report

A 33-year-old previously healthy man ingested an unidentified liquid, mistaking it for a beverage, and reported a noxious taste, leading to immediate vomiting. However, the patient did not consider this incident seriously. The next morning, the patient presented with persistent nausea, vomiting, and diarrhea, seeking medical attention at a local hospital. Upon admission, the patient's initial evaluation revealed elevated serum creatinine levels ($548.7 \mu\text{mol/L}$) and signs of progressive renal dysfunction. The patient was treated with fluid resuscitation and ceftriaxone for suspected infection, given the suspicion of gastroenteritis, but developed hypotension and worsening renal function. Two days following the initial presentation, the patient was transferred to the intensive care unit of an alternate hospital for advanced management. Meropenem was initiated to treat the suspected infection there. Subsequent repeat chest computed tomography imaging demonstrated bilateral pulmonary infiltrates, consistent with paraquat poisoning. A thorough review of the patient's history repeatedly pointed to

paraquat poisoning as the likely diagnosis. The patient was subsequently transferred to our emergency department for further evaluation and management. Chest computed tomograph scan revealed diffuse pulmonary edema with alveolar hemorrhage and possible localized fibrosis, predominantly in the right lung (Figure 1).

Laboratory analyses, encompassing toxicology screening of the patient's blood and urine, were swiftly conducted. The findings revealed paraquat in both samples, with concentrations of 576 ng/mL in blood and 1 709 ng/mL in urine. This, combined with the clinical presentation and history of ingestion, led to a diagnosis of paraquat poisoning. Initial treatment consisted of gastric lavage, administration of activated charcoal, and symptomatic support. Additionally, to further detoxify the patient, bedside hemoperfusion and continuous renal replacement therapy were initiated. The patient was also administered anti-inflammatory, anti-fibrotic, antioxidant, and antimicrobial therapies. To mitigate oxygen-related lung injury, the administration of oxygen was avoided in the early stages of management. However, the patient's clinical status acutely worsened, with the development of profound dyspnea accompanied by chest discomfort. The patient's oxygen saturation levels dropped to 78%, and an arterial blood gas analysis conducted at that time revealed a critically low corrected partial pressure of oxygen of 43 mmHg, indicative of respiratory failure. After obtaining informed consent from the patient's family, the decision was made to endotracheally intubate and place the patient on mechanical ventilation to support respiratory function. Despite all efforts, considering the rapid deterioration of the patient's condition and the potential for poor prognosis, the family eventually elected to withdraw care and discharge the patient from the hospital.

3. Discussion

Paraquat, a highly toxic herbicide, poses a significant risk to human health upon ingestion, resulting in severe systemic toxicity and a high mortality rate. The toxicological mechanism of paraquat involves the generation of ROS, which induce lipid peroxidation, DNA damage, and cell death, culminating in organ failure, with a particular predilection for lung damage. This case report documents a tragic instance of paraquat poisoning in a previously healthy individual, underscoring the critical importance of early recognition and management of this condition. The initial symptoms of nausea and vomiting in our patient were not immediately attributed to paraquat poisoning, emphasizing the need for a high index of suspicion in the differential diagnosis of acute poisoning cases. The swift deterioration observed in this patient highlights the imperative nature of prompt and aggressive medical intervention in the face of

paraquat poisoning.

Future research should focus on advancing the development of early, simple diagnostic methods and more effective treatments for paraquat poisoning. Experimental therapies, including novel mitochondrial antioxidants, demonstrate promise; however, they require additional investigation to substantiate their efficacy and safety profiles[4]. Furthermore, the potential therapeutic benefits of early immunomodulatory interventions, as well as the development of novel pharmacological agents capable of scavenging reactive oxygen species, represent promising strategies[5,6].

In summary, this case highlights the grave consequences of paraquat poisoning, underscoring the need for a high degree of vigilance when encountering symptoms such as vomiting and diarrhea in the context of acute, unexplained multi-organ failure. Managing paraquat intoxication is a significant clinical challenge, with a poor prognosis even with aggressive treatment, compounded by the absence of a specific antidote. This case emphasizes the critical need for extensive research to validate the therapeutic potential of emerging treatment modalities. Preventive strategies, including public education campaigns and strict regulatory oversight of paraquat storage and application, are essential to reduce the likelihood of accidental exposure and subsequent adverse outcomes.

Conflict of interest statement

The authors report no conflict of interest.

Funding

This study received no extramural funding.

Authors' contributions

CL: manuscript revision; MY and JM: case presentation, drafting of the original manuscript and formatting; SN: Supervision. All authors have made substantial contributions to the writing and revision of this manuscript and have approved its final version.

References

- [1]Stuart AM, Merfield CN, Horgan FG, Willis S, Watts MA, Ramírez-Muñoz F, et al. Agriculture without paraquat is feasible without loss of productivity-lessons learned from phasing out a highly hazardous herbicide. *Environ Sci Pollut Res Int* 2023; **30**(7): 16984-17008.

- [2]Kim J, Shin SD, Jeong S, Suh GJ, Kwak YH. Effect of prohibiting the use of Paraquat on pesticide-associated mortality. *BMC Public Health* 2017; **17**(1): 858.
- [3]Eizadi-Mood N, Jaber D, Barouti Z, Rahimi A, Mansourian M, Dorooshi G, et al. The efficacy of hemodialysis on paraquat poisoning mortality: A systematic review and meta-analysis. *J Res Med Sci* 2022; **27**: 74.
- [4]Liu C, Sun Z, Wang M, Yang Z, Zhang W, Ren Y, et al. Mitoquinone mitigates paraquat-induced A549 lung epithelial cell injury by promoting MFN1/MFN2-mediated mitochondrial fusion. *J Biochem Mol Toxicol* 2022; **36**(9): e23127.
- [5]Li LR, Chaudhary B, You C, Dennis JA, Wakeford H. Glucocorticoid with cyclophosphamide for oral paraquat poisoning. *Cochrane Database Syst Rev* 2021; **6**(6): Cd008084.
- [6]Blanco-Ayala T, Andérica-Romero AC, Pedraza-Chaverri J. New insights into antioxidant strategies against paraquat toxicity. *Free Radic Res* 2014; **48**(6): 623-640.

Publisher's note

The Publisher of the *Journal* remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Edited by Liu JJ