



## ROLE OF SERIAL HEMOPERFUSION IN PARAQUAT POISONING

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## KEYWORDS :

## INTRODUCTION

Paraquat remains one of the most lethal herbicides in use today, with ingestion, whether accidental or intentional, often resulting in multi-organ failure and mortality. Amongst the organ systems affected, the lungs and kidneys are particularly vulnerable due to paraquat's selective uptake and oxidative stress-induced injury. Despite advances in critical care, treatment options for paraquat poisoning remain limited and supportive. Hemoperfusion has long been explored as a method for toxin removal in paraquat poisoning, but its clinical effectiveness has been variable. The HA230 hemoperfusion cartridge, a resin-based adsorptive filter, offers a novel approach due to its dual ability to adsorb circulating toxins and pro-inflammatory cytokines. Recent literature suggests that early and serial hemoperfusion may reduce systemic toxicity and improve outcomes in paraquat poisoning. The presence of paraquat toxicity was confirmed using urine sodium dithionite, and was repeated after every session of hemoperfusion to look for clearance. In this article, we present four consecutive cases of paraquat poisoning managed at our center with serial hemoperfusion using the HA230 cartridge. We describe the clinical course, timing of intervention, biochemical trends, and patient outcomes while reviewing the rationale for this emerging therapeutic modality. We aim to contribute real-world clinical data to the evolving understanding of hemoperfusion in the treatment of paraquat toxicity.

## Case Series

We report 4 cases of paraquat poisoning that presented to our centre, and our experience with the HA 230 filter hemoperfusion. Table 1 highlights the key characteristics of our case series. Between the four

**Table 1: Depicts the Demographics of the Study Group.**

S. No	Age	Comorbidities	Amount of 24%paraquat consumed and additional drug abuse	Time to presentation from consumption	Time to initiation of hemoperfusion from time of consumption	Number of hemoperfusion session	out-comes
1.	25years/male	nil	20ml	10 hours	12hours	3(achieved urine sodium dithionite negative )	Dead
2.	16years/male	nil	100-150ml	3 hours	5hours	3(achieved urine sodium dithionite negative)	Alive
3	26 years/male	nil	30ml	12 hours	14 hours	4(urine sodium dithionite remained positive	Dead
4.	17year old/female	nil	Not known, mixed with 200ml carbonated drink	8hours	9hours	8(urine sodium dithionite negative at the end of 5 sessions. Restarted due to rebound)	Alive

## DISCUSSION

Paraquat is a low molecular weight compound (~186 Da), highly water-soluble, with minimal protein binding. It exhibits a rapid distribution phase in the first few hours of ingestion, with a tendency to accumulate in the lungs via the polyamine uptake system. These properties suggest potential for removal via extracorporeal therapies.<sup>(1)</sup> However, after paraquat has been absorbed into tissues, the effectiveness of extracorporeal clearance methods significantly diminishes. The HA230 Hemofilter is a highly adsorptive cartridge engineered for the removal of circulating toxins and inflammatory mediators in critical illness and toxicological emergencies.<sup>(1)</sup> It is composed of a neutral microporous resin made from styrene-divinylbenzene copolymer, which provides a large surface area and strong adsorptive properties. Mechanistically, the HA230 filter works

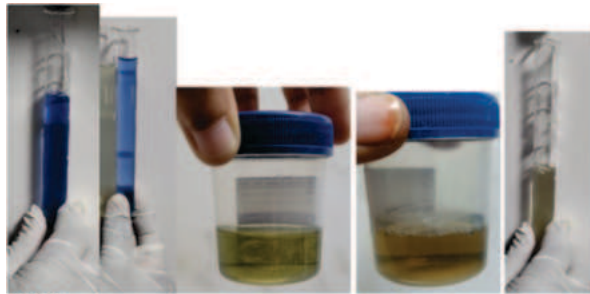
by adsorbing middle and large molecular weight solutes, including a wide range of cytokines, endotoxins, and certain hydrophobic or protein-bound toxins. While it can bind paraquat directly to a limited extent, its primary benefit in paraquat poisoning likely comes from attenuating the cytokine storm and systemic oxidative stress that follow paraquat-induced tissue injury. The filter's high affinity for pro-inflammatory mediators may help blunt the progression of multi-organ dysfunction, especially when used early and in repeated sessions. This study has several limitations. The small sample size limits the generalizability of the findings. The criteria for determining the number and timing of hemoperfusion sessions are not clearly defined. Moreover, the outcomes reported are restricted to immediate survival or death, with no data on long-term complications, organ damage, or functional recovery in the survivor. Urine sodium dithionite test may

Interestingly, one survivor had consumed a large amount of paraquat (100–150 ml), while one of the deceased had taken only 20 ml, underscoring that early intervention and toxin clearance, as indicated by dithionite test negativity, may be more critical to survival than the ingested dose alone. These findings suggest that early medical presentation, timely initiation of hemoperfusion, and achieving a negative urine sodium dithionite test may be linked to better survival outcomes in cases of paraquat poisoning.

not be accurate in the presence of acute kidney injury, and also does not reflect the sequestration of poison in the body. The effectiveness of extracorporeal therapies such as hemoperfusion is highly time-sensitive, with benefit diminishing significantly once paraquat is taken up by tissues, typically within 4 to 6 hours after ingestion.<sup>(2)</sup> Unfortunately, many patients present late, limiting the potential impact of toxin removal. Moreover, there are no randomised controlled trials (RCTs) to support the routine use of hemoperfusion in paraquat poisoning; most available evidence is drawn from retrospective studies, small case series, or observational data. Logistical challenges, including delayed referral and limited access to early hemoperfusion, especially in resource-limited settings, further constrain timely intervention. Hemoperfusion (HP) achieves a reduction of 67–83% in paraquat (PQ) concentration within three hours, demonstrating its significant efficacy in the emergency management of acute paraquat poisoning.<sup>3</sup>

## CONCLUSIONS

While studies have shown 60-100% mortality with paraquat poisoning, two out of four patients survived with serial hemoperfusion in our case series, despite one among them having consumed a significantly high quantity of the toxin. The two fatalities occurred in patients who consumed lower amounts but had delayed presentation, after 10 hours. This suggests that early hemoperfusion done serially till a negative urine test for paraquat can play a more decisive role in survival, even in those patients who have consumed large volumes.



IMAGE

A-100 microgram/mL

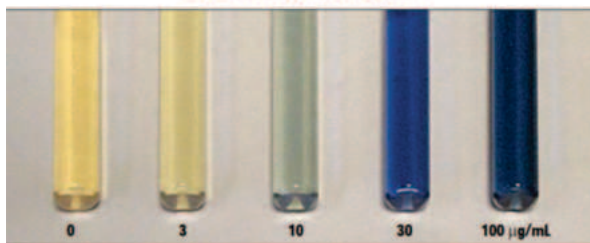
B-30 microgram/mL

C-10 microgram/mL

D-3 microgram/mL

E-CONTROL

Color Chart for Pre- Screen



**Figure 1: Serial Urine Sodium Dithionate Test Demonstrating Clearance of Paraquat in Urine**

## REFERENCES

1. Shanbhag, V., Sukumar, C.A. and Shastry, A.B. (2019) 'Paraquat: The poison potion', *Indian Journal of Critical Care Medicine*, 23(S4), pp. 0-0. doi:10.5005/jp-journals-10071-23306.
2. Jose, N. et al. (2023) 'Paraquat poisoning; an experience from a tertiary care center in India', *Journal of Renal Injury Prevention* [Preprint]. doi:10.34172/jrip.2023.32045.
3. Wang, HR., Pan, J., Shang, AD. et al. Time-dependent haemoperfusion after acute paraquat poisoning. *Sci Rep* 7, 2239 (2017). <https://doi.org/10.1038/s41598-017-02527-0>.
4. Ankawi, G. et al. (2018) 'A new series of sorbent devices for multiple clinical purposes: Current evidence and Future Directions', *Blood Purification*, 47(1-3), pp. 94-100. doi:10.1159/000493523.