

Clinical spectrum and outcome of Patients Admitted with Paraquat Poisoning in a Tertiary Care Teaching Hospital Kangra at Tanda, Himachal Pradesh

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ABSTRACT

Background: Paraquat is a herbicide commonly used for controlling weeds in India. It produces various local and systemic manifestations in the early course. It is very notorious to cause multi-organ dysfunction and mortality within 24 hours in large amount of consumption. Lack of specific antidote makes the management of paraquat poisoning challenging. Paraquat is most common insecticide compound used for suicidal consumption in rural part of the Himachal Pradesh next to organo-phosphorous compound. Hence, we took up the study to evaluate the clinical features, course, management option, and outcome of the poisoning .

Aim: To study the clinical spectrum and outcome of paraquat poisoning in tertiary care centre. **Materials and Methods:** It is observational study conducted at Dr. RPGMC Kangra at Tanda College, A Tertiary Rural Care Centre. In this study we included the data of all patients admitted to the hospital with paraquat poisoning for a period of one-year and four months between January 2024 to May 2025. History was collected from patients and relatives. Clinical features, laboratory parameters were noted regularly and frequently. Patient's complications were identified initially and treated accordingly.

Results: A total of 55 participants were included in the final analysis. Ninety percent of the patients consumed paraquat with the suicidal intention . The quantity of paraquat ingested was quite varied, ranging from as low as 5ml to as high as 150ml. Out of 55 patients, 43 were males and 12 were females; most of them were in the age group of 18-55 years. Mild poisoning was noted in 10 (18.18%), moderate in 12 (21.815%) and 33 (60%) patients were severe. Most common symptom was nausea and vomiting, signs were oral cavity ulcers followed by tachycardia and tachypnea. The overall mortality was (41) 74.54%, (10) 18.18% were recovered fully and (4) 7.5% patients referred to higher centre PGIMER Chandigarh for further management. **Conclusion:** Since there is a lack of antidote, management of paraquat is challenging. Early gastric lavage, aggressive fluids, IV methyl prednisolone , N-Acetyl-Cysteine and injection cyclophosphamide is beneficial. Acute kidney injury is the major clinical outcome of paraquat poisoning other than lung injury. This may result in multiple organ dysfunction syndrome (MODS) and mortality. Paraquat poisoning consumption is mainly with suicidal intention. Most of them were young.

Keywords: Paraquat poisoning (PQ), Lung injury, Acute Kidney Injury, multiple organ dysfunction syndromes (MODS), Hemoperfusion/ Hemodialysis

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1. INTRODUCTION

Paraquat is a herbicide commonly used to control weeds in India[1]. Paraquat is classified as “class II chemical or moderately hazardous by the World Health Organization and as ‘hazardous’ by other agencies”[2,3]. The active ingredient in paraquat is 1,1’-dimethyl-4,4’-bipyridinium which is toxic to organs in humans and has been the cause of acute poisoning by ingestion and also by skin exposure. The primary target organ for paraquat poisoning are the lungs and kidneys. Due to its structural similarity to naturally occurring polyamines, it is absorbed by alveolar cells and its accumulation leads to damage in the form of alveolitis and fibrosis of the lungs[4]. Paraquat is secreted by the kidneys because of which there is accumulation in the proximal tubular cells at higher concentrations and which in-turn causes vacuolation of epithelial cells leading to renal tubular necrosis[5]. The cause of death in most of the cases are due to lung injury or multiorgan failure[6]. Exposure to paraquat is mainly by ingestion with suicidal intention. Consumption of PQ >40mg/kg causes multiple organ dysfunction with death within 48 hours of consumption, whereas consumption of < 20 mg/kg of PQ will result in mild symptoms with high survival rates[6]. There are no specific antidotes available to block the effects of paraquat. Majority of patients receive systemic steroids, cyclo- phosphamide or antioxidants which reduces free radical damage[7]. It has been observed that acute cases of poisoning with paraquat are admitted to the hospital with various stages of acute kidney injury. Often specific diagnosis of paraquat poisoning was missing. Few studies are available observing the outcome of paraquat poisoning and the efficacy of hemoperfusion. Hence this study was conducted to describe the clinical profile: symptoms, signs, biochemical profile and also the outcome of patients who presented with paraquat poisoning.

2. MATERIALS AND METHODS:

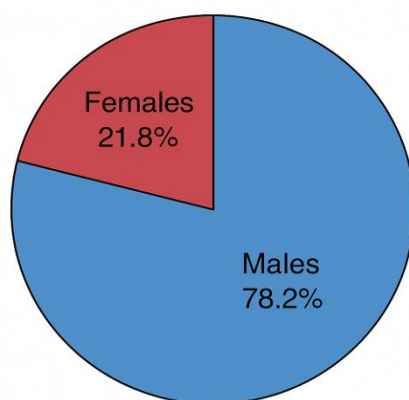
A prospective observational study was conducted at Dr. RPGMC Kangra at Tanda College, A Tertiary Rural Care Centre. In this study we included the data of all patients admitted to the hospital with paraquat poisoning for a period of one-year and four months between January 2024 to May 2025. Patients aged more than 18 years of age admitted to the hospital with history of paraquat poisoning taken from patients who were conscious and oriented to time, place and person and also confirmed from attendants by asking them to produce wrapper of bottles containing poisons. Patients aged more than 18 years of age who presented with paraquat poisoning were included, while patients with pre-existing renal or liver diseases and other poisonings were excluded from the study. After identifying the cases based on the inclusion and exclusion criteria, The details about the demographic characteristics, route and amount of paraquat ingestion, whether suicidal or accidental, clinical features, laboratory parameters, organ involvement and response to treatment and final outcome of the patients was recorded. Mortality details with the cause of death following paraquat poisoning were recorded.

3. STATISTICAL METHODS:

Data was entered in the excel sheet and quantitative variables were expressed as mean with standard deviation in SPSS software and V.22 was used for analysis. Categorical variables were described using frequency and proportion

4. RESULT

Out of 55 patients, 43 (78.02%) were males and 12 (21.81%) were females, most of them were in the age group of 18-52 years shown in figure no.1 and table no.1 respectively.



.Figure 1: Sex-wise distribution of the sample size involved in the study.

Table 1: Age wise distribution of the patients involved in the study.

Age group	Sample size
18-20	01
21-30	12
31-40	33
41-50	06
50-60	02

Ninety percent of patients consumed paraquat with the suicidal intention and 10% were accidental. There was a wide range of quantities ingested, ranging from 5ml to 150ml. 47.27% (N=26) got admitted within 6 hrs of ingestion, and 21.81 % (N=12) were admitted 4 to 24 and hours and 30.90% (17) were admitted after 24 hours of ingestion. Shown in tables 2 and 3 respectively.

Table 2 Intention of Ingestion	
Suicidal	50 (90.90%)
Accidental	05 (9.09%)
Homicidal	0%
Amount of paraquat ingested (in ml)	52 ± 58.34 (range 5 to 150 ml)

Table 03 Duration (hours) from ingestion to admission	
<6 hours	26 (47.27%)
6 to 24 hours	12 (21.81%)
> 24 hours	17 (30.90%)

On the basis of severity of poisoning 33 (60%) patients were found in severe condition, 12 (21.81% in moderate poisoning, and mild poisoning was noted in 10 (18.18%) . Severity of the poison is shown in Figure. 2 and intention of poisoning shown in Figure 3.

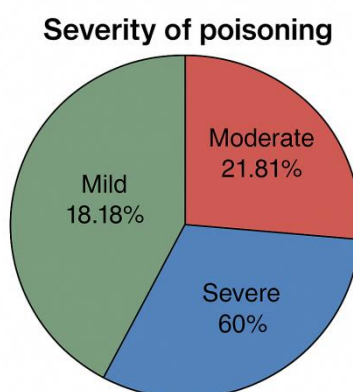


Figure. 2 Percentage of patients on the basis of severity of poisoning

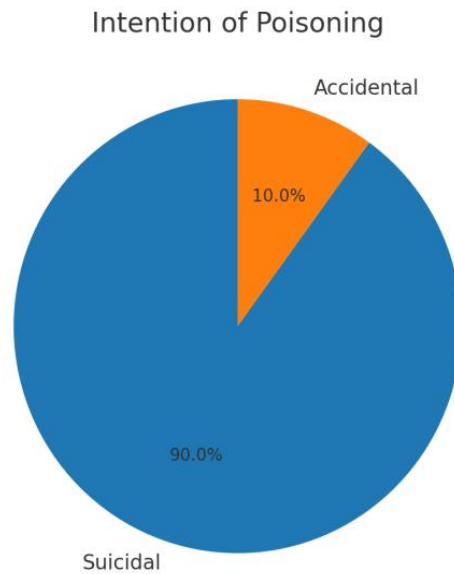
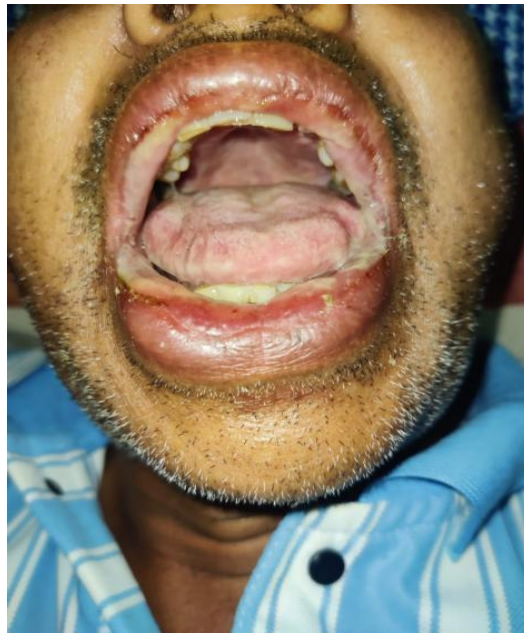


Figure no.3 showing percentage of intention of poisoning

Most common symptom was nausea and vomiting observed in all patients followed by throat pain and cough, headache. Three presented in altered sensorium. 5 (9.09%) patients presented with GCS of 9 to 11, and 50 (90.90%) patients had GCS within normal limit. Most common sign was oral cavity ulcers followed by tachycardia and tachypnea shown in (figure 4) and (Table 4).



(Figure 4) Oral ulceration with 24 hours of consumption of paraquat

Table 4: Signs and symptoms on presentation

Symptoms	%	Sign	%
Nausea	100	Oral ulcers	94
cough	82	Tachycardia	92
Throat pain	98	Tachypnea	90
Abdominal pain	75	Hypotension	70
Vomiting	80	Hypoxia	88
Headache	70	Icterus	70
Chest pain	60	GCS-9 to 11	9.09
Shortness of breath	68	GCS-12	90.90
Altered sensorium	9.37		

With respect to the biochemical parameters of the patients, 58.3% of the patient presented with metabolic acidosis. With respect to liver function tests, increased total bilirubin were seen in 13 (23.63%) of the patients. Increased SGOT in 15 (27.27%) and increased SGPT in 10 (18.2%) of the patients. Increased INR was present in 27 (49.09%) of the patients, revealed in (Table 5)

Out of 55 patients, 60% (N=33) patients had Acute Kidney Injury (AKI)

Table .5 Biochemical Parameters

Creatinine	3.21±4.37 range 0.76 to 14.90
Liver function test	
Abnormal total bilirubin	13 (23.63%)
Direct bilirubin	15 (27.27%)
SGOT	15 (27.3%)
SGPT	10 (18.2%)
INR	27 (49 %)
ABG	
Metabolic acidosis	60%
Normal	40%

Regarding the clinical management of the cases, all patients were treated with gastric lavage with activated charcoal. Hemodialysis was done in 25% patients. 10% patient received 3 sessions of hemodialysis, 6% patient received 4 session and 9% patient received 1 hemodialysis. On chest Xray, 35 patients had normal findings and 20 patients showed lung involvement. (60.00 % (N=12) out of 15 required ventilatory support.

The clinical outcome of patients admitted with paraquat poisoning was analysed. 41 out of 55 patients died with mortality rate of 74.54%. Ten patient recovered fully and 7.50% (N=4) were referred to PGIMER Chandigarh and their final outcome was not assessed. Out of the 41, nineteen patients died within 72 hours and 22 patients after 72 hours. The major cause of death for these patients, 63.63% (N=35), was multiple organ dysfunction syndromes (MODS) .(Table 6)

Table 6: Outcome of paraquat poisoning

Outcome	N(%)
Referred to Higher centre	4 (7.5%)
Recovery	10 (18.18)
Death	41 (74.54%)
Mortality occurrence time (N=41)	
24 to 72 hours	06 (10.90%)
>72 hours	13 (23.63%)
Cause of death (N=35)	
MODS	22 (40.00%)

5. DISCUSSION

Paraquat poisoning has vital toxicological importance, most common route of poisoning are ingestion, inhalation, and contact. Ingestion of paraquat results in local ulceration and rapid absorption into systemic circulation. Inhalation results in local irritation. More than 90% is excreted unchanged by the kidneys. After absorption, it is distributed to highly perfused organs like lungs, kidneys, liver, and muscles, and remains partly in the intravascular space. Paraquat concentration in the lung parenchyma is very high because of active, energy-dependent uptake of paraquat by type 1 and type 2 alveolar epithelium, via the polyamine uptake pathway.[8] The mortality rate in our study was 74.54% which is significantly higher. This rate is comparable to the study by Raghavendra Rao et al. in India, which showed a mortality rate of 61%[9]. This is similar to the hospital mortality in other countries, too, which ranges from 35-62%[10,11]. Majority of the deaths in our study were due to multiple organ dysfunction syndromes (MODS). The finding is similar to another study conducted by M. Indira et al. in South India, in which all the deaths (N=6) were due to MODS[12]. In this study, 90.90% [50] patients consumed paraquat with suicidal intention, and there was 10% [5] accidental consumption of paraquat. This is comparable to a study conducted by Kanchan et al. in South India, which shows 92.9% of paraquat poisoning was with suicidal intention[13]. In our study, the mean age was 34 years, and the majority of the patients were male. This is comparable to the study by Kanchan et al., which showed paraquat poisoning mainly occurs in young males[13]. The respiratory system was analysed through Chest X-ray and the requirement of ventilatory support. X-ray showed involvement of the lower lobes. Similar findings were observed by Kanchan et al. in South India, in which major involvement was seen in the lower lobe of the lungs[13]. In our institution there is no facility of hemoperfusion. Rao et al. reported that early hemoperfusion might be beneficial[9]. Other studies conducted by Li et al. and Koo et al. showed that there is moderate benefit when hemoperfusion is combined with continuous venovenous hemofiltration[14,15]. In our study, Acute Kidney Injury has been seen in 60% (N=33) of patients with paraquat poisoning. The association of paraquat poisoning with AKI is explained by Wang et al. where it has been explained that paraquat-induced oxidative stress affects the renal tubules.[16] A study by Gao et al. showed that the incidence of AKI could reach 71.7% with paraquat poisoning[17]. The causative link between paraquat and acute kidney injury has been explained in a systematic review conducted by Vadovar D et al[18]. Initial management focuses on prevention of further absorption and gastrointestinal decontamination with adsorbents like activated charcoal. There is no specific antidote. Paraquat is not removed by dialysis. Hemodialysis is used only as a supportive treatment for patients who develop kidney failure.[19] Although high doses of cyclophosphamide and Dexamethasone treatments, had been initiated to all patients who presented to medicine ward. In spite of all possible treatment available at our institution was given but only 12% patient could get survived. In a study by Afzali et al., the therapeutic effect has been reported with high dose cyclophosphamide and glucocorticoid where survival was about 75%.[20] This was further supported by Agarwal et al. Since there is a lack of clear evidence-based therapy, different approaches have been tried for supportive management.[21,22]

6. CONCLUSION

Paraquat poisoning remains a serious toxicological emergency with high mortality, predominantly affecting young

individuals who consume it with suicidal intention. In our study, the majority of patients presented with severe poisoning, and acute kidney injury emerged as the most common complication, often progressing to multiple organ dysfunction syndrome (MODS) and death. Despite aggressive supportive management, including gastric lavage, antioxidants, immunosuppressants, and hemodialysis, outcomes remained poor due to the lack of a specific antidote. There is a pressing need for stricter regulation of paraquat use in rural areas and for future research to develop evidence-based protocols to reduce mortality.

Limitations: The study is limited by its small sample size, single-centred, variability in presentation and management. Standardized diagnostic and treatment protocols are required for better understanding of paraquat poisoning.

7. DECLARATIONS

Patient consent: Obtained

Funding: No

Conflicts of interest: Nil

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