

## A Clinical Study of Patients With Acute Kidney Injury Due To Agrochemical Poisoning

Saikanth.B, Manjusha Yadla,

Department Of Nephrology, Gandhi Medical College,

HYDERABAD, TELANGANA 500 083

---

**ABSTRACT:** Agrochemicals are chemicals used in agriculture to maintain the ecosystem. This includes fertilizers, pesticides, insecticides, rodenticides etc. Agrochemicals are known to be associated with acute kidney injury. Of all the agrochemicals, Organophosphorus causing AKI was the most common agrochemical reported in literature. But with increasing use of Paraquat, the number of cases with Paraquat poisoning and thus with AKI are on rise. Of 40 cases of agrochemical poisoning with AKI, most common poisoning was Paraquat (18/40), Organophosphorus (9/40). Factors associated with mortality were found to be low Oxygen status at admission, and low hemoglobin.

**Keywords :** Agrochemical poisoning, acute kidney injury

---

Date of Submission: 14-09-2018

Date of acceptance: 29-09-2018

---

### I. Introduction

Poisoning is a global health problem. According to WHO, in 2012, an estimated 193,460 people died worldwide due to intentional poisoning. Of these deaths, 84% occurred in low income and middle income countries (1).

An agrochemical is any substance used to manage agricultural ecosystem or management of community of organisms in a farming area. Types of Agrochemicals include : Fertilizers, Pesticides, Liming and acidifying agents, Soil conditioners and chemicals used in animal husbandry such as antibiotics, hormones (2).

Acute kidney injury due to poisoning has been well reported in tropical countries. In tropics, Poisonings causing organ involvement may be due to agrochemical poison or nonagrochemical poison. Agrochemical poisonings include Pesticides, fertilizers, Weedicides and insecticides. Nonagrochemical poisonings are hairdyes, Coppersulfate and drugs. Agrochemical poisonings are more common compared to non agrochemical poisoning as agrochemicals are consumed by the village population who are dependent on agriculture as their main occupation.

### AIM :

To assess the prevalence of acute kidney injury and the outcomes in patients presenting with agrochemical poisoning

### PATIENTS AND METHODS :

This observational study was done in our hospital, tertiary care referral centre over a period of two years.

Inclusion criteria:

All patients presenting with AKI due to agrochemical poisoning

Patients of age >18 years

Those who have given consent for the collection of details

Exclusion criteria :

Those with AKI due to non agrochemicals

Those patients without AKI after consumption of agrochemicals.

Patients of age <18 years

Those who have not consented for collection of details

Those patients admitted to our Hospital with history of alleged consumption of agrochemicals were assessed for organ involvement. Those with AKI were referred to Nephrology department for further management. These patients were initiated on hemodialysis or peritoneal dialysis as per the indication for initiation of RRT. The patients labeled to have AKI were further assessed daily for other organ involvement and outcomes.

Outcomes assessed were renal outcome defined as partial renal recovery, complete renal recovery and nonrecovery patients. The mortality and the factors associated with it were also analysed.

Dialysis was given using polysulfone membrane of 1.3m2. Dialysis was given depending on the requirement till the recovery. If patients did not recover within 3 weeks of time, renal biopsy was done depending on the condition of the patient.

In those patients with hemodynamic instability, peritoneal dialysis was done.

## II. Results

Out of 820 poisoning cases which were admitted in our hospital during the study period, AKI was observed in 6.09% of patients. Out of 1614 patients admitted with AKI in our hospital, AKI due to poisoning was seen in 3.09% of cases. Of all the patients with AKI due to poisoning, patients with AKI due to agrochemical poisoning were studied. 40 patients were included in the study. Mean age of the population was 32.97±12.02 years. Majority of the study group was between 21-30 years. Men were 24 and women were 16 in number. All the poisonings were suicidal in nature. Of the poisons consumed, 18 (45%) were Paraquat, 9 (22.5%) were Organophosphorus compound, weedicide 3 (7.5%) in number, herbicide 2 (5%) in number, Rodenticide and Fipronil one each, unknown agrochemical were 6 (15%) in number. Referral to nephrology services was due to oligoanuria in 37 patients and elevated renal parameters in 3 patients. Referral time duration to Nephrology services varied between 6 hours - 48 hours.

**Table 1:** Baseline characteristics of study population

Variable	Value
Mean age (years)	32.7±12.02
Men : Women	24:16
Average referral duration	6-48 hours
Referring renal problem	
Oliguria	16
Anuria	4
Raised renal parameters	20
Hypotension at admission	5
Ventilator at admission	6
MODS	21
No of RRT patients	37
	HD
	PD
Mean S.Cr (mg/dl)	5.93±2.8
Mean hemoglobin	11.43±2.3
Mean TLC (cells /mm <sup>3</sup> )	12746±8551
Mean S.K <sup>+</sup> (meq/L)	4.32±0.9
Mean pH	7.31±0.11
Mean bicarbonate (meq/L)	17.86±16.1
Mean PCO <sub>2</sub> (mm of Hg)	31.63±13.9
Mean PO <sub>2</sub> (mm of Hg)	74.3±21.5
Mean bilirubin (mg/dl)	3.83±6.81
Mean SGOT (IU)	61.7±65.2
Mean SGPT (IU)	78.4±79.7

Amongst the referring renal problems, oliguria was present in 16 patients, anuria in 4 patients and elevated renal parameters in 20 patients. Mean duration of referral to nephrology services after admission to hospital was 6 hours – 48 hours. 38 of 40 patients needed renal replacement therapy. Hemodialysis was given in 26 patients, peritoneal dialysis was done in 9 patients and two patients received both PD and HD. None of the patients received CRRT. All the patients except one patient had oligoanuric AKI (anuria:4, oliguria 16). Multiorgan dysfunction was present in all the patients. All the Paraquat poisoning had pulmonary symptoms and needed supportive ventilation. Mortality was 52.5% (21/40) in our study. Amongst the poisonings related to mortality, Paraquat poisoning was the most common poisoning (10/21) followed by Organophosphorus poisoning (5/21), herbicide poisoning (2/21), unknown agrochemical (3/21) and Weedicide in one patient. There was 100% mortality in those patients with herbicide poisoning.

Poisoning	No. of patients	Mortality (%)
Paraquat	18	10 (52%)
OP	9	5 (55%)
Weedicide	3	1 (33%)
Herbicide	2	2 (100%)
Unknown agrochemical	6	3 (50%)

Factors predicting mortality were analysed using one way ANOVA. Low hemoglobin (p = 0.01), presence of low Po2 (p=0.001) were the factors found to be associated with mortality. The number of days of hospitalization and the duration of RRT also showed a significant association with the survival. In all the patients who dies, multiorgan dysfunction was present.

**Table 2 : Factors predicting mortality using one way ANOVA**

Variable	F	p
Age	0.2	0.62
BP	0.4	0.88
Creatinine	0.6	0.4
Hemoglobin	7.3	<b>0.01</b>
WBC	0.18	0.66
pH	0.23	0.66
PO2	13.3	<b>0.001</b>
Bicarbonate	0.61	0.43
PCO2	3.8	0.68
Aniongap	0.03	0.8
Hepatic involvement	1.21	0.22

There was a statistically significant difference in duration of RRT and duration of hospital stay between both the groups. This difference may be due to lesser number of sessions during the short stay of critically ill patients

Variable	F	p
Duration of hospital stay	8.3	0.006
Duration of RRT	5.9	0.02

### III. Discussion

An agrochemical is any substance used to manage agricultural ecosystem or management of community of organisms in a farming area. Types of Agrochemicals include :Fertilizers, Pesticides, Liming and acidifying agents, Soil conditioners and chemicals used in animal husbandry such as antibiotics, hormones (2).

In Southern India, Pesticides like Paraquat ,Organophosphorus are commonly used in agriculture as this is the main occupation of majority of the people living in villages. Easy availability and the definitiveness of mortality may be the factors for consumption of these poisons. In contrast in north India, it was reported that the common poisoning is aluminum phosphide used for rat control during wheat grain storage (3).

Recent reports of agrochemicals with chronic kidney disease of unknown etiology have been published(4). It is well known that Paraquat, Organophosphorus, Glycophosate(Herbicide), Rodenticide are associated with AKI. In addition organochlorines, Fipronil have also been reported to be associated with AKI (5,6).

In our study, all the poisonings were suicidal in nature. All the patients were referred from district hospitals or area hospitals where primary treatment in the form of gastric lavage was given. All the patients were initially admitted in internal medicine department and then referred to Nephrology services with oliguria / anuria or raised renal parameters. Patients with pre renal azotemia were not included in the study as they were not referred to nephrology services.

The prevalence of poisoning related AKI was 6.3% amongst all causes of AKI admitted to our hospital during the period of study. In our study, majority were between 21-30 years age group and youngest patient was 16 years old and oldest patient was aged 70 years. This finding is in concordance with other studies where it was observed that younger and productive group of the society is at risk of poisoning (7).

Men were slightly higher in number than women(60%). This may be because of the financial stress and the work related expectations and outcomes that led many of them to commit suicide. Reasons for consumption in women was mostly due to domestic and family related issues. Nocaes of accidental or homicidal nature were identified in our group. This is in contrast to other studies in which suicidal nature of poisoning was 72% (8). The increase to 100% may be due to increasing economic stress in this group.

Many reports regarding agrochemical poisoning and AKI were on organophosphorus. In our study, the most common poisoning was with Paraquat. Lack of definitive antidote and imminent death with consumption of Paraquat may be the reasons for rise in number of cases with this poisoning compared to OP, where definitive antidotes are available.

In our study, though percentage mortality was similar in both OP poisoning and Paraquat poisoning, number of deaths were more with Paraquat. On an average, patients of Paraquat poisoning consumed 20-100ml of poison. Higher the consumption, worse was the clinical profile in these patients. Patients of Paraquat poisoning had renal manifestations earlier than pulmonary symptoms. Pulmonary manifestations occurred in first week of admission. Of 18 patients with Paraquat poisoning, 5 patients did not have pulmonary involvement. All the patients with out pulmonary involvement had complete recovery with follow up discharge creatinine of 1.3

mg/dl. Kim et al. reported that the prevalence of AKI and acute kidney failure following acute paraquat intoxication was 51.4% and 34.7%, respectively (9). Severe acute kidney injury is a common complication of Paraquat poisoning as it is eliminated predominantly by kidney. Certain direct mechanisms like injury to proximal tubule mitochondria, lipid peroxidation have proposed and some indirect mechanisms identified include sepsis, rhabdomyolysis, hypotension, DIC (10).

Other manifestations of renal injury include Fanconi syndrome, variety of proximal tubular abnormalities (glycosuria, aminoaciduria, phosphaturia) and acute tubular necrosis (10).

OP poisoning was the second common poisoning in our study. Faiz et al reported an incidence of AKI to be 1.66% in 300 patients of OP poisoning.

Of the patients with OP poisoning, those with pulmonary involvement and had worse outcome (5/9) compared to those with out pulmonary involvement (4/9). Those with Pulmonary manifestations had bad outcome with increase in mortality. Factors like low Po<sub>2</sub> and anemia were associated with higher mortality.

Of 19 patients who survived, sixteen patients had complete renal recovery, 3 patients had three partial renal recovery. In three patients renal biopsy was done due to delayed renal recovery. Histopathology showed features suggestive of acute tubular necrosis.

In conclusion, in our study the most common agrochemical poisoning was Paraquat poisoning followed by Organophosphorus poisoning. Factors associated with mortality were found to be hypoxemia and anemia. In view of high risk associated with these agrochemicals, there should be stringent laws against the easy availability

### References

- [1]. World health Organisation 2014. Preventing suicide :A global imperative .Geneva
- [2]. Essay on agrochemicals and their effects-Biology discussion .www.biologydiscussion.com
- [3]. Sharma BR, Harish D, Sharma V, Vij K. Poisoning in Northern India: Changing trends, causes and prevention There of. Med Sci Law. 2002;42:251-7
- [4]. Jayasinghe .S Chronic kidney disease of unknown etiology should be renamed chronic agrochemical nephropathy. MEDICC Rev. 2014 Apr;16(2):72-4.
- [5]. Yadla M, Yanala SR, Parvithina S, Chennu KK, Annapindi N, Vishnubhotla S. Acute kidney injury in Endosulfan poisoning. audi J Kidney Dis Transpl. 2013 May;24(3):592-3
- [6]. Yadla M, Sailaja S, Ahmed N, Uppin M, Arlappa N. An unusual case of insecticide poisoning presenting as acute kidney injury. SJKDT Nov-Dec;28(6):1432-1434. 2017
- [7]. Singh S, Wig N, Chaudhary D, Sood N, Sharma B. Changing pattern of acute poisoning in adults: Experience of a large North West Indian hospital (1970-1989) J Assoc Physicians India. 1997;45(3):194-7.
- [8]. Singh S, Sharma BK, Wahi PL. Spectrum of acute poisoning in adults (10 years experience) J Assoc Physicians India. 1984;32:561-3.
- [9]. Kim SJ, Gil HW, Yang JO, Lee EY, Hong SY. The clinical features of acute kidney injury in patients with acute paraquat intoxication. Nephrol Dial Transplant 2009;24:1226-32.
- [10]. Vaziri ND, Ness RL, Fairshir RD, Smith WR, Rosen SM. Nephrotoxicity of paraquat in man. Arch Intern Med 1979;139:172-4.

Manjusha Yadla, "A Clinical Study of Patients With Acute Kidney Injury Due To Agrochemical Poisoning." IOSR Journal of Dental and Medical Sciences (IOSR-JDMS), vol. 17, no. 9, 2018, pp 48-51.