



PARAQUAT POISONING AND PARAQUAT MORTALITY IN PATIENTS REFERRED TO AHVAZ TEACHING HOSPITALS

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ABSTRACT

Introduction: Today poisoning with pesticides has increased and Poisoning with paraquat is one of the most significant poisoning in patients. The aim of this study was to investigate paraquat poisoning and mortality rates in Ahvaz patients. **Material and Method:** This study was conducted retrospectively on poisoned patients with Paraquat and all patients who were poisoned by Paraquat who were referred to hospitals in Ahvaz was analyzed. All of the patients who were poisoned with paraquat were examined and then the frequency of the patients was analyzed by gender and the rate of morbidity and mortality was analyzed. In this study we used SPSS version 22 for statistical analysis. **Results:** A total of 392 poisoned patients with paraquat were studied in this study. The gender of the patients showed that among them, 154 (39.28%) were men and 238 (60.72%) were female. Also, the mortality rate of patients revealed that 87 patients (22.19%) died from the studied patients that 47 patients (54%) were male and 40 (46%) of them were women. Also, 305 (77.81%) patients survived, that from them 107 patients (35%) were male and 198 (65%) were female. **Conclusion:** the rate of parquet poisoning mortality is 22.19% and the rate of survival in women is more than men. Future studies suggested to find more details about managing this patients.

KEYWORDS: Paraquat Poisoning, toxicity, N,N'-dimethyl-4,4'-bipyridinium, Mortality, Ahvaz.

INTRODUCTION

Poisoning with herbicides and other agricultural products is one of the major problems in public health. More than 2 million poisonings are reported annually due to poisoning with agricultural pesticides and more than 1% of these patients die.^[1-3] Paraquat or N,N'-dimethyl-4,4'-bipyridinium is a herbicide of the bipyridinium group. It is absorbed through the body through oral, pulmonary and skin, and its absorption is very rapid, and it reaches all organs and tissues, and its storage is more in the lungs. This herbicide is very toxic to humans and animals. Paraquat's toxicity mechanism is often associated with the production of anionic peroxide. These radicals are highly toxic and highly mixed with macromolecules, and also can produce large amounts of reactive oxygen species (ROSs) such as hydrogen peroxide and anion superoxide, which are two of the two most commonly released radicals, The particles produced by paraquat may cause serious damage to the organs.^[4-6] Paraquat is absorbed quickly but imperfectly and then largely excreted unchanged in the urine within 24 to 24 hours. Clinical symptoms are predominantly due to a

generation of intracellular oxygen species that can cause cell damage through lipid peroxidation, activation of Kappa B, mitochondrial damage and apoptosis in many organs. Poisoning with paraquat causes complications such as acute lung injury, pulmonary hypertension, leukocytosis, metabolic acidosis, heart enlargement, acute renal damage, edema and increased levels of amylase, glucose and creatinine.^[7-8] A urine test that is sensitive to paraquat poisoning with a concentration of 1 µg / ml or more (1 ppm) is performed by adding 2 cc of sodium dithionate solution to 1/10 sodium hydroxide sodium to 10 cc of urine.^[9] Hemodialysis and hemoipoiesis are other methods that are used to increase the clearance of paraquat from the poisoned body. However, although clearance is enhanced by hemodialysis (especially in renal dysfunction), however, this method has not been clinically feasible It can reduce morbidity and mortality.^[10-11] Therefore, some hemodialysis researchers will only be used for commonly indicating patients developing kidney failure.^[9-11] All patients who are poisoned by eating paraquat do not die, but mortality is estimated at about

75% for this poisoning.^[12] In some survivors, pulmonary vascular fibrosis has been reported, but most patients who survive have no lung damage and no effects on them. The prognosis of a poisoned person is related to the amount of para-clinical disease. The aim of this study was to evaluate the morbidity and mortality of paraquat poisoning in Ahvaz, Iran.

MATERIAL AND METHOD

After obtaining permission from the ethical committee of Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran committee, this study was conducted retrospectively on poisoned patients with Paraquat. The inclusion criteria was all patients who were poisoned by Paraquat who were referred to hospitals in Ahvaz. And exclusion criteria was Patients whose documents were not available or who were reluctant to participate in the study and also Patients who used toxins other than paraquat and those who used unknown poison were excluded from the study. In this study, all of the patients who were poisoned with paraquat were examined and then the frequency of the patients was analyzed by gender and the rate of morbidity and mortality was

analyzed. In this study we used SPSS version 22 for statistical analysis.

RESULTS

As outlined in the methodology, all patients who were poisoned with paraquat who referred to hospitals in Ahvaz were included in the study. A total of 392 poisoned patients with paraquat were studied in this study. The gender of the patients showed that among them, 154 (39.28%) were men and 238 (60.72%) were female. Also, the mortality rate of patients revealed that 87 patients (22.19%) died from the studied patients that 47 patients (54%) were male and 40 (46%) of them were women. Also, 305 (77.81%) patients survived, that from them 107 patients (35%) were male and 198 (65%) were female. All of this details was showed on the table 1. Further investigation of the data showed that Of the 154 men studied, 47 patients (30.51%) died and 107 (69.49%) survived. Also of the 238 men studied, 40 patients (16.8%) died and 198 (83.2%) survived. On the other word in this study the survive rate in women (83.2%) was higher than the men (69.49%). This details was showed on the figure 1 and 2.

Table 1: Patient's characterization and rate of mortality and survival.

Variables	Total		Male		Female	
	Number	Percent	Number	Percent	Number	Percent
Poisoned Patients	392	100	154	39.28	238	60.72
Expired	87	22.19	47	54	40	46
Survived	305	77.81	107	35	198	65

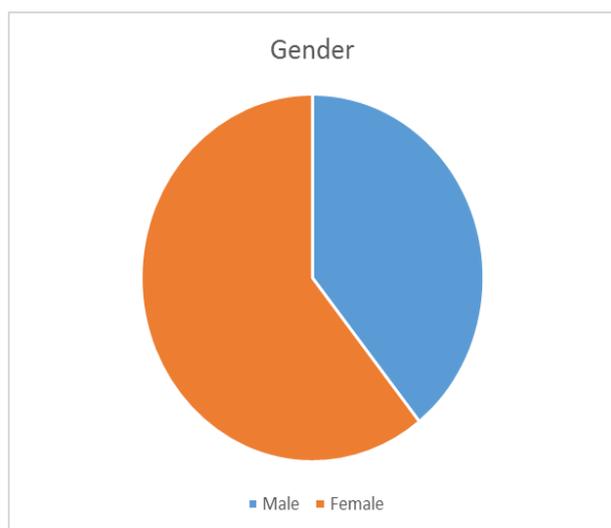


Figure 1: Gender difference in parquat poisoned patients.

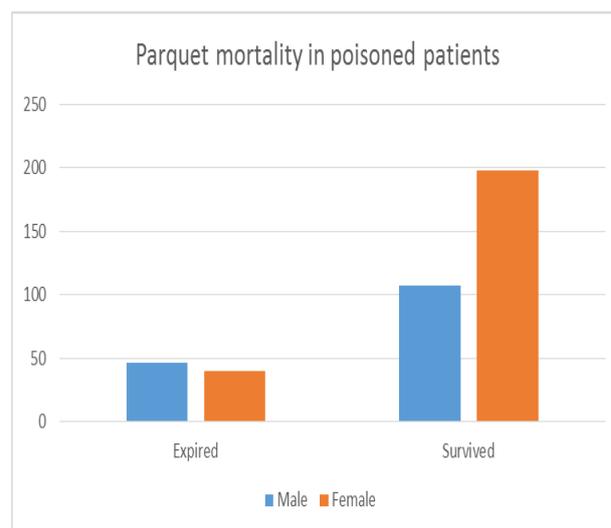


Figure 2: Parquet mortality in poisoned patients.

DISCUSSION AND CONCLUSION

As it has been stated, poisoning with agricultural pesticides is one of the most significant poisoning that has been found to be highly prevalent and has spread from various poisonings with herbicides.^[13-14] Paraquat is the most common source of toxin because it is the most available agricultural poison. In Iran, this poison is also used extensively, and therefore poisoning with this poison is very much reported. In Khuzestan, farmers also

use Paraquat, and therefore many patients refer to Ahvaz hospitals due to poisoning with Paraquat. As shown in the results section, the mortality rate of paraquat in this study was 22.19%, and the survival rate for male patients was 69.49%, and for women it was 83.2%, and survival rate was higher in women than in men. To better understand the results of this study, we will review other studies on paraquat poisoning patients and comparing the results of this study with other studies. In one of them, Ja-Liang Lin et al To clarify the efficacy of repeated methylprednisolone (MP) and cyclophosphamide (CP) pulse therapy and daily dexamethasone (DEX) therapy in patients with severe paraquat (PQ) poisoning reported that The study group patients had a lower mortality rate (39/59, 66%) than the control group patients (48/52, 92%; $P = 0.003$, log-rank test). Multivariate Cox regression analysis revealed that the repeated pulse therapy was correlated with decreased hazard ratios (HR) for all-cause mortality (HR = 0.50, 95% CI 0.31–0.80; $P = 0.004$) and death from lung fibrosis-related hypoxemia (HR = 0.10, 95% CI 0.04–0.25; $P < 0.001$) in severely PQ-intoxicated patients.^[15] In other study Malleshappa Pavan in valuable study entitled Acute Kidney Injury Following Paraquat Poisoning in India presented that Paraquat poisoning is associated with high mortality varying from 35% to 50%. Six cases of paraquat poisoning were treated in our center. Acute kidney injury developed in all the cases and mortality was 66%. Respiratory and multi organ failure are the main causes for mortality.^[16] Also the other research by jamshidi et al entitled Investigation Paraquat Poisoning in Southwest of Iran – from Sign to Mortality and Morbidity presented that Of 159 patients studied for paraquate poisoning, 65 patients (40.9%) were female and 94 patients (59.1%) were male and 138 cases (86.8%) of patients were 15–29 years and 150 patients (66%) were single. rate of poisoning due to suicide was 96.9%. First signs in this patients was Nausea and Vomiting, Mouth and throat ulcers, Mouth and throat erythema and Mouth and throat Irritation. 113 patients (71.1%) were treated by specialized medicines without antibiotics. 73 patients (45.9%) developed acidosis during hospitalization, and 13 patients (8.2%) experienced alkalosis. Sixty-three cases (39.6%) died.^[17] Also Torabi et al in study entitle Prognostic Parameters of Hospital Mortality in Paraquat Poisoning showed that From 108 patients poisoned with paraquat, 61 (56.48%) were male. The mean age of the patients was 23.25 ± 8.27 years and the hospital mortality rate was observed in 28.70% of the patients.^[18] In conclusion the result of this study showed that the rate of parquet poisoning mortality is 22.19% and the rate of survival in women is more than men. Future studies suggested to find more details about managing this patients and reduced the rate of mortality due to paraquat poisoning.

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REFERENCES

1. Mohamed F, Buckley NA, Jayamanne S, Pickering JW, Peake P, Palangasinghe C, Wijerathna T, Ratnayake I, Shihana F, Endre ZH. Kidney damage biomarkers detect acute kidney injury but only functional markers predict mortality after paraquat ingestion. *Toxicology letters*, 2015 Sep 2; 237(2): 140-50.
2. Shahzad CM, Mohafez OM, Rasool ST, Nair AB. Effect of vitamin C on N, N'-dimethyl-4, 4'-bipyridinium dichloride-induced hepatic and renal toxicity in Swiss albino mice. *Tropical Journal of Pharmaceutical Research*, 2017; 16(11): 2645-9.
3. Wunnapuk K, Mohammed F, Gawarammana I, Liu X, Verbeek RK, Buckley NA, Roberts MS, Musuamba FT. Prediction of paraquat exposure and toxicity in clinically ill poisoned patients: a model based approach. *British journal of clinical pharmacology*, 2014 Oct 1; 78(4): 855-66.
4. Perez Y.Y., Jimenez-Ferrer E., Zamilpa A., Hernandez-Valencia M., Alarcon-Aquilar F.J., Tortoriello J., Roman-Ramos R. (2007), Effect of a polyphenol-rich extract from Aloe vera gelon experimentally induced insulin resistance in mice, *The American Journal of Chinese Medicine*, 35(6): 1037-1046.
5. Farrington J.A., Ebert M., Land E.J., Fletcher K. (1973), Bipyridylum salts and related compounds. v. Pulse radiolysis studies of the reaction of paraquat radical with oxygen. Implication for the mode of action of bipyridyl herbicides, *Biochemistry and Biophysics*, 314(3): 372-381.
6. Mohammadi-Bardbori A, Ghazi-Khansari M. The inhibitory effect of captopril on paraquat toxicity in mitochondria isolated from the rat liver. *Journal of Keratan University of Medical Sciences*, 2014; 3.
7. Delirrad Mohammad, Majidi Mohammad, Boushehri Behzad. Clinical features and prognosis of paraquat poisoning. *Int J Clin Exp Med*, 2015; 8(5): 8122-8128.
8. Cant JS, Lewis DR. Ocular damage due to paraquat and diquat. *Br Med J*, 1968; 3(5609): 55-9.
9. JG, Lee KS, Han MC, Kim SJ, Kim IO. Paraquat poisoning: findings on chest radiography and CT in 42 patients. *AJR Am J Roentgenol*, 1991; 157(4): 697-701.
10. Fairshter RD, Miyada DS, Ulich TR, Tipper P. The effects of paraquat dichloride on clinical chemistry measurements. *J Anal Toxicol*, 1986; 10(4): 162-4.
11. Nagil. Naik RB, Polka A. Paraquat ingestion with methemoglobinemia treated with methylene blue. *Br Med J*, 1982; 784: 1445-6.
12. Gregus Z, Klaassen CD. Mechanisms of toxicology. In: Klaassen CD, Amdur MO, Doull J, editors. *Casarett & Doull's Toxicology the basic Science of Poison*. New York: McGrawHill Companies, 1996; 39-41.

13. Jamshidi F, Fathi G, Davoodzadeh H. A case of inhaled paraquat poisoning. *MINERVA PNEUMOLOGICA*, 2017 Dec 1; 56(4): 271-3.
14. Jamshidi F, Ghorbani A, Darvishi S, Davoodzadeh H. Study of laboratory profile in patients with aluminium phosphide poisoning in the southwest of Iran from 2010 to 2015. *Archiwum Medycyny Sądowej i Kryminologii/Archives of Forensic Medicine and Criminology*, 2017 Jan 1; 66(3): 149-57.
15. Lin JL, Lin-Tan DT, Chen KH, Huang WH, Hsu CW, Hsu HH, Yen TH. Improved survival in severe paraquat poisoning with repeated pulse therapy of cyclophosphamide and steroids. *Intensive care medicine*, 2011 Jun 1; 37(6): 1006-13.
16. Pavan M. Acute kidney injury following Paraquat poisoning in India. *Iranian journal of kidney diseases*, 2013 Jan 1; 7(1): 64.
17. Jamshidi F, Fathi G, Davoodzadeh H. Investigation Paraquat Poisoning in Southwest of Iran—from Sign to Mortality and Morbidity. *Archiwum Medycyny Sądowej i Kryminologii/Archives of Forensic Medicine and Criminology*, 2017; 67(1): 35-45.
18. Torabi M, Jafari M, Mirzaee M. Prognostic Parameters of Hospital Mortality in Paraquat Poisoning. *Indian Journal of Forensic Medicine & Toxicology*, 2018; 12(1): 291-7.