

# Research Paper: Organophosphorus Insecticide Poisoning Related Mortality and Neurotoxicity in Sabzevar



Davood Soroosh<sup>1</sup>, Narges Ranjbar<sup>1</sup>, Mohammad Nematshahi<sup>\*2</sup>, Seyed Alireza Javadinia<sup>3</sup>

1. Department of Internal Medicine, School of Medicine, Sabzevar University of Medical Science, Sabzevar, Iran.

2. Department of Anesthesiology, School of Medicine, Sabzevar University of Medical Science, Sabzevar, Iran.

3. Cellular and Molecular Research Center, Sabzevar University of Medical Sciences, Sabzevar, Iran.



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## ABSTRACT

**Background:** This study aimed to assess mortality and neurotoxicity caused by the pesticide organophosphate and its correlation with the type of poison and treatment in patients admitted to Vasei Hospital of Sabzevar City, Iran, in 2018.

**Methods:** Out of 122 cases, 52 patients (43.3%) were male, and 70 patients (56.9%) were female. The Mean±SD age of the men was 32.65±29.15, and women was 30±15.30 years.

**Results:** Mortality in women and men was 10% and 17.3%, respectively. Among treated people, diazinon had the highest frequency of 76.4%, and among dead people from diazinon and malathion had the highest rates of 56.3% and 43.8%, respectively.

**Conclusion:** The prevalence of mortality in patients was 7.3% (n=9). As most people with organophosphorus poisoning have been exposed to diazinon toxins; therefore, strategies to prevent and reduce exposure to this toxin are essential.

## 1. Introduction

In recent years, the prevalence of poisoning has increased dramatically due to the growth and development of societies and the ease of access to drugs and toxins [1]. Toxins are one of the most important causes of hospitalization today. In the United States, millions of people come to hospitals every year because of poisoning, and poisoning is high in Iran, too. Poisonings are the most crucial cause of specific diseases in many developed countries [2-4]. In general, the incidence of

poisoning varies widely depending on the geographical region in every country [5].

Many of the poisonings are of the pharmacological type, and the rest of us are non-pharmacological poisonings, of which the common causes are drugs, hydrocarbons, organophosphorus toxins, natural or chemical anticholinergic compounds, dead rats, drugs, carbon monoxide, alcohol, fungi are bites of insects and animals and are acidic or playful (less abundant) [5, 6]. In some areas, pesticides are used in particular to combat pests, especially organophosphate, and because of their ease of access,

\* Corresponding Author:

Mohammad Nematshahi, PhD.

Address: Department of Anesthesiology, School of Medicine, Sabzevar University of Medical Science, Sabzevar, Iran.

Tel: +98 (51) 44014091

E-mail: [nematshahim@medsab.ac.ir](mailto:nematshahim@medsab.ac.ir)

they are more common than other types of poisoning, so poisoning is more common. With organophosphorus compounds, one of the major clinical problems in the world, especially the third world countries, is associated with a high mortality rate [5, 7].

Following organophosphorus poisoning, there are four clinical stages, three acute and one chronic: acute cholinergic crisis, interstitial syndrome, organophosphorus-induced delayed neuropathy, chronic organophosphate-induced neuropsychiatric disorder. This study aimed to determine the rate of mortality and neurotoxicity due to organophosphorus toxins and its relationship with the type of poison and treatment performed in patients.

## 2. Materials and Methods

This cross sectional study was performed at the Vasei Hospital in 2018. The inclusion criteria were a definitive diagnosis of organophosphorus poisoning based on clinical and patient evidence and completeness of information needed in patient records. The diagnosis of organophosphorus poisoning in this study was based on patient history and patient companionship as well as a measurement of serum butyrylcholinesterase.

Given the prevalence of organophosphorus pesticides at the community level, 95% confidence level, and 0.2% accuracy, the sample size was estimated to be approximately 120. The study data were collected using a researcher-made checklist, including information about the patient's gender and age, the name of the toxin used, referral to another facility, initial treatment, type of medication taken at the facility, symptoms of the patient on admission, and condition at discharge were collected.

Neuropsychiatric symptoms were assessed at the first visit and three weeks later. The indices of Mean±SD were used to describe the quantitative variables and frequency and percentage for qualitative variables. The t test was used to compare the mean quantitative outcomes between the two groups. The Chi-square test or Fisher exact test was used to compare the qualitative variables between the groups.

## 3. Results

In this study, a total of 122 subjects met the inclusion criteria. Of these patients, 52 patients (43.3%) were male, and 70 (56.9%) were female. The mean age in male patients was 32.65 ± 15.29 years with the youngest and highest age being 3 and 81 years, and the mean age in females was 30.00 ± 15.39 years ranged 4-91 years.

The mortality rate was 10% (n=7) in women and 17.3% (n=9) in men. The Fisher exact test results showed no significant difference between men and women in mortality rate due to organophosphorus poisoning (P=0.28) (Table 1).

Table 2 presents the frequency distribution of the type of treatment and its association with morbidity and mortality in patients exposed to organophosphorus. The treatments include using atropine, gastric washing, sorbitol, charcoal, pralidoxime, pantoprazole, and ranitidine:

Treatment 1, atropine; treatment 2, gastric washing; treatment 3, sorbitol; treatment 4, atropine, gastric washing, sorbitol, charcoal, pralidoxime, pantoprazole, and ranitidine; treatment 5, ranitidine; treatment 6, atropine and ranitidine; treatment 7, atropine, gastric washing, sorbitol, charcoal, pralidoxime, pantoprazole, ranitidine intubation; and treatment 8, atropine, gastric washing, sorbitol, and charcoal.

## 4. Discussion

In the present study, 56.9% of the patients with organophosphorus intoxication were female, and 43.3% were male. This indicates a higher rate of poisoning in women than in men. The mean age for men was 32.65 years, and for women 30.00 years. Razwiedan conducted a study in South Africa between 2012 and 2014 on 207 patients who were 58% male and 42% female. Women under 30 were mostly affected by organophosphorus poisoning.

The age range of people affected by organophosphorus poisoning was between 10 months and 59 years. Poisoning was deliberate in 51.7%, accidental in 21.7%, and without any known cause in 26.6% [8]. In Ghaffar Ali Mahmoodi et al. study on 153 patients with organophosphorus poisoning, the highest rate of organophosphorus poisoning was found in the age ranged 17-21 years, with 57.6% of female poisoning and 42.4% of male poisoning [9].

In Gannur et al. study, the highest incidence of intoxication was observed in young people (16-30 years) [10]. Yazdani Nejad et al. conducted a study between 2012 and 2013 at Lohman Hakim Hospital on 201 patients. About 47% of patients were female, and 52% were male. Their mean age was 33 years ranged 2-89 years. Of 201 patients, 18 died, and 183 survived. Diazinon was the most abundant toxin with 15%, followed by malathion, chlorpyrifos, and cyhalothrin with 7%, 6%, and 0.5%, respectively.

**Table 1.** Frequency distribution of mortality and toxicity complications by the type of toxin in people exposed to organophosphorus

Variables	No. (%)				Total	P
	Malathion	Parathion	Diazinon	Demeton		
Mortality	7 (43.8)	0 (0)	9 (56.3)	0 (0)	16	0.111
Delayed neuropathy	1 (25)	1 (25)	2 (50)	0 (0)	4	0.118
Intermediate syndrome	4 (23.5)	2 (11.8)	11 (64.7)	0 (0)	17	0.353
Seizure	1 (10)	0 (0)	8 (80)	1 (10)	10	0.006
Headache	2 (28.6)	0 (0)	5 (71.4)	0 (0)	7	0.907
Dizziness	0 (0)	0 (0)	1 (100)	0 (0)	1	0.949

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**Table 2.** Frequency distribution of the type of treatment and its relation to morbidity and mortality

Variables	No. (%)								Total	P
	Treat-ment 1	Treat-ment 2	Treat-ment 3	Treat-ment 4	Treat-ment 5	Treat-ment 6	Treat-ment 7	Treat-ment 8		
Mortality	0	0	0	1 (6.25)	0	0	15 (93.75)	0	16	0.111
Delayed neuropathy	0	0	0	4 (100)	0	0	0	0	4	0.118
Intermediate syndrome	1 (1)	0	1 (5)	7 (41)	0	2 (11)	0	0	17	0.353
Seizure	0	0	0	8 (80)	0	0	1 (10)	1 (10)	10	0.006
Headache	0	0	0	4 (57)	0	2 (28)	1 (14)	0	7	0.907
Dizziness	0	0	0	4 (57)	0	2 (28)	1 (14)	0	1	0.949

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In 93% of them, poisoning was by mouth and in 7% by other methods like inhalation, injections, and so on. In 85% of cases, the use of organophosphorus pesticides was deliberate, and in 14%, it was accidental [11]. Umakanth et al. investigated the prevalence of organophosphorus poisoning in Sri Lanka. They studied 121 patients, 98% of whom had deliberate intoxication, and only 1.65% had accidental poisoning. All patients had oral toxicity. Of 121 patients, 68% were female, and 38% male, most of them were in the age group of 12-29 years [12].

Banday et al. investigated the mortality rate of organophosphorus pesticides among 133 patients during 2015. About 76% of them were male, and 24% were female, and most of them were under 40 years old. Of the 133 poisoned patients, 98% had oral poisoning, and 36% of these patients recovered after gastric lavage and were discharged after three days. The mortality rate was 33% in these patients [13].

Yurumez et al. investigated the acute toxicity of organophosphorus from 1995-2004 in 220 patients (59% female and 41% male). The age group of 14-24 was also more prevalent than the other age groups. The oral method was the most common method of intoxication and suicide poisoning (75%). The most common types of organophosphate poisoning were dichlorvos, diazinon, and parathion-methyl. The mortality rate was 9% in patients exposed to organophosphorus [14].

Kang et al. investigated 68 patients to evaluate survival factors in organophosphate poisoning. Their mean age was 54 years, and 56% were male, and the rest were female. The most common organophosphorus toxins were dichlorvos, O-ethyl-O-(4-nitrophenyl) phenylphosphothioate, phosphamidon, phenthoate, and malathion with 30%, 17%, 11%, 4%, and 3%, respectively. The mortality rate was 19% in these patients [15].

Diazinon was the most prevalent poison among live patients, Although, among dead patients, Diazinon and Malathion had the highest frequency (56.3 and 43.8%, respectively).

## 5. Conclusion

According to the results of this study, the prevalence of organophosphorus poisoning was higher in females, but there was no significant difference in the mortality rate due to organophosphorus poisoning between men and women. The mean age of men and women exposed to organophosphorus poisoning was 30 and 32.65 years, respectively. The organophosphate poisoning was caused by Diazinon mostly.

## Ethical Considerations

### Compliance with ethical guidelines

The Ethics Committee of Sabzevar University of Medical Sciences approved this study (Code: IR.MEDSAB.REC.1396.49). Written informed consent form has been obtained from patients or their legal guarantees.

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### Author's contributions

All authors contributed in preparing this article.

### Conflict of interest

The authors declared no conflict of interest.

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