

Research Article

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Diagnostic value of red blood cell distribution width in patients with organophosphate poisoning in emergency department of Sina hospital in 2019**Kavous Shahsavarinia¹; Afshin Gharekhani²; Zahra Mousavi³; Sorour Aminzadeh⁴; Sepideh Harzand Jadidi⁵; Neda Gilani⁵; Shilan Nourani Koliji⁶; Pooya Jalali⁷***¹Road Traffic Injury Research Center, Tabriz University of Medical Sciences, Tabriz, Iran.²Department of Clinical Pharmacy, Faculty of Pharmacy, Tabriz University of Medical Sciences, Tabriz, Iran.³Research Center of Psychiatry and Behavioral Science, Tabriz University of Medical Sciences, Tabriz, Iran.⁴Emergency Medicine Research Team, Tabriz University of Medical Sciences, Tabriz, Iran.⁵Tuberculosis and Lung Research Center, Department of Biostatistics and Epidemiology, Faculty of Health, Tabriz University of Medical Sciences, Tabriz, Iran.⁶Faculty of Medicine, Kurdistan University of Medical Sciences, Kurdistan, Iran.⁷Faculty of Medicine, Islamic Azad University Tabriz Branch, Tabriz, Iran.***Corresponding Author: Pooya Jalali**Faculty of Medicine, Islamic Azad University Tabriz
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Abstract**Introduction:** Organophosphates are pesticides used for agricultural purposes, and their poisoning has critical complications. The purpose of this study was to determine the estimated Red Blood cell distribution width (RDW) prognostic role in patients with organophosphate poisoning in the emergency department.**Materials and methods:** In this Descriptive-analytical study, patients with acute organophosphate poisoning referred to the emergency department of Sina Hospital in Tabriz from March 2019 to March 2020 were enrolled. The primary outcome of the patients including, organophosphate-induced RDW changes, and the secondary outcome including, organophosphate-induced death were recorded.**Results:** Eighty two patients with organophosphate poisoning were enrolled in this study. The mean age was 36.21 years. Of 82 patients, insecticidal poisoning, herbicide, fungicides, and acaricide were seen in 62 (76.8%), 16 (19.5%), 1 (1.2%), and 1 (1.2%) patients respectively.There were no statistically significant difference observed between types of pesticides and patients' outcomes ($p > 0.05$). There was no statistically significant difference between different organophosphates in terms of pH, HCO_3^- , PCO_2 , WBC, Hb, platelets, RDW, sodium, potassium, PT, PTT, INR, urea, creatinine, and cholinesterase ($p > 0.05$).**Conclusion:** Generally, RDW in patients with organophosphates toxicity does not have prognostic value and is not affected by the severity of poisoning.**Keywords:** organophosphate; RDW; poisoning.

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Introduction

Organophosphates are used predominantly in agriculture as insecticides to control mollusks; additionally, some have household uses [1,2]. The most common organophosphate toxins used in Iran include parathion, metacystox, malathion, casein, and superoxide, which are easily absorbed through the skin, lungs, and gastrointestinal tract [3,4]. Symptoms of poisoning include cardiac manifestations, pulmonary disorders, transient liver dysfunction, and coagulation disorders. Changes in the Red blood cell Distribution Width (RDW) is one of the parameters of red blood cell (RBC) that, in recent years, has drawn much attention to itself for clinical decision making [5,6].

Studies have shown that RDW is an inexpensive and accessible parameter in patients that shows heterogeneity of erythrocyte volume and changes in metabolic disorders, poisoning, oxidative stress, malnutrition. It also indicates the patient's condition and clinical condition and is reliable in determining the prognosis of patients [6]. Based on the results of previous studies, the increase in RDW is significantly associated with an increase in the likelihood of patient mortality in patients with critical conditions [7]. Studies have also shown that from 2008 to 2013, the mortality rate in patients with organophosphate poisoning was 20.6%, and the increase in RDW was significantly associated with mortality in patients with organophosphate poisoning [8]. A study conducted in 2016, evaluate RDW as a prognostic factor in patients with organophosphate poisoning, showed that this type of poisoning causes changes in the size of peripheral blood cells due to lipid peroxidase and oxidative stress of cell membranes, both cause damage to the blood cell membrane. Therefore, different sizes of RBCs in peripheral blood can be a predictor of the severity of poisoning. Hence, the use of RDW in these patients will be helpful to predict the patient's condition [9].

Inflammatory cytokines stop the maturation of red blood cells in the bone marrow, and as a result, immature red blood cells enter the bloodstream and increase RDW [10,11]. Pierce and Hunziker's, have suggested that increased RDW is associated with systemic inflammation and oxidative stress [11,12]. These reasons indicate the effectiveness of RDW testing in a broad range of diseases and indicate that it is affected by various factors to give inconsistent and inaccurate results about the disease and its prognosis; This reminds us to be more vigilant to eliminate the effects of confounders.

The results of studies conducted in recent years showed the value of assessing RDW in different diseases [9-12]; Nevertheless, most studies do not, mention the factors that may lead to invalidity and discrepancies in results. Anemia or the synchronicity of other diseases should be excluded from these studies to avoid false results. Accordingly, we performed the present study by considering these confounders to discover the diagnostic value of changes in RDW in patients with acute organophosphate poisoning referred to the emergency department of Sina Hospital in Tabriz in 2019.

Methods

In this Descriptive-analytical study, patients with acute organophosphate poisoning referred to the emergency department of Sina Hospital in Tabriz from March 2019 to March 2020 were enrolled. Informed consent was obtained from all the patients. The primary outcome of the patients including, organophosphate-induced RDW changes, and the secondary outcome including, organophosphate-induced death were recorded. The sample size for this study was 82 people with a 95% confidence level and 80% power.

The Inclusion criteria were People with organophosphate poisoned patients referred to Sina Hospital in Tabriz. The exclusion criteria were patient disapproval, exposure to other toxic substances with organophosphates, previous history of heart disease, history of anemia (iron deficiency, folate deficiency), hemolytic anemia, history of liver disease.

Data were analyzed using STATA version 16 (Chicago, IL, USA). The Kruskal-Wallis test was performed to compare quantitative variables between groups. Also, to compare the qualitative variables, binomial and Chi-square tests were used. Two-state logistic regression was used to model and obtain the Odds Ratio with confidence intervals. *P-value* of less than 0.05 were regarded as statistically significant for any differences.

Table 1: Distribution of demographic characteristics.

variable	Variable levels	number	percentage
Gender	male	45	54.9
	female	37	45.1
Education	illiterate	19	23.2
	Primary school	13	15.9
	Secondary school	29	35.4
	High school	14	17.1
	M.Sc. Diploma	1	1.2
	Bachelor	6	7.3
Occupation	unemployed	20	24.4
	homemaker	29	35.4
	Self-employment	12	14.6
	Laborer	7	8.5
	Employee	6	6.8
	farmer	8	9.8
Location	Tabriz	35	42.7
	Other cities	47	57.3
History of previous disease	yes	26	31.7
	no	56	68.3
History of previous hospitalization	yes	8	9.8
	no	74	90.2
History of Previous suicide history	yes	3	3.7
	no	79	96.3
History of hospitalization due to medication	yes	1	1.2
	no	81	98.8

Results

In this study, 82 patients with organophosphate poisoning were enrolled. Of these, 45 (54.9%) were male and 37 (45.1%) were female. The mean age \pm Standard Deviation of patients was 36.21 ± 1.95 years. 29 (35.4%) patients were House wives, which was the most prevalent job among patients. Demographic characteristics of the participants are shown in Table 1.

The time spent since the drug intake was more than 3 hours (the highest rate) in 61.0% of the patients and less than an hour (the lowest rate) in 6.1%. In terms of consciousness, 79.3% of the patients were conscious, and 4.9% were in a coma. 76.8% of the patients were poisoned with insecticides, 19.5% with herbicides, and 1.2% with fungicides and acaricides. The average intake volume was 108.72 cc (4-600 cc). There was no statistically significant difference between different organophosphates in terms of p^H , HCO_3 , PCO_2 , WBC, Hb, platelets, RDW, sodium, potassium, PT, PTT, INR, urea, creatinine, and cholinesterase ($p > 0.05$) (Table 2).

Table 2: Comparison of the amount of different parameters for each toxin in the subjects

Parameter	Type of organophosphate	Mean \pm Standard error	Significance level
PH	Herbicide	7.39 \pm 0.01	0.970
	insecticide	7.39 \pm 0.01	
	Fungicides	7.41 \pm 0.00	
	Acaricide	7.36 \pm 0.00	
HCO ₃	Herbicide	23.45 \pm 0.85	0.681
	insecticide	23.62 \pm 0.84	
	Fungicides	26.30 \pm 0.00	
	Acaricide	30.80 \pm 0.00	
PCO ₂	Herbicide	38.45 \pm 1.56	0.312
	insecticide	37.53 \pm 1.14	
	Fungicides	41.20 \pm 0.00	
	Acaricide	53.50 \pm 0.00	
WBC	Herbicide	11118.75 \pm 1067.05	0.776
	insecticide	16201.59 \pm 2640.03	
	Fungicides	13700.00 \pm 0.00	
	Acaricide	23100 \pm 0.00	
Hb	Herbicide	14.76 \pm 0.34	0.382
	insecticide	14.48 \pm 0.23	
	Fungicides	12.90 \pm 0.00	
	Acaricide	17.00 \pm 0.00	
Platelet	Herbicide	214312.50 \pm 10569.10	0.923
	insecticide	225333.33 \pm 7588.46	
	Fungicides	223000.00 \pm 0.00	
	Acaricide	228000.00 \pm 0.00	
RDW	Herbicide	13.11 \pm 0.18	0.690
	insecticide	13.34 \pm 0.14	
	Fungicides	12.30 \pm 0.00	
	Acaricide	13.50 \pm 0.00	
Urea	Herbicide	31.10 \pm 2.55	0.712
	insecticide	27.98 \pm 1.28	
	Fungicides	27.98 \pm 1.28	
	Acaricide	27.98 \pm 1.28	

Based on the results of the study, 98.8% of the patients were hospitalized. The average duration of hospitalization was 4.33 days (1-42 days). 93.9% of the patients were discharged without complications and 1.2% were discharged with complication (esophageal erosion) (Table 3).

The Chi-square test results showed no statistically significant difference between different types of pesticides in terms of

Table 3: Distribution of hospitalization variables in the subjects

Variable	Variable levels	Number	Percentage	P-value
Hospitalization	yes	81	98.8	0.001
	no	1	1.2	
Inpatient department	Poisoning section	48	59.3	0.120*
	ICU	33	40.7	
Outcome	Death	4	4.6	<0.001
	Discharge without complications	77	93.9	
	Discharge with complications	1	1.2	

1. Precise Binomial test.
2. Single sample chi-square test

outcome and inpatient wards ($p > 0.05$). Also, there was no statistically significant difference between the two genders in terms of outcome ($p > 0.05$) (Table 4).

Patients with insecticide, fungicide, or acaricide poisoning; the chance of hospitalization was 1.81 times higher than those who had herbicide poisoning; although this ratio was not statistically significant ($P = 0.858$). The chance of being admitted to the poisoning ward for patients with herbicide poisoning was 22% higher than other cases ($P = 0.734$). The mortality rate in people with herbicide poisoning was 1.38 times higher than other cases of poisoning, ($P = 0.788$).

Discussion

This study aimed to determine the diagnostic value of changes of RDW in patients with acute organophosphate poisoning referred to the emergency department of Tabriz Sinai Hospital in 2019.

Salvagno found that this parameter changes in conditions such as poisoning, metabolic disorders, oxidative stress, malnutrition, and the use of this parameter in determining the prognosis of patients is reliable [6], but contrary to them, the results of our study showed that RDW levels are not affected in patients with organophosphate poisoning and have no prognostic role.

Luo and Kang's studies show that an increase in RDW is significantly associated with increased mortality in patients with organophosphate poisoning [8,7]; While in the present study, the mortality rate was much lower than these studies, and there was no significant relationship between increasing the RDW level and increasing the mortality rate of the patients.

Surana showed that the use of RDW in patients with organophosphate poisoning would help predict the patient's condition [9].

Dündar and Kang's study also showed that high RDW was more associated with mortality in ICU patients [13,8], whereas,

in our study, there was no significant relationship between RDW level and mortality and also patients with different clinical intensities were not statistically significantly different.

The Dundar and Pierce's study showed that RDW level had a sensitivity of 73%, specificity of 70%, a negative predictive value of 91%, and a cut-off value of 14.5% in predicting the need for mechanical ventilation in patients with organophosphate poisoning [13,14]. In this study, sensitivity and specificity were relatively low, and the prediction of the need for mechanical ventilation in these patients based on the RDW level was uncertain. However, the cut-off determined in the study of patients can be helpful.

The results of the present study showed that there was no statistically significant difference between different toxins in terms of pH, HCO₃, PCO₂, WBC, Hb, platelets, RDW, sodium, potassium, PT, PTT, INR, urea, creatinine, and cholinesterase. It is crucial to pay attention to the type of disease. Inflammatory and toxic disease seem to affect RDW more, so based on this, the severity of the disease and its prognosis can be determined.

Conclusion

According to the results of this study, RDW levels in patients with organophosphate poisoning is not affected and has no diagnostic value. However, because the statistics obtained are only from one medical center, we suggest conducting similar studies on larger statistical populations to obtain more reliable results. Considering the prevalence of social problems, and the increasing use of these substances in domestic, industrial, and agricultural uses, it is possible to make decisions based on the results of these studies and by considering the changes in the distribution of red blood cell volume in these patients, important decisions are made at critical times and reduce the mortality rate of these people.

References

1. Fauci AS. Harrison's principles of internal medicine: McGraw-Hill, Medical Publishing Division New York; 2018.
2. Pesticides. Medical toxicology: A synopsis and study guide. St. Louis: Mosby; 2016.
3. Dart RC, Hurlbut KM, Kuffner EK, Yip L. The 5 minute toxicology Consult: Lippincott Williams & Wilkins; 2000.
4. Karki P, Ansari J, Bhandary S, Koirala S. Cardiac and electrocardiographical manifestations of acute organophosphate poisoning. Singapore medical journal. 2004; 45: 385-389.
5. Bai Y, Gao J, Shi X, Zou D, Li Z. Prophylactic corticosteroids do not prevent post-ERCP pancreatitis: A meta-analysis of randomized controlled trials. Pancreatology. 2008; 8: 504-509.
6. Salvagno GL, Sanchis-Gomar F, Picanza A, Lippi G. Red blood cell distribution width : A simple parameter with multiple clinical applications. Critical reviews in clinical laboratory sciences. 2015; 52: 86-105.
7. Luo R, Hu J, Jiang L, Zhang M. Prognostic value of red blood cell distribution width in non-cardiovascular critically or acutely patients: a systematic review. PLoS One. 2016; 11: e0167000.
8. Kang C, Park IS, Kim DH, Kim SC, Jeong JH, Lee SH, et al. Red cell distribution width as a predictor of mortality in organophosphate insecticide poisoning. The American journal of emergency medicine. 2014; 32: 743-746.
9. Surana A, Sharma S. Raised red cell distribution width as a prognostic tool for Acute Aluminium Phosphide Poisoning (AALPP) patients. J Med Sci Clin res. 2016; 4: 13039-13042.
10. Lippi G, Targher G, Montagnana M, Salvagno GL, Zoppini G, Guidi GC. Relation between red blood cell distribution width and inflammatory biomarkers in a large cohort of unselected outpatients. Archives of pathology & laboratory medicine. 2009; 133: 628-632.
11. Pierce CN, Larson DF. Inflammatory cytokine inhibition of erythropoiesis in patients implanted with a mechanical circulatory assist device. Perfusion. 2005; 20: 83-90.
12. Hunziker S, Celi LA, Lee J, Howell MD. Red cell distribution width improves the simplified acute physiology score for risk prediction in unselected critically ill patients. Critical care. 2012; 16: 1-8.
13. Dünder ZD, Köylü R, Ergin M, Günaydin YK, Özer R, Cander B. Prognostic value of red cell distribution width in patients with organophosphate poisoning. Journal of Academic Emergency Medicine. 2015; 14: 65.
14. Pierce CN, Larson DF. Inflammatory cytokine inhibition of erythropoiesis in patients implanted with a mechanical circulatory assist device. Perfusion 2005; 20: 83-90.