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"A STUDY OF RED CELL DISTRIBUTION WIDTH AND SERUM CHOLINESTERASE LEVELS ON ADMISSION AS A PROGNOSTIC MARKER IN ORGANOPHOSPHORUS COMPOUND POISONING "

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Abstract:

Introduction:

Organo-phosphates are widely used in horticulture and agriculture in developing countries and therefore poisoning with these agents is common either by unintentional or suicidal ingestion. In developing countries like India, it is still a major public health problem because of its association with high morbidity and mortality. Organo-phosphates may cause deformation of erythrocyte membranes by acute and chronic inflammation. Hence, it is expected that Red cell distribution width (RDW) levels may be increased in Organophosphorus (OP) poisoning and can thus aid in prognosis.

Objectives:

1. To assess red cell distribution width and serum cholienesterase levels on admission.
2. To assess correlation between red cell distribution width and outcome in organophosphorus poisoning.

Methodology:

A prospective interventional study was conducted among 100 Organophosphorus poisoning cases admitted in our hospital. A detailed history was obtained using a pre-designed, structured proforma followed by a detailed systemic examination. Relevant investigations were conducted which included red cell distribution width. Chi-square test was used to assess the relation between red cell distribution width and outcome in organophosphorus poisoning.

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Results:

Among 100 participants, majority were males (65%) and between 21-30 years age group (43%). Most common compounds involved in poisoning wereMonocrotophos (36%) Chlorpyrifos (34%), Duration of exposure for 69% of them was 1-2 hours. 50% of them had RDW ≤ 13 and 50% had RDW > 13. There were 6 deaths among 50 subjects with RDW >13 and only 1 death among 50 subjects with RDW ≤ 13 and this difference was statistically significant (P<0.05).

Conclusion:

In this study RDW was significantly associated with outcome and served in assessing the outcome in OP poisoning. We conclude that RDW is simple test which can be measured easily at the time of admission and used as a predictor of outcome in OP poisoning.

Key words: Organophosphorus poisoning, Red cell distribution width, outcome, prognosis, correlation

Introduction:

Organophosphates are predominantly used in agriculture in developing countries and therefore poisoning with these agents is common either by unintentional or suicidal ingestion and associated with high morbidity and mortality particularly in developing countries and it is still a major public health problem across the world [1]. Suicidal poisoning by OP is major public health problem and annual no of mortalities is approximately 2000000 worldwide[2].

In India 70% of the population rely on agriculture. Organophosphates are routinely usedfor advanced farming. These are readily available overthe counter. Therefore, it is an easy accesssource for suicidal purpose but it can even happen accidentally[3].

Symptoms ofpoisoning include cardiac manifestations, pulmonary disorders,transient liver dysfunction, and coagulation disorders. Changes in the Red blood cell Distribution

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Width (RDW) is one of theparameters of red blood cell (RBC) that, in recent years, hasdrawn much attention to itself for clinical decision making[4].

In organophosphate poisoning there can be acute inflammation and oxidative stress. organophosphates change the balance between free radical formation and antioxidant defence mechanisms [5]. This maycause a change in structure and size of RBC. So, there is an expected increase in red cell distribution width.Red cell distribution width reflects anisocytosis. It can easily be assessed in acomplete blood count[6].

There may be deformation of erythrocyte membranes by acute and chronic inflammation . Hence, it isexpected that RDW levels may be increased in OP poisoning and can thus aid in prognosis[7].Hence this study was undertaken to correlate RDW with outcome in OP poisoning.

Objectives:

1. To assess red cell distribution width and serum cholienesterase level on admission.
2. To assess correlation between red cell distribution width and outcome in organophosphorus poisoning.

Materials and Methods:

A Prospective interventional study was carried out for a duration of 18 Months (1 /03/2021-31/08/2022) among 100 subjects admitted with OP poisoning at our hospital.

Inclusion Criteria:

All patients with age > 18 yrs , at the time of admission with acute organophosphorus poisoning with the physical evidence of consumption of poison before starting treatment.

Exclusion Criteria:

1. Co-ingestion with other poison

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2. Coronary artery disease

3. Hypertension

4. Diabetes

5. Chronic liver disease

6. Iron deficiency anaemia, Vit B12 and folate deficiency

7. Recent haemorrhage

Sample size: 100

Sampling technique: - all the cases of organophosphrus poisoning

Method of collection of data:

After Ethical Committee approval and after obtaining informed consent,a detailed history was collected from qualifying patients using a pre-designed, structured proforma. Further, a detailed systemic examination, followed by relevant investigations were conducted. Red cell distribution width was measured with 3 part and 5part automated haematology analyser which works on the principle of electrical impedence and flow cytometry and the results were noted.

Statistical Analysis:

Data collected was compiled and entered into Microsoft excel sheet and analysed using SPSS software 20.0 version. Descriptive data was presented using frequency and percentages. For association of Qualitative data Chi-square test was done and for association of Quantitative data unpaired t test and ANOVA test was done.P value of <0.05 was considered significant.

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Results:

Study included 100 subjects. Table- 1 shows that majority of the subjects i.e., 43% belonged to 21-30 years age group followed by 22 (22%) were in ≤20 years age group. Mean age was 30.65 ± 11.65. Minimum age found was 19 years and maximum age in the study was 60 years.Males were predominant 65 (65.0%) compared to females 35 (35.0%). Male to female ratio was 1.85:1 in the study. Most common organophosphates encountered in the study were monocrotophos, 36 (36.0%) followed by chlorpyrifos 34 (34.0%) and profenophos 26 (26.0%). 69 (69%) of the subjects had exposure history for 1-2 hours.

Our study shows that 50 (50%) had RDW <13 and another 50 (50%) had RDW >13.Mean SBP and DBP was almost similar for the subjects with RDW<13 and RDW> (SBP:109 ± 9.65 V/S 111.08 ±12.9; DBP:72.7 ± 7.89 V/S 71.90 ± 9.83), Pulse rate and Respiratory rate were significantly lower in the subjects with RDW>13 (P<0.05) (PR: 75.08 ±10.14 V/S 62.50 ± 7.71; RR: 19.10 ± 2.77 V/S 16.10 ± 1.99), proportion of subjects with SPO2 >96% were significantly higher in the group with RDW<13 (P<0.05) (TABLE-2).

Table-3 shows that number of subjects with miosis (33) were significantly higher in the group with RDW > 13, subjects with fasciculations (33) and seizures (8) were significantly more in the group with RDW > 13. Size of the pupil, fasciculations and seizures were significantly associated with Red cell distribution width (P<0.05).

Table-4 shows that number of subjects intubated, subjects with respiratory failure were significantly higher in the group with RDW >13. Subjects with number of days of hospital stay of < 5 days were more in the group with RDW ≤ 13 and with 6-10 days were more in the group with RDW>13.There were 6 deaths among 50 subjects with RDW>13 whereas only one death was observed among 50 subjects with RDW≤ 13. There were 6

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deaths among 50 subjects with RDW>13 whereas only one death was observed among 50 subjects with RDW≤ 13

Table-1: Demographic profile of the subjects

Demographical profile	Categories	Frequency	%
Age	**≤ 20**	22	22.0
	21--30	43	43.0
	31--40	16	16.0
	41--50	11	11.0
	51—60	8	8.0
	Mean ± SD	30.65 ± 11.65	
Gender	**Males**	65	65.0
	Females	35	35.0
Compounds	**Monocrotophos**	36	36.0
	Chlorpyrifos	34	34.0
	Profenophos	26	26.0
	Others	4	4.0
Duration of exposure	**1-2 hours**	69	69.0
	3-4 hours	29	29.0
	>5 hours	2	2.0

Table 2: Association of vitals with RDW

VITALS	CATEGORY	RDW ≤ 13	RDW > 13	Total	test value, P-value
		Mean ± SD	**Mean ± SD**	**Mean ± SD**	
Blood Pressure	**SBP**	109.2 ± 9.65	111.08 ±12.9	110.14 ± 11.32	t = 0.825, P = 0.412
	DBP	72.7 ± 7.89	71.90 ± 9.83	72.30 ± 8.84	t = 0.449, P = 0.655
	PR	75.08 ±10.14	62.50 ± 7.71	68.79 ± 10.91	t = 6.982, P = 0.000*
	RR	19.10 ± 2.77	16.10 ± 1.99	17.60 ± 2.82	t = 6.214, P = 0.000*

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SPO2	**85—90%**	0	5	5	$\chi 2 = 77.72$, P = 0.000*
	91—95%	4	43	47	
	≥ 96%	46	2	48	

***-significant**

Table 3: Comparison of Pupils, Fasciculation's and Seizures with RDW

Variables		**RDW ≤ 13**	**RDW > 13**	**Total**	**$\chi 2$- test value P-value & Significance**
		N	**N**	**N**	
Pupils					$\chi 2 = 14.06$, P = 0.001*
	2mm	21	13	34	
	3mm	20	4	24	
	Miosis	9	33	42	
Fasciculations	Positive	12	33	45	$\chi 2 = 17.81$, P = 0.000*
	Negative	38	17	55	
Seizures	Positive	2	8	10	$\chi 2 = 4.03$, P = 0.045*
	Negative	48	42	90	
Serum Cholienesterase					
<1000		14	45	59	**t = 6.865 P = 0.000, HS***
1000-5000		15	4	19	
>5000		21	1	22	
Total		50	50	100	
Mean ± SD		3623.9 ± 3120.7	475.6 ± 882.15	2049.7 ± 2762.5	

***-significant**

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Table 4: Comparison of outcome with RDW

Outcome		RDW ≤ 13	RDW > 13	Total	χ2 - test value P-value & Significance
		No.	No.	No.	
Intubated	Yes	2	8	10	χ2 = 4.03, P=0.045*
	No	48	42	90	
Respiratory Failure	Yes	1	6	7	χ2 = 3.87, P = 0.048*
	No	49	44	93	
Number of days of hospital stay	≤ 5 Days	31	16	47	t = 2.258, P = 0.026*
	6—10 Days	13	28	41	
	> 10 days	6	6	12	
Final Outcome	Survived	49	44	93	χ2 = 3.87, P = 0.048*
	Death	1	6	7	

***-significant**

Discussion:

Organophosphates compounds have biologicaleffects might be harmful as they interact with a lot ofenzymes, proteins, transcription factors and receptors[8]. Poisoning with OPCs isthe most widely used for suicide with a mortality rate of10%-20% in spite of the great achievements in ICUmanagement. Therefore, it is important to estimate theseverity and prognosis in the early stage of theintoxication[9].

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The present study was conducted among 100 cases of acute organophosphorus poisoning. Mean age in the study was 30.65 ± 11.65 years which was similar to a study by Aslam etal.,[11] in which it was31.3±11.8 years. Majority of the subjects i.e., 43% belonged to 21-30 years age group followed by 22 (22%) were in ≤20 years age group. Mean age group was 30.65 ± 11.65. Minimum age found was 19 years and maximum age in the study was 60 years.Males were predominant 65 (65.0%) compared to females 35 (35.0%). Male to female ratio was 1.85:1 in the study. In a study by Aslam etal.,[10]Dhundar etal.,[11] and Shahsavarinia etal.,[12]males were predominant (58.2% and 54.9%) which was in accordance with this study.

Most common organophosphates encountered in the study were monocrotophos, 36 (36.0%) followed by chlorpyrifos 34 (34.0%) and profenophos 26 (26.0%). 69 (69%) of the subjects had exposure history for 1-2 hours.

In this study, 50 (50%) had RDW <13 and another 50 (50%) had RDW >13.Mean SBP and DBP was almost similar for the subjects with RDW<13 and RDW> (SBP: 109.2 ± 9.65 V/S 111.08 ±12.9; DBP:72.7 ± 7.89 V/S 71.90 ± 9.83). This was consistent with a study by Aslam etal.,[10] in which SBP and DBP was 120.9±14.5 and 119.2±20.5 respectivelyamong those with RDW<13.5, 74.1±11.7 and 69.9±14.8 among those with RDW >13.5.

Pulse rate and Respiratory rate were significantly lower in the subjects with RDW>13 (P<0.05) (PR: 75.08 ±10.14 V/S 62.50 ± 7.71; RR: 19.10 ± 2.77 V/S 16.10 ± 1.99), proportion of subjects with SPO2 >96% were significantly higher in the group with RDW<13 (P<0.05) This was similar to a study by Pranaav etal.,[13] in which patients with higher RDW had significantly lower RR and lower SPO2 which was similar to this study whereas in a study by Asalm etal.,[10] and Kang etal.,[14] there was no significant difference found in PR, RR and SPO2 between the groups which was contrary to this study.

Total number of subjects with fasciculations were 45 (45%) in this study which was much higher when compared to a study by Aslam etal.,[10] in which it was seen in

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14(8.9%)patients.Number of subjects with Pupils size 1mm (6) and with miosis (27) were significantly higher in the group with RDW > 13, subjects with fasciculations (33) and seizures (8) were significantly more in the group with RDW > 13. Size of the pupil, fasciculations and seizures were significantly associated with Red cell distribution width (P<0.05).In a study by Aslam etal.,[11]miosis was seen in 77 (48.7%) patients which was more compared to this study (36%) and seizures was present in 7 (4.4 %) which was less compared to this study (10%).

Study reveals that; There was statistically highly significant difference of meanSerumCholienesteraselevel of patients between RDW ≤ 13 and RDW >13 (P<0.001).The mean SerumCholienesterase was significantly high in the patients RDW ≤13 as compare to patients of RDW >13 Which had 45 patients .

Total number of deaths in the study were 7 (7%) which was similar to a study by Aslam etal.,[10] and Dhundar etal.,[11] in which it was 8.9% and 9.7% respectively and was less compared to a study by Kang etal.,[14] in which it was 20.6%. In this study there were 6 deaths (12%) among 50 subjects with RDW>13 whereas only one death (2%) was observed among 50 subjects with RDW≤ 13 and this difference was statistically significant (P<0.5). This was similar to a study by Asalm etal.,[10]in which subjects with RDW > 13.5 % had higher mortality (15.4 %) compared to those with RDW < 13.5%(5.7%) which was statistically significant.

In a study by Pranaav etal.,[13]similar number of deaths occurred (7%) and all these were seen in the group with higher RDW.Number of subjects intubated (8,16%), subjects with respiratory failure (6,12%) were significantly higher in the group with RDW >13 which was similar to a study by Pranaav etal.,[13]Subjects with number of days of hospital stay of < 5

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days were more in the group with RDW ≤ 13 and with 6-10 days were more in the group with RDW>13.

Conclusion:

This study was conducted to assess the corelation between Red cell distribution width and outcome in Organophosphorus poisoning. It was observed that males were predominantly involved in OP poisoning. Half of the study population had RDW> 13 and half of them had RDW ≤13. Pulse rate, Respiratory rate and SPo2 were significantly lower among the subjects with RDW >13. Proportion of miosis, seizures and fasciculations was significantly higher in the subjects with RDW>13. Among the patients with higher RDW the mean serum cholinesterase levels were low compared to the patients with lesser RDW who has normal serum cholinesterase levels . Among the subjects with RDW>13, number of days of hospitalization and number of intubations were significantly higher. RDW is a quick, simple, easy and effective tool to predict outcome in Organophosphate poisoning cases in low income countries and also it can be measured through complete blood count which is a common investigation done for the emergency cases and is available at all the health facilities.

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