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Indian Journal of Obstetrics and Gynecology Research

Journal homepage: www.ijogr.org

Original Research Article

Determinants of preterm labor among mothers admitted to the obstetrics ward in a tertiary care hospital in Iraq 2023: case control study

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Abstract

Background: Preterm labor is still one of important cause of neonatal morbidity and mortality, many researches done to find the relationship with biochemical marker for early detection to promote the management plan to reduce the complication simple, cheap, available blood test applicable and acceptable by patients for that we choose complete blood test for this purpose.

Aim and Objectives: To perform CBC in a group of pregnant women; follow women who have abnormal RDW-CV%, MPV/Fl through pregnancy to know whether they will go in for preterm labor.

Materials and Methods: A 200 pregnant women were involved in the study, they divided into two group 100 term pregnant woman (37-40wk), and the others were preterm labor women (24- 36) weeks of gestation these patients collected from obstetric outpatient unit in hospital. gestational age was confirmed by menstral history and early ultrasound, preterm patient were examined by sterile speculum, preterm labor was considered if there was more than three cm dilatation of cervix and effacement ≥80% or uterine contractions (≥4 contractions/20 min), lasting in 30 seconds or more). Blood sample was taken from all patients in the laboratory unit before any treatment, send for CBC the mean platelets volume, and RDW data are recorded.

Study Design: case control study done from January 2022, till December 2023.

Result: Case control study involved 200 pregnant patients divided into two group, first group include 100 preterm labor (24-36weeks), and second group include 100 control term patient (37-40 week), When compared the result of complete blood count of patients it's revealed significant difference of RDW-CV% between preterm and term group (P-value 0.0001), mean platelet volume also show significant difference the P-value was 0.004)

Conclusion: RDW-CV% and MPV/Fl can be used as a predictor of preterm labor.

Keywords: Platelets mean volume, Red cell distribution width, Preterm.

Received: 21-07-2024; **Accepted:** 14-05-2025; **Available Online**: 18-11-2025

1. Introduction

Preterm birth is delivery before 37 complete gestational weeks, 5% to 18% of deliveries in the world was preterm.[1,2] It leads to both neonatal and child (under the age of 5 years) death.[3] Many factors play a role as a risk factor for preterm birth familial genetic factors, environmental, and social habit risk factors.[4] Pathogenesis of preterm labor involve inflammation predisposing by microbial infection, decidual bleeding and vascular trauma, defect of maternal-fetal membrane defence mechanism, progesterone withdrawal, mechanical over-distension of uterus and others[5,6] inflammation had major role in establishing of preterm labor (PL) and the delivery is the result of an imbalance between maternal inflammation and hormone-driven uterine quiethere evidence proved that there was a enormous influx of inflammatory cells (neutrophils and macrophages) into both the lower and the upper segment of myometrium in association with physiological labor.[7,8] Many research is being made to detect if there is specific tests and evaluation modalities like cervical length measurement, fibronectin testing, and bacterial vaginosis diagnosis to predict the occurrence of PL to ovoid the complication in turn, but none of these tests was found to improve the perinatal outcome.[6,9]

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https://doi.org/10.18231/j.ijogr.98790.1763458721

Recent studies using various hematological and biochemical markers for detecting inflammation.

Criteria for the diagnosis of preterm labor is depend on clinical finding of efficient uterine contractions with progressive cervical changes (which is called true labor). We use the following specific criteria for diagnosis of preterm labor:

1. Uterine contractions (≥4 every 20 minutes or ≥8 in 60 minutes).
2. 3 cm or more Cervical dilation
3. Less than 20 mm Cervical length measurement by transvaginal ultrasound or

Gestational age estimation was done by early ultrasound examination.[5]

Infectious or sterile inflammatory events stimulate the maternal immune system to lead to cascade of a pro-inflammatory events, including infiltration of leukocyte decidual tissues and secretion of cytokines and Chemokines (CCL and CXCL chemokines).[10] These cytokines lead to further production of pro-inflammatory cytokines and chemokines labor mediators, which play fundamental role in initiation of labor. The immune system plays a vital role in the development of preterm birth (PTB). Multiple receptors and signaling mechanisms are involved in initiating the inflammatory response. Specifically, pathogen-associated molecular patterns (PAMPs) and damage-associated molecular patterns (DAMPs) engage with pattern recognition receptors (PRRs), which are abundantly found on immune cells and gestational tissues. This interaction triggers intracellular signaling pathways that result in the production of pro-inflammatory molecules.

Research has shown that DAMPs can be detected in both maternal blood and placental tissues, even in the absence of infection, among women who delivered prematurely or were at risk of preterm labor (PTL). These DAMPs—also referred to as alarmins—include molecules such as HMGB1, uric acid, cell-free fetal DNA, and interleukin-1 alpha (IL-1α). They are typically released under conditions such as hypoxia, cellular injury, stress, or senescence, and serve as signals alerting surrounding cells to danger. Specific receptors are responsible for identifying these alarmins. For instance, HMGB1 interacts with TLR-2, TLR-4, and the receptor for advanced glycation end-products (RAGE), while IL-1α and IL-1β bind to the interleukin-1 receptor (IL-1R). Cell-free fetal DNA is recognized by TLR-9. These receptors, expressed on immune and gestational cells, act as part of the body's frontline defense once pathogens bypass barriers like the cervix.[10,11]

There are ten known TLRs (Toll-like receptors), each specialized to detect unique PAMPs and DAMPs. Upon activation, they initiate distinct signaling cascades that help tailor the immune response to the specific inflammatory trigger. Ultimately, both the innate and adaptive arms of the immune system become engaged in the process, recent research has suggested that RDW could reflect oxidative stress and chronic inflammation in many diseases such as heart failure, chronic obstructive pulmonary disease, for that our study detect the relation of it with preterm labor.[11]

2. Materials and Methods

Case control study done in Al Yarmouk teaching hospital from January 2022, till December 2023. A 200 patients were involved in the study after verbal consent, patients were divided into two group 100 patients term pregnant(37-40wk), and the others were preterm labor patients (24- 36) weeks of gestation questionnaire involved detailed history, examination was done gestational age was calculated by Naegele's role from Last menstrual period and early ultrasound, patient were examined by sterile speculum to detect cervical changes and examine for presence of efficient uterine contraction) in order to be considered PL. Blood sample was taken from all participants before any treatment, the requirement MPV and RDW data were recorded.

2.1. Inclusion criteria

Pregnant healthy women in their third trimester, preterm labor women gestational age (24-36).

2.2. Exclusion criteria include

Haemtological disease, sepsis, multiple gestation, acute or chronic inflammatory disease, Patients with significant obstetric or medical complications, prolonged rupture of membrane with signs of infection, abruption placenta, antepartum haemorrhage, and fetal distress.

The local ethics committee approved the study in Al Yarmouk teaching hospital.

3. Results

Case control study involved 200 pregnant patients divided into two group 100 preterm (24-36 weeks)in labor, and 100 control term patient(37-40 week), **Table 1** show demographic distribution of data between studying group.

When compared the result of complete blood count of patients it revealed significant difference of RDW-CV% between preterm and term group (P-value 0.0001), mean platelet volume also show significant difference the P-value was 0.004) as shown in **Table 2**, **Figure 1**, **Figure 2**.

Receiver operating characteristic curve determine the "cut-off value" which of optimum sensitivity and specificity for diagnosing preterm which was shown in **Figure 3**.

Table 1: Demographic distribution of data between studying group

		Preterm		Term	
		No	%	No	%
Age (years)	<20 years	8	8.0	12	12.0
	20---24	16	16.0	28	28.0
	25---29	17	17.0	28	28.0
	30---34	34	34.0	17	17.0
	=>35years	25	25.0	15	15.0
Gravida	1	8	8.0	15	15.0
	2	16	16.0	15	15.0
	3	24	24.0	26	26.0
	4	22	22.0	21	21.0
	5	30	30.0	23	23.0
Parity	0	11	11.0	15	15.0
	1	15	15.0	18	18.0
	2	24	24.0	29	29.0
	3	26	26.0	22	22.0
	4	24	24.0	16	16.0
Mode of delivery	NVD	23	23.0	59	59.0
	CS	77	77.0	41	41.0

Table 2: Relation between RDW-CV% and MPV/Fl between term and preterm

		Preterm		Term		p value
		No	%	No	%	
RDW-CV%	12.0---	5	5.0	50	50.0	0.0001*
	14.0---	47	47.0	32	32.0	
	16.0---	41	41.0	11	11.0	
	18.0---	7	7.0	7	7.0	
MPV/fl	8.0---	-	-	13	13.0	0.004*
	9.0---	28	28.0	32	32.0	
	10.0---	36	36.0	26	26.0	
	11.0---	24	24.0	19	19.0	
	12.0---12.9	12	12.0	10	10.0	

*Significant difference between percentages using Pearson Chi-square test (χ^2-test) at 0.05 level.

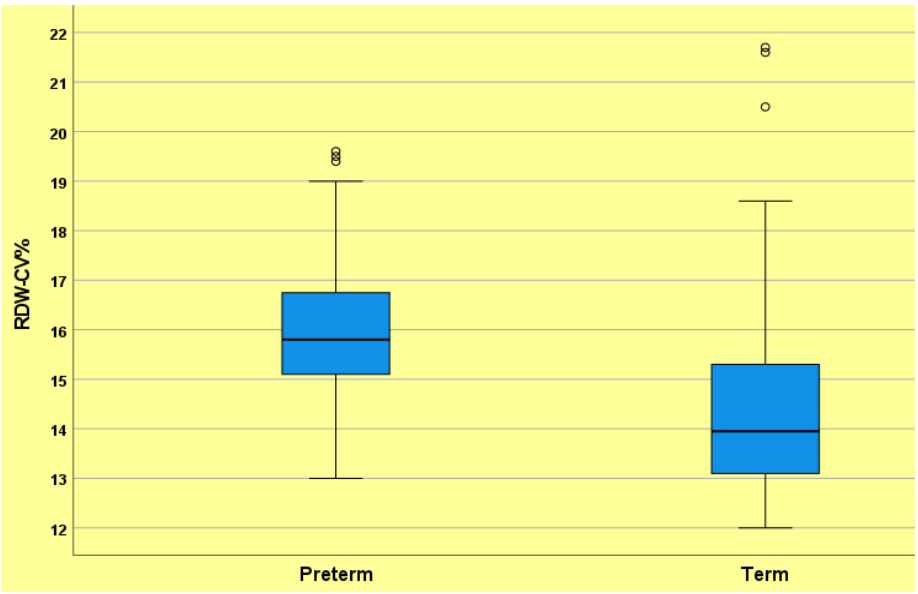

Figure 1: The RDW-CV% between preterm and term groups

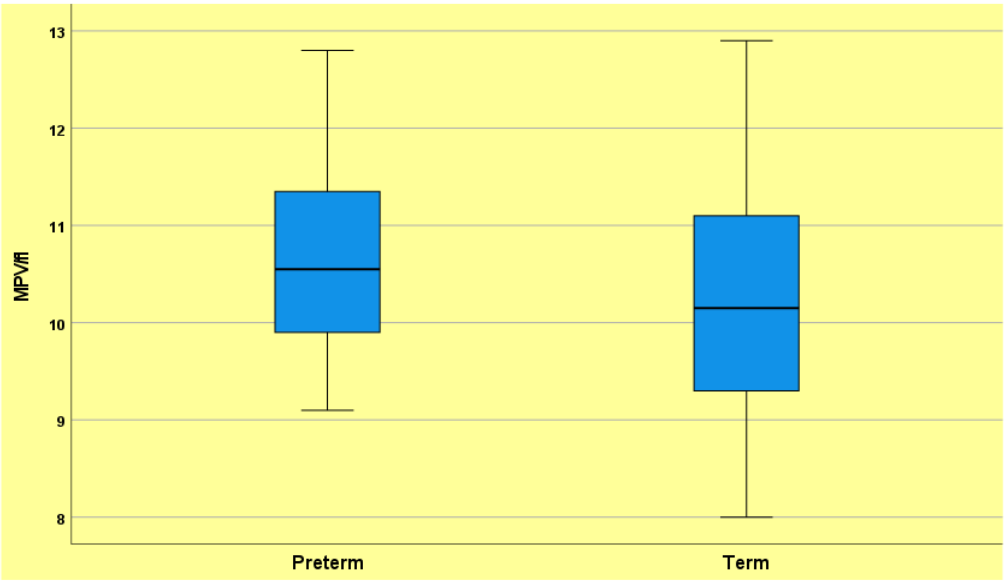

Figure 2: The MPV/fl between preterm and term groups

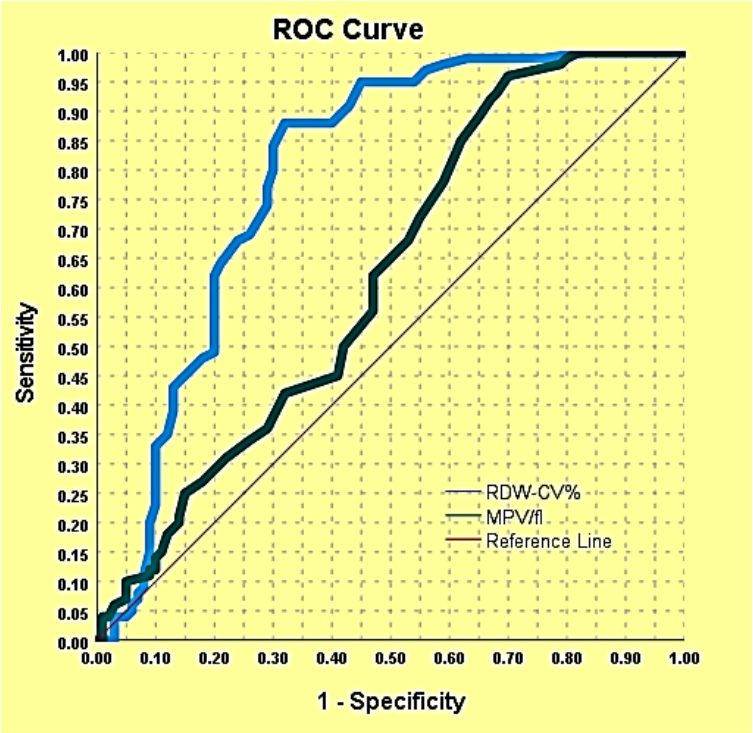

Figure 3: ROC show sensitivity and specificity of RDW-CV, MPV/fl

3.1. Statistical analysis

Analysis of data occurred by using statistical package of SPSS-28. Data were demonstrated as frequency, range, mean, percentage, standard deviation.

The different means significance difference (quantitative data) were tested using Students-t-test or ANOVA test for difference among more than two independent means. The significance of difference of different percentages (qualitative data) were tested using Pearson Chi-square test (χ^2-test) with application of Yate's correction or Fisher Exact test whenever applicable. Statistical significance was considered whenever the P value was equal or less than 0.05.

4. Discussion

Preterm labor is one of major cause of fetal morbidity and mortality, the causes and risk factors of preterm take awide range of researching and argument, inflammation and infection were one of these risk factors and it's found that immunity cascade stimulation contraction and induce preterm labor, in the study the aim was to find relationship of these inflammatory marker and preterm labor, the inflammatory role in the pathogensis of PL was studied in

many research, and potent relation between PL and multiple inflammatory markers was found Shaaban HA, Safwat N. study correlated the level of complete blood count including MPV in preterm study revealed the level of MPV was high associated with adverse outcome in turn this agree with concept of the recent study in that red blood cell haemolysis or formation may elevate RBC variability, and lead to RDW increament.[12] SAFAA A Ibrahim et al. study blood marker also specifically Platelet Volume and Count for predict preterm PROM Compared with controls, PPROM patients had significantly high levels of PC and significantly low levels of MPV in the first trimester and as comparing with our study it show the level of MPV was significantly increased as compared with control.[13] Cai N et al. study a simple marker in predicting adverse outcomes in some of disease like, coronary artery disease, heart failure, infective endocarditis, sepsis why there is increase of RDW in such condition is not clear. Increased inflammatory cytokines in circulation, and infection cause abnormalities in erythropoiesis. Also increase of RDW occur due to oxidative stress which affect the erythroid tissue. RDW in preterm pregnancies was much higher than term pregnancies. So irregular RBC production, and/or stress is lead to high RDW level, mainly in preterm gestation. MPV elevated in condition where circulating platelet (PLT) break down is increased and diminished in condition where PLT formation impaired.[14]

Gasparyan et al. revealed that MPV, which acts as an inflammatory factor and PLT indices was impaired in some pregnancy related condition like recurrent abortion, PET, diabetes, and preterm labor[15] this is agree with the result of recent study

Ekin et al. revealed that MPV may had a role in prediction of PPROM and detect PL severity,[16] further studies needs to support these thoughts.

5. Conclusion

According to the result of the study RDW-CV% and MPV/Fl can be used as a predictor of preterm labor and thus will help to decrease the complication and determine which patient will progress to preterm labor by using this simple inexpensive non invasive test.

6. Author Contribution

We declare that M.M.A was contributed to the design and to the writing of the manuscript, A.M.M was contributed to the analysis of result, S.I.A was contributed to the implementation of the research, S.S.H was contributed to the design of the research, to the analysis of the results and Writing – review & editing.

7. Source of Funding

None.

8. Conflicts of Interest

None.

9. Patient Consent

Written informed consent was obtained from each woman before participating in the study.

10. Data Availability

The data that support the findings of this study are available from the corresponding author upon reasonable request.

11. Acknowledgments

The authors would like to express their deepest appreciation to all those who provided them the possibility to complete this article.

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Cite this article: Hussein SS, Mohamed A, Ismael S, Abdulqader MM. Determinants of preterm labor among mothers admitted to the obstetrics ward in a tertiary care hospital in Iraq 2023: case control study. *Indian J Obstet Gynecol Res*. 2025;12(4):726–731.