

The Use of Hematocrit in Evaluation of Patients With Recurrent Pregnancy Loss

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Abstract: ***Objectives:** This study was conducted to determine whether the level of hematocrit is higher among patients with RPL or not differing to those with normal pregnancy. **Methods:** The medical records of 45 women with a history of RPL and 45 women who gave birth without experiencing RPL were reviewed retrospectively from 3 governmental hospitals in Yemen. The personal, obstetric and complete blood count reports were analyzed. **Results:** The mean HCT and MCH were significantly higher among RPL patients when compared to the control and the ROC curve for each RBC index showed insignificant AUC for MCV, MCH and RDW and statistically significant AUC for HCT. The multiple logistic regression analysis for all RBC parameters revealed that the HCT is the significant predictor for RPL in this study. **Conclusion:** This study concluded that the use of hematocrit may help gynecologist in predicting high risk pregnancy (pregnancy loss) in the low resources areas in Yemen.*

Keywords: Recurrent - Pregnancy loss - Red cells - RDW - HCT.

1. Introduction

Recurrent pregnancy loss (RPL) is the occurrence of two or more failed clinically documented pregnancies before 20 weeks gestation, where ectopic, molar, and biochemical pregnancies are not included.⁽¹⁾ Worldwide, there is about up to 5% of women experienced pregnancy loss of at least two consecutive pregnancies at their reproductive age.⁽²⁾

RPL is a multifactorial obstetric problem and the underlying causes cannot be clarified in up to 50% to 60% of all RPL.^(3,4) However, researches reported that early pregnancy loss within 12th to 14th weeks has been attributed to maternal thrombophilia that interferes with development of the placenta and implantation of the fertilized egg in the uterine decidua.⁽⁵⁾

As red blood cells (RBCs) participate in the formation of in vivo clots and thrombi, it is possible that anisocytosis could increase the thrombotic predisposition of RBCs.⁽⁶⁾ Changes in the hematocrit (HCT) can be a warning of a high-risk pregnancy.⁽⁷⁾ The relationship between high levels of hemoglobin (Hb), HCT and red cell mass and the complications such as preterm delivery, low birth weight, preeclampsia, intrauterine growth restriction and intrauterine fetal death have been also shown in several studies.⁽⁸⁻¹⁰⁾

This study was conducted to determine the hematocrit and the Red blood cell indices, namely Mean corpuscular volume (MCV), Mean corpuscular hemoglobin (MCH), Mean corpuscular hemoglobin concentration (MCHC) and Red cell distribution width (RDW) values in patients with RPL compared to those with normal pregnancy.

2. Method

This is a retrospective study included 45 women with a history of RPL (2 or more), and a control group of 45 women who gave birth without experiencing recurrent pregnancy loss (2 or more). All the included women were between 20 and 35 years old. The medical records were taken from the gynecology department of 3 hospitals in Ibb

governorate, Republic of Yemen, for a period of 2 years (May 2015 - April 2017). Excluding patients with a known history of chronic diseases, immobilization, surgery, trauma during pregnancy, uterine abnormalities, fever or proven infection in the first trimester, smokers and those used non-steroid anti-inflammatory drugs or anti-coagulants. Data of personal, obstetric and complete blood count reports were collected from medical records.

3. Ethical Consideration

This study was conducted retrospectively after taking the consent of each hospital director and archive who requested to code personal data to numbers and accordingly no psychological or any type of harm was on patients and the control included in this study.

4. Statistical analysis

Data were processed and analyzed by computer facilities using the statistical package of social science (SPSS) program version 24. Quantitative variables were found with parametric distribution, presented as means with standard deviations and tested by the Student T test for the presence of significant difference between patients and the control. To test the role of RBCs indices in RPL, the ROC curve was obtained for the each index and the multiple logistic regression analysis was conducted for all using enter method. The statistical tests were conducted with the 95% confidence interval and p-value of ≤ 0.05 was considered statistically significant.

5. Results

Analysis of the demographic data obtained from records of the studied population revealed that no significant difference present between RPL patients and the control regarding patients' age, body weight and gestational age. Only parity was statistically significantly higher among the control [Table 1].

Table 1: Demographic data obtained from medical records of RPL patients and the control group

Variable	RPL Patients (n=45)	Control group (n=45)	P-value
	Mean ± SD (Min. – Max.)	Mean ± SD (Min. – Max.)	
Age (years)	26.7 ± 3.2 (20 – 34)	27.5 ± 4.1 (20 – 34)	0.305
Parity	2.1 ± 0.89 (0 – 6)	3.4 ± 1.3 (2 – 6)	0.001*
Body weight (kg)	72.45 ± 7.09 (59 – 96)	70.15 ± 7.75 (57 – 95)	0.145
Gestational age (weeks)	8.5 ± 1.42 (6 – 13.7)	7.9 ± 2.28 (5 – 15.6)	0.138

*Statistically significant

The mean red blood cells' count, hemoglobin concentration, MCV, MCHC and RDW were not significantly differing among RPL patients and the control. While the mean HCT and MCH were significantly higher among RPL patients when compared to the control [Table 2].

The ROC curve for each RBC index showed insignificant AUC for MCV, MCH and RDW and statistically significant AUC for HCT [Figure 1] and the multiple logistic regression analysis for all RBC parameters revealed that the HCT is the significant predictor for RPL in this study [Table 3].

Table 2: RBCs indices of RPL patients compared to the control

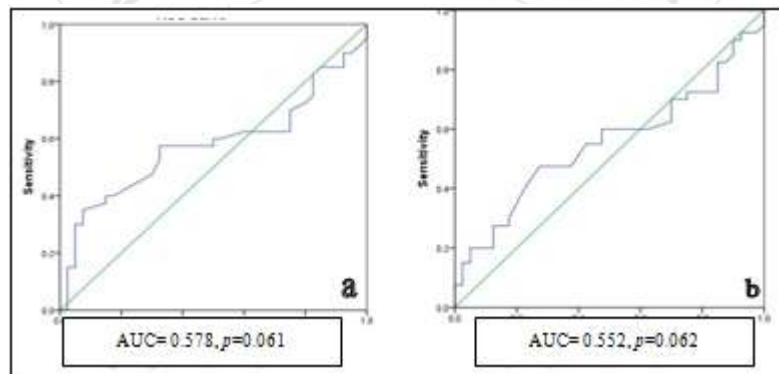
Variable	RPL Patients (n=45)	Control group (n=45)	p-value
	Mean ± SD (Min. – Max.)	Mean ± SD (Min. – Max.)	
Hemoglobin (g/dl)	11.3 ± 1.7 (8.6–13.6)	11.2 ± 1.8 (8.5–13.4)	0.787
Hematocrit (%)	36.9 ± 2.5 (29.8–39)	32.6 ± 2.4 (27–37.2)	0.001*
Mean corpuscular volume (fl)	79.4 ± 7.6 (62.7–92.0)	78.6 ± 5.7 (69.5–92.5)	0.574
Mean corpuscular hemoglobin (pg)	27.3 ± 4.1 (17.7–34.1)	25.8 ± 2.8 (18–32.1)	0.046*
Mean corpuscular hemoglobin concentration (g/dl)	33.2 ± 3.6 (29.4 – 37.9)	32.8 ± 2.3 (26.6–35.1)	0.532
Red cell distribution width (%)	14.5 ± 1.13 (12.6–18.1)	14.3 ± 0.9 (12.5–16.9)	0.356
Red blood cell count (×10 ¹² /L)	4.6 ± 0.5 (3.9–5.8)	4.4 ± 0.5 (3.6–6.3)	0.061

*Statistically significant

Table 3: Multiple logistic regression analysis for risk factors of recurrent pregnancy loss

Predictors	Standardized Beta Coefficients	t	p
Hemoglobin (g/dl)	0.43	0.42	0.33
Hematocrit (%)	1.32	0.35	0.01*
Mean corpuscular volume (fl)	- 0.64	0.84	0.49
Mean corpuscular hemoglobin (pg)	2.28	2.85	0.42
Mean corpuscular hemoglobin concentration (g/dl)	- 1.29	2.09	0.56
Red cell distribution width (%)	0.92	0.63	0.14
Red blood cell count (×10 ¹² /L)	0.92	3.32	0.79

The test performed by using the enter method (F=6.76, p < 0.05). Adjusted R square = 0.67.
 * Statistically significant



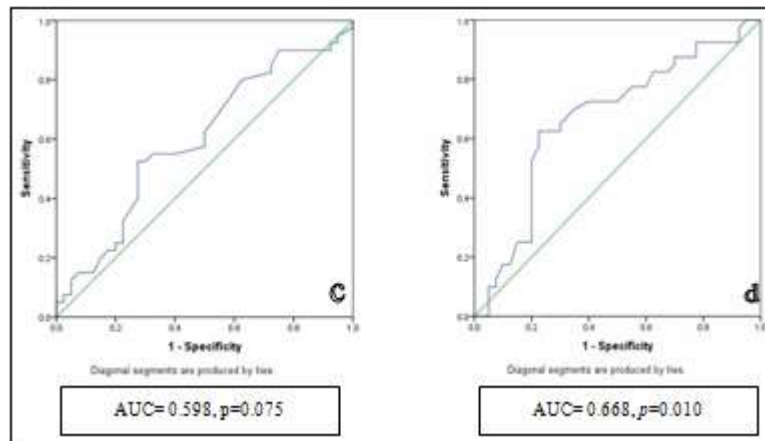


Figure 1: The ROC curve for MCV^a, MCH^b, RDW^c and HCT^d to discriminate between RPL and control

6. Discussion

Pregnancy is associated with profound changes that affect multiple organs and systems.⁽¹¹⁾ Recurrent pregnancy loss is one of the most frustrating and difficult areas in reproductive medicine because the etiology is often unknown and there are few evidence-based diagnostic and treatment strategies.⁽¹²⁾

The diagnostic tests for recurrent pregnancy loss evaluation are time consuming and costly. There is doubt about when testing is needed. Some gynecologists recommended testing after two consecutive pregnancy losses, while others recommended waiting until three pregnancy losses occur. The prognosis will depend on both the underlying cause for pregnancy losses and the number of prior losses.⁽¹³⁾

In Yemen, where the resources are lacking, most gynecologists manage RPL randomly. This situation mandates the need for simple, easy and cheap methods to evaluate Yemeni patients with RPL.

There are several studies dealt with the subject of RBCs' indices among RPL. In the current study, the RBCs' parameters were studied concentrating on the hematocrit. The hematocrit is the proportion, by volume, of the blood that consists of red blood cells.

The present study revealed significantly higher HCT among RPL patients when compared with control pregnant women, even the ROC curve for HCT was performed to discriminate between RPL and the control, revealed a significant area under the curve

When the multiple logistic regression analysis for all RBCs parameters was conducted among the studied pregnant women with RPL, it revealed that the HCT is the significant predictor for RPL in this study.

Some studies evaluated RDW in patients with pulmonary embolism and found that a high mean RDW (i.e. anisocytosis) was an independent predictor of pulmonary-embolism-related early mortality.⁽¹⁴⁻¹⁶⁾ In the present study, there was no significant difference between RPL patients and the control groups in respect to RDW, however, Dundar et al,⁽¹⁷⁾ in their study reported an association between RPL and the increased values of RDW. While other RBCs'

indices were not found to be associated with RPL in their study group. This is similar to our findings, except for HCT which was found significantly higher in RPL patients of the current study.

Changes in HCT can be a warning of a high-risk pregnancy.⁽¹⁸⁾ The relationship between high levels of hemoglobin, hematocrit and red cell mass and the complications as preeclampsia, preterm delivery, low birth weight, intrauterine growth restriction and intrauterine fetal death have been also shown in several studies.^(8-10,19)

The present study suggested that the increased HCT value in patients with RPL may play a role in activation of thrombosis, which in turn leads to micro-emboli in the uteroplacental circulation and consequently pregnancy loss.

7. Conclusion and Recommendation

This study concluded that the use of HCT may help gynecologist in predicting high risk pregnancy (pregnancy loss) in a low resources area such as Yemen. Since this parameter is simple, easy and cost-effective test, it is recommended to perform HCT in follow-up of any pregnant during her first trimester.

References

- [1] Practice Committee of American Society for Reproductive Medicine. Definitions of infertility and recurrent pregnancy loss: a committee opinion. *Fertil Steril* 2013; 99(1): 63.
- [2] Jauniaux E, Farquharson RG, Christiansen OB, Exalto N. Evidence-based guidelines for the investigation and medical treatment of recurrent miscarriage. *Hum Reprod* 2006; 21: 2216 - 22.
- [3] Lund M, Kamper-Jorgensen M, Nielsen HS, Lidgaard O, Andersen AM, Christiansen OB. Prognosis for live birth in women with recurrent miscarriage: what is the best measure of success? *Obstet Gynecol* 2012; 119: 37 - 43.
- [4] Isaksson R, Tiitinen A. Present concept of unexplained infertility. *Gynecol Endocrinol* 2004; 18: 278 - 90.
- [5] Grandone E, Margaglione M, Colaizzo D, Cappucci G, Paladini D, Martinelli P, et al. Factor V Leiden, C > T

- MTHFR polymorphism and genetic susceptibility to preeclampsia. *Thromb Haemost* 1997; 77: 1052 - 4.
- [6] Gersh KC, Nagaswami C, Weisel JW. Fibrin network structure and clot mechanical properties are altered by incorporation of erythrocytes. *Thromb Haemost* 2009;102:1169-75.
- [7] Yang JM, Wang KG. Relationship between acute fetal distress and maternal-placental-fetal circulations in severe preeclampsia. *Acta Obstet Gynecol Scand* 1995;74:419-24.
- [8] Chang SC, O'Brien KO, Nathanson MS, Mancini J, Witter FR. Hemoglobin concentrations influence birth outcomes in pregnant African-American adolescents. *J Nutr* 2003;133:2348-55.
- [9] Rappaport VJ, Velazquez M, Williams K. Hemoglobinopathies in pregnancy. *Obstet Gynecol Clin North Am* 2004;31:287-317, vi.
- [10] Khoigani MG, Goli S, Hasanzadeh A. The relationship of hemoglobin and hematocrit in the first and second half of pregnancy with pregnancy outcome. *Iran J Nurs Midwifery Res* 2012;17:S165-70.
- [11] Costantine MM. Physiologic and pharmacokinetic changes in pregnancy. *Front Pharmacol* 2014;5:65.
- [12] Christiansen OB, Nybo Andersen AM, Bosch E, Daya S, Delves PJ, Hviid TV et al. Evidence-based investigations and treatments of recurrent pregnancy loss. *Fertil Steril* 2005; 83:821.
- [13] Ford HB, Schust DJ. Recurrent Pregnancy Loss: Etiology, Diagnosis, and Therapy. *Reviews in Obstetrics and Gynecology*. 2009;2(2):76-83.
- [14]. Zorlu A, Bektasoglu G, Guven FM, Dogan OT, Gucuk E, Ege MR, et al Usefulness of admission red cell distribution width as a predictor of early mortality in patients with acute pulmonary embolism *Am J Cardiol* 2012;109:128-34.
- [15] Ozsu S, Abul Y, Gunaydin S, Orem A, Ozlu T. Prognostic value of red cell distribution width in patients with pulmonary embolism. *Clin Appl Thromb Hemost* 2014;20:365-70.
- [16] Xi Q, Wang Y, Liu Z, Zhao Z, Luo Q. Red cell distribution width predicts chronic thromboembolic pulmonary hypertension in patients with acute pulmonary embolism in a long-term follow-up. *Clin Chem Lab Med* 2014;52:e191-5.
- [17] Dundar O, Pektas MK, Bodur S, Bakir LV, Cetin A. Recurrent pregnancy loss is associated with increased red cell distribution width and platelet distribution width. *J Obstet Gynaecol Res* 2015;41:551-8.
- [18] Yang JM, Wang KG. Relationship between acute fetal distress and maternal-placental-fetal circulations in severe preeclampsia. *Acta Obstet Gynecol Scand* 1995;74:419-24.
- [19] Stoev S, Dikov I, Iovchev S, Ivanov S. [Hemorheological parameters in the prognosis of the risk of fetal retardation in pregnancy with arterial hypertension]. *Akush Ginekol (Sofia)* 1996;35:23-4.

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