RESEARCH ARTICLE

Evaluation of complete blood count parameters to predict endometrial cancer

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Background: Complete blood count parameters have been introduced to be diagnostic biomarkers for many cancer-related diseases associated with inflammatory process. The aim of our study was to detect whether there is any relationship between benign or malignant endometrial pathologies and complete blood count parameters.

Methods: Four hundred and sixteen patients with a complaint of abnormal uterine bleeding who admitted to Zeynep Kamil Women and Children's Health Training and Research hospital between 2013 and 2016 and undergoing endometrial biopsy were included in the study. The patients were evaluated in three groups as follows: endometrial carcinoma (n: 97), endometrial hyperplasia (n: 135), and healthy control (n: 184) groups. All patients had a complete blood count on the day of biopsy or within the week of the biopsy, and the presence of a relationship between complete blood count parameters and benign or malignant endometrial disease was investigated.

Results: Mean corpuscular volume measurements were found to be significantly higher in endometrial carcinoma ($P = .018$) and endometrial hyperplasia ($P = .001$) groups compared to the control group. While red cell distribution width measurements were found to be significantly lower in patients with endometrial carcinoma group compared to other groups ($P < .01$); the area under curve obtained for MPV is 58.7% to determine endometrial carcinoma.

Conclusion: Mean corpuscular volume and red cell distribution width are bio-markers that we can use as the predictive marker in patients with endometrial carcinoma and which are cheap, repeatable, and readily obtainable from complete blood count panels and promising.

KEYWORDS

endometrial biopsy, endometrial carcinoma, endometrial hyperplasia, mean platelet volume, red cell distribution width

1 | INTRODUCTION

As it is known, endometrial hyperplasia and endometrial neoplasia are two different diseases biologically. The most discriminating feature is the absence or presence of cytological atypia. Endometrial hyperplasia is the only direct predictor of invasive disease. In a case-control study of Lacey, cumulative risk for endometrial carcinoma

among women with atypical and nonatypical endometrial hyperplasia was reported to be 28% and 5%, respectively, during a 20-year follow-up.¹

The risk factors for endometrial hyperplasia are similar to those for endometrial carcinoma. In most of the cases, there is a chronic endometrial unopposed estrogen exposure. The other risk factors are hormone replacement therapy, nulliparity, late menopause,

obesity, hypertension, and diabetes mellitus.² Currently, there is no place for routine screening in women at high risk for endometrial carcinoma. However, annual endometrial sampling is recommended in women at very high risk for endometrial carcinoma due to HNPCC starting with 30-35 years old.³

Cancer-related inflammation is a marked feature in the development and progression of the tumor. Many tumor secreting factors and cytokines released by inflammatory cells in the tumor microenvironment affect tumor cell proliferation and migration. Excessive pro-inflammatory cytokine production in most of the cancer patients stimulates the release of young and large platelets from bone marrow to the peripheral blood and these cause changes in hematological parameters.

Due to their angiogenic, metastatic, and proteolytic activities, platelets have a major role in the background of inflammation.⁴ Mean platelet volume (MPV) is an important inflammatory marker indicating platelet activation.⁵ Until today, the relationship between hematological parameters such as MPV, RDW, NLR, PLR, PDW were investigated, diagnostic, and prognostic features of these parameters with their role in metastatic activities of cancer were evaluated.⁶⁻⁸

Today, we can evaluate the systemic inflammation or systemic inflammatory response developing against tumor cell in the body rapidly and practically with hematological parameters. In this study, we aimed to assess the relationship between hematological parameters and endometrial carcinoma, which was a solid gynecological tumor, and additionally endometrial hyperplasia, which was a preliminary pathological finding of this carcinoma.

2 | MATERIALS AND METHODS

Four hundred and sixteen patients with a complaint of abnormal uterine bleeding who admitted to Zeynep Kamil Women and Children's Health Training and Research hospital between August 2013 and January 2016 and undergoing endometrial biopsy were included in the study. The study protocol was approved by the institutional ethics committee.

The patients were assessed in three groups. Group 1 (n: 97): endometrial carcinoma group, Group 2 (n: 135): endometrial hyperplasia group, and Group 3 (n: 184): control group.

Inclusion criteria were as follows:

Patients who admitted to our hospital with a diagnosis of abnormal uterine bleeding (AUB) and who had complete blood count parameters at the biopsy day or within the previous week before biopsy day and who had no marked pathology in the gynecological examination and laboratory tests which would explain AUB.

Exclusion criteria were as follows:

The patients with hyperprolactinemia, abnormal thyroid function test results, chronic inflammatory disease, malignancies, hematological disorders, patients receiving anticoagulant therapy, and the individuals receiving hormone therapy within last 12 months.

Blood samples were taken in laboratory tubes with EDTA at the biopsy day or in the previous week before the procedure and

analyzed by automated hematology analyzer (CELL-DYN 3700, Abbott Diagnostics, Abbott Park, IL) within 60 minutes following venipuncture.

2.1 | Pathological examination

Histopathological pre-diagnosis was made in all patients with endometrial sampling performed under general or local anesthesia. All endometrial surfaces were sampled by entering the uterine cavity with sharp curette following cervical dilation.

The histological samples were assessed by the pathologists. The results of EH (endometrial hyperplasia) were classified into four categories: (i) simple EH without atypia, (ii) simple atypical EH, (iii) complex atypical EH, and (iv) complex EH without atypia. The other pathology results not reported as endometrial hyperplasia and cancer such as proliferative endometrium, secretory endometrium, endometrial polyp, atrophic endometrium, and endometrial cell fragments were included under the topic of the healthy control group.

2.2 | Statistical analysis

NCSS (Number Cruncher Statistical System) 2007 Statistical Software (Kaysville, Utah, USA) program was used for the statistical analysis. During the evaluation of the study data, one-way ANOVA test was used for the comparisons of descriptive statistical methods (mean, standard deviation, median, frequency, ratio, minimum, maximum) as well as comparisons of three or more groups with normal distribution and Kruskal-Wallis test was used for the comparisons of three or more groups without normal distribution. Pearson's chi-square test was used for the comparison of qualitative data. ROC curve analysis was used to determine the effects of biochemical markers in prediction of endometrial carcinoma. Significance was evaluated at a level of $P < .05$.

3 | RESULTS

Comparisons of demographic parameters between three groups are shown in Table 1. The mean age of group 1 was significantly higher than group 2 and control group ($P < .01$). The parity of group 1 was significantly higher than group 2 and control group ($P < .01$). The parity was similar between group 2 and control group. The rates of systemic diseases including diabetes mellitus and hypertension in group 1 were higher than group 2 and control group ($P < .01$). The rate of Diabetes mellitus was similar among group 2 and control group, but the rate of hypertension was significantly higher in the control group than group 2 ($P < .05$).

Comparisons of hematological parameters according to groups are shown in Table 2. While hemoglobin and hematocrit levels were found to be significantly lower in endometrial carcinoma group (group 1) compared to endometrial hyperplasia group ($P < .01$) and control group ($P < .01$); hemoglobin and hematocrit levels were

TABLE 1 Evaluation of descriptive characteristics according to the groups

	Endometrial cancer (n = 97)	Endometrial hyperplasia (n = 135)	Control (n = 184)	^a P
Age (y) (n = 401)				
Min-Max (Median)	28-88 (62)	21-69 (45)	24-76 (46)	^b .001**
Mean ± SD	59.51 ± 11.41	44.53 ± 7.60	46.86 ± 8.60	
Parity; n (%) (n = 325)				
Min-Max (Median)	1-9 (3)	1-8 (2)	1-9 (2)	^c .004**
Zero	37 (38.1)	34 (25.2)	20 (10.9)	
1-3	34 (35.1)	84 (62.2)	134 (72.8)	
4-6	18 (18.6)	14 (10.4)	27 (14.7)	
>6	8 (8.2)	3 (2.2)	3 (1.6)	
Comorbid disease; n (%)	55 (56.7)	31 (23.0)	76 (41.3)	.001**
Hypertension	34 (35.1)	11 (8.1)	31 (16.8)	.001**
Diabetes Mellitus	26 (26.8)	11 (8.1)	17 (9.2)	.001**

SD, Standard deviation.

^aPearson's chi-square test.^bOne-way ANOVA Test.^cKruskal-Wallis Test.

**P < .01.

found to be significantly lower in endometrial hyperplasia group compared to the control group ($P < .01$).

There were no significant differences between groups with respect to leukocyte counts, neutrophil counts, lymphocyte counts, and platelet counts ($P > .05$).

While MPV measurements were significantly higher in endometrial carcinoma group ($P = .018$) and endometrial hyperplasia group ($P = .001$) compared to the control group; it was determined that there was no significant difference between endometrial carcinoma group and endometrial hyperplasia group with respect to MPV measurements ($P > .05$).

While RDW measurements were significantly lower in endometrial carcinoma patients compared to endometrial hyperplasia group ($P = .004$) and control group ($P = .007$) ($P < .01$); no significant difference was observed between endometrial hyperplasia group and control group with respect to RDW measurements ($P > .05$).

It was observed that there were no statistically significant differences between groups with respect to neutrophil/lymphocyte ratio (NLR) and platelet/lymphocyte ratio (PLR) ($P > .05$).

ROC curve analysis was performed for neutrophil, lymphocyte, platelet counts, MPV, RDW, NLR, PLR measurements to determine endometrial carcinoma in the groups including endometrial carcinoma patients and healthy controls (Figure 1). Analysis revealed that, while a significant difference was determined in MPV ($P = .018$) and RDW ($P = .003$) measurements ($P < .05$); no significant difference was determined in other measurements ($P > .05$). The area under the ROC curve obtained for MPV is 58.7% with a standard error of 3.6%, and the rate obtained for RDW is 39.3% with a standard error of 3.6%.

4 | DISCUSSION

Endometrial carcinoma is the most commonly observed malignancy among gynecological neoplasms.⁹ Since the demonstration of the relationship between cancer and inflammation for the first time, many studies were performed on this topic. While the mechanism remains uncertain, neutrophils, lymphocytes, and platelets with various cytokines, growth factors, and local mediators have been shown to have a contribution to tumor development and metastatic potential of the tumor.¹⁰ Endometrial carcinoma is the tumor group, which has lower number of investigations among other solid gynecological tumors. It is well-known that, patients with endometrial carcinoma are older adults. Also, we observed that patients with endometrial carcinoma constituted the oldest age group in our study. Estrogen production ceases after menopause and most of the estrogens in the circulation are produced as a result of peripheral aromatization of androgens to estrogens in the adipose tissue. It was shown that proinflammatory cytokines could stimulate aromatase activity in the adipose tissue and therefore increased estrogen production and bioavailability.¹¹ This condition explains why endometrial carcinoma is seen in elderly women and especially obese individuals.

Diabetes mellitus and hypertension are the conditions increasing the risk for endometrial carcinoma. Here, a metabolic syndrome associated with obesity with insulin resistance, restricted physical activity, low levels of HDL, high levels of triglyceride, diabetes mellitus, and hypertension have been considered to be responsible for increased risk of endometrial carcinoma.¹² In our study, we also found that the rates of diabetes mellitus and hypertension were significantly higher in endometrial carcinoma group compared to endometrial hyperplasia group and control group.

TABLE 2 Evaluation of the laboratory results according to the groups

	Endometrial Ca (n = 97)	Endometrial hyperplasia (n = 135)	Control (n = 184)	
	Min-Max (Median) Mean $\pm$ SD	Min-Max (Median) Mean $\pm$ SD	Min-Max (Median) Mean $\pm$ SD	P
Hemoglobin (gr/dL)	6.3-14 (10.4) 10.57 $\pm$ 1.81	5.4-15 (11.5) 11.30 $\pm$ 1.72	6.1-15.3 (12.3) 11.98 $\pm$ 1.78	^a .001**
Hematocrit(%)	21-41.7 (32) 31.39 $\pm$ 5.17	18-44 (35.7) 34.55 $\pm$ 4.79	21.2-46.8 (36.8) 36.26 $\pm$ 4.64	^a .001**
White blood cell count (10 ³)	3.7-14.3 (8.1) 8.16 $\pm$ 2.15	4.3-14.5 (7.6) 7.78 $\pm$ 1.98	4.5-13.8 (7.6) 7.81 $\pm$ 1.90	^a .297
Neutrophil (10 ³)	1.8-11.9 (5) 4.94 $\pm$ 1.69	2.2-8.9 (4.3) 4.60 $\pm$ 1.53	1.8-9.3 (4.6) 4.73 $\pm$ 1.53	^b .177
Lymphocyte (10 ³)	0.9-4.7 (2.4) 2.41 $\pm$ 0.86	1.1-6.6 (2.4) 2.48 $\pm$ 0.90	0.6-4.4 (2.3) 2.36 $\pm$ 0.66	^b .920
Platelet (10 ³)	137-553 (277) 284.10 $\pm$ 76.23	71.4-505 (283) 289.16 $\pm$ 67.59	155-575 (273) 296.07 $\pm$ 78.19	^b .584
MPV (fL)	5.9-12.3 (8.3) 8.46 $\pm$ 1.20	6.3-14.8 (8.7) 8.79 $\pm$ 1.36	5.9-12.8 (7.9) 8.20 $\pm$ 1.26	^b .001**
RDW	12.4-30.5 (15) 15.44 $\pm$ 2.46	11.9-30.5 (15.6) 16.39 $\pm$ 3.05	12.8-42.5 (15.4) 16.34 $\pm$ 3.31	^b .008**
NLR	0.7-12.4 (2.1) 2.32 $\pm$ 1.44	0.4-6 (1.8) 1.99 $\pm$ 0.79	0.8-11.8 (2) 2.16 $\pm$ 1.11	^b .195
PLR	57.1-582.1 (119.7) 135.40 $\pm$ 77.63	26.1-267 (120.6) 126.09 $\pm$ 41.45	57.6-491.5 (123) 134.12 $\pm$ 52.95	^b .417

NLR, Neutrophil/Lymphocyte ratio; PLR, Platelet/Lymphocyte ratio; SD, Standard deviation.

^aOne-way ANOVA Test.

^bKruskal-Wallis Test.

**P < .01.

Platelet number and MPV were shown to be the most important two parameters indicating platelet activity. Increased levels of MPV are considered an indicator of the large and active platelets in peripheral circulation. Elevated MPV levels are considered to be a consequence of systemic inflammatory response which plays a critical role in the development and progression of cancer.⁵ Increased levels of MPV of peripheral blood have been demonstrated in various types of cancer such as hepatocellular carcinoma, ovarian cancer, and breast cancer.¹³⁻¹⁵

We determined no significant difference between groups with respect to the platelet counts. In the study performed by Gorelick et al in patients with endometrial carcinoma, the authors reported that preoperative thrombocytosis was a poor prognostic factor.¹⁶

In our study, we found that preoperative MPV measurements were significantly higher in endometrial carcinoma group and endometrial hyperplasia group compared to the control group. In the study performed by Karateke et al in patients with endometrial carcinoma and endometrial hyperplasia, the highest MPV values were determined in the endometrial carcinoma group and the lowest MPV values were determined in the control group. Karateke et al

compared the groups with respect to white blood cell counts, platelet counts, and hemoglobin levels and they reported that there was no significant difference between groups.¹⁷ In our study, we found the lowest hemoglobin and hematocrit levels in endometrial carcinoma group.

In the study performed by Oge et al in 310 patients with endometrial adenocarcinoma and 250 healthy controls, the lowest hemoglobin levels and the highest MPV levels were reported in patients with advanced-stage endometrial cancer compared to patients with early-stage endometrial cancer and the control group. In the same study, no significant difference was reported between all patients with endometrial adenocarcinoma and healthy controls with respect to hemoglobin levels and platelet counts.¹⁸

Kurtoglu et al investigated the role of systemic inflammatory markers (white blood cell, NLR, MPV, PLR, PDW) in the discrimination of benign and malignant endometrial disease and in the discrimination of early-stage endometrial cancer and advanced-stage endometrial cancer.¹⁰ Kurtoglu et al reported that MPV was increased significantly in malignant cases compared to benign cases, but there was no significant relationship between blood parameters

FIGURE 1 ROC curve plot for endometrial Ca

and the stage of the disease and lymphovascular space invasion according to the ROC analysis performed. Similar to the study performed by Kurtoglu et al in our study, we determined no relationship between NLR and PLR and benign or malignant endometrial disease.

In the study performed by Cakmak et al and comparing patients with endometrial hyperplasia and healthy controls, NLR and PLR were significantly elevated in patients of endometrial hyperplasia with atypia compared to the control group, but there was no relationship between endometrial hyperplasia without atypia and NLR and PLR.¹⁹ This study was conducted with a quite low number of patients (endometrial hyperplasia with atypia) as 15, and this was its limitation.

In another study performed by Ural et al patients with endometrial hyperplasia and endometrial carcinoma diagnosed with an endometrial biopsy and healthy controls were compared and the relationship between NLR, PLR, PDW, and endometrial disease was investigated.²⁰ The authors reported that NLR and PDW were significantly higher in patients with endometrial carcinoma compared to endometrial hyperplasia group and control group, but PLR was similar in the groups.

In a study performed by Abide et al the relationship between mole pregnancies and hematological parameters was compared and the authors reported that MPV was significantly higher in cases with molar pregnancy compared to healthy pregnant, but PLR was significantly lower in cases with molar pregnancy compared to healthy controls. NLR was found to be similar in both groups.²¹

Another inflammatory marker RDW is an indicator of heterogeneity in the size of circulating erythrocytes and used to determine the amount of anisocytosis in the peripheral blood. RDW is an indicator of impaired erythropoiesis and abnormal red blood cell survival.²² In recent years, many studies investigating the relationship between RDW and cardiovascular disease and cancer were performed. RDW was proved to be an independent prognostic factor for many cancers such as lung cancer, prostate cancer,

and chronic lymphocytic leukemia.^{6–8} In our study, we found that RDW measurements were significantly lower in patients with endometrial carcinoma compared to patients with endometrial hyperplasia and healthy controls. In a study performed by Kemal et al the patients with endometrial carcinoma and cases with the benign endometrial disease were compared and the authors determined that RDW levels were significantly higher in endometrial carcinoma group.²³

In another study performed by Abide et al the relationship between blood count parameters and diagnosis of placental invasion anomalies was assessed. We know that cancer cell invasion has many common features with trophoblastic invasion.²⁴ Abide et al determined that RDW levels were significantly less in cases with placental invasion anomalies compared to the cases without placental invasion anomalies and MPV levels were significantly higher in cases with placental invasion anomalies compared to the cases without placental invasion.

However, as the number of study about RDW and cancer was increased different interpretations emerged. Until now, only one meta-analysis was performed to determine the prognostic value of RDW in cancer patients.²⁵ In consequence of this meta-analysis, Hu et al decided that elevated RDW was an unfavorable predictor of prognosis in patients with cancers. The inclusion of a limited number of tumor types in this study and the number of studies related to each type of cancers (less than 5) were the major limitation of this meta-analysis. Additionally, different cutoff values of RDW and retrospective studies were among reasons of limitation of this meta-analysis. Some other inflammatory markers have been investigated to detect cases with endometrial cancer such as CRP, IL6, and IL1Ra, authors found significant associations between these markers and endometrial cancer, and authors concluded that chronic inflammation which was thought to be secondary to insulin resistance and estrogen production might be a mediator for the obesity-related increase in risk of endometrial cancer independently from these two pathways²⁶; however, these markers are not widely available to be used so we do not have the data regarding other possible inflammatory markers for the endometrial cancer prediction.

In conclusion, we think that MPV and RDW which are cheap, repeatable, and readily obtainable from complete blood count panels can be used as diagnostic biomarkers for endometrial carcinoma.

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REFERENCES

1. Lacey JV Jr, Sherman ME, Rush BB, et al. Absolute risk of endometrial carcinoma during 20-year follow-up among women with endometrial hyperplasia. *J Clin Oncol*. 2010;28:788-792.
2. Ario DT, Pektas M, Tuncer N, et al. L-Carnitine: a new insight into the pathogenesis of endometrial cancer. *Arch Gynecol Obstet*. 2015;291:1147-1152.

3. Johnatty SE, Tan YY, Buchanan DD, et al. Family history of cancer predicts endometrial cancer risk independently of Lynch Syndrome: implications for genetic counselling. *Gynecol Oncol*. 2017;147:381-387.
4. Shacter E, Weitzman SA. Chronic inflammation and cancer. *Oncology*. 2002;16:217-226.
5. Gasparyan AY, Ayvazyan L, Mikhailidis DP, Kitas GD. Mean platelet volume: a link between thrombosis and inflammation? *Curr Pharm Des*. 2011;17:47-58.
6. Warwick R, Mediratta N, Shackcloth M, Shaw M, McShane J, Poullis M. Preoperative red cell distribution width in patients undergoing pulmonary resections for non-small-cell lung cancer. *Eur J Cardiothorac Surg*. 2014;45:108-113.
7. Albayrak S, Zengin K, Tanik S, Bakirtas H, Imamoglu A, Gurdal M. Red cell distribution width as a predictor of prostate cancer progression. *Asian Pac J Cancer Prev*. 2014;15:7781-7784.
8. Podhorecka M, Halicka D, Szymczyk A, et al. Assessment of red blood cell distribution width as a prognostic marker in chronic lymphocytic leukemia. *Oncotarget*. 2016;7:32846-32853.
9. Gaudet MM, Falk RT, Stevens RD, et al. Analysis of serum metabolic profiles in women with endometrial cancer and controls in a population-based case-control study. *J Clin Endocrinol Metab*. 2012;97:3216-3223.
10. Kurtoglu E, Kokcu A, Celik H, Sari S, Tosun M. Platelet indices may be useful in discrimination of benign and malign endometrial lesions, and early and advanced stage endometrial cancer. *Asian Pac J Cancer Prev*. 2015;16:5397-5400.
11. Zhao Y, Nichols JE, Bulun SE, Mendelson CR, Simpson ER. Aromatase P450 gene expression in human adipose tissue. Role of a Jak/STAT pathway in regulation of the adipose-specific promoter. *J Biol Chem*. 1995;270:16449-16457.
12. Weiderpass E, Persson I, Adami H-O, Magnusson C, Lindgren A, Baron JA. Body size in different periods of life, diabetes mellitus, hypertension, and risk of postmenopausal endometrial cancer (Sweden). *Cancer Causes Control*. 2000;11:185-192.
13. Cho SY, Yang JJ, You E, et al. Mean platelet volume/platelet count ratio in hepatocellular carcinoma. *Platelets*. 2013;24:375-377.
14. Kemal Y, Demirağ G, Ekiz K, Yücel I. Mean platelet volume could be a useful biomarker for monitoring epithelial ovarian cancer. *J Obstet Gynaecol*. 2014;34:515-518.
15. Aksoy S, Kilickap S, Hayran M, et al. A: platelet size has diagnostic predictive value for bone marrow metastasis in patients with solid tumors. *Int J Lab Hematol*. 2008;30:214-219.
16. Gorelick C, Andikyan V, Mack M, Lee YC, Abulafia O. Prognostic significance of preoperative thrombocytosis in patients with endometrial carcinoma in an inner-city population. *Int J Gynecol Cancer*. 2009;19:1384-1389.
17. Karateke A, Kaplanoglu M, Baloglu A. Relations of platelet indices with endometrial hyperplasia and endometrial cancer. *Asian Pac J Cancer Prev*. 2015;16:4905-4908.
18. Oge T, Yalcin OT, Ozalp SS, Isikci T. Platelet volume as a parameter for platelet activation in patients with endometrial cancer. *J Obstet Gynaecol*. 2013;33:301-304.
19. Cakmak B, Gulucu S, Aliyev N, Ozsoy Z, Nacar M, Koseoglu D. Neutrophil-lymphocyte and platelet-lymphocyte ratios in endometrial hyperplasia. *Obstet Gynecol Sci*. 2015;58:157-161.
20. Ural ÜM, Şehitoğlu İ, Tekin YB, Şahin FK. Neutrophil-to-lymphocyte and platelet-to-lymphocyte ratios in patients with endometrial hyperplasia and endometrial cancer. *J Obstet Gynaecol Res*. 2015;41:445-448.
21. Abide Yayla C, Özkaya E, Yenidede I, et al. Predictive value of some hematological parameters for non-invasive and invasive mole pregnancies. *J Matern Fetal Neonatal Med*. 2018;31:271-277.
22. Morris MW, Davey RD. Basic examination of blood. In: Henry JB, ed. *Clinical Diagnosis and Management by Laboratory Methods*, 20th edn. Philadelphia: W.B. Saunders Company; 2001:479-519.
23. Kemal Y, Demirağ G, Baş B, Önem S, Teker F, Yücel İ. The value of red blood cell distribution width in endometrial cancer. *Clin Chem Lab Med*. 2015;53:823-827.
24. Abide Yayla C, Özkaya E, Tayyar A, Senol T, Senturk MB, Karateke A. Predictive value of complete blood count parameters for placental invasion anomalies. *J Matern Fetal Neonatal Med*. 2017;30:2324-2328.
25. Hu L, Li M, Ding Y, et al. Prognostic value of RDW in cancers: a systematic review and meta-analysis. *Oncotarget*. 2017;8:16027-16035.
26. Dossus L, Rinaldi S, Becker S, et al. Obesity, inflammatory markers, and endometrial cancer risk: a prospective case-control study. *Endocr Relat Cancer*. 2010;17:1007-1019.

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