Importance of hemogram parameters for predicting uterine scar dehiscence

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Abstract

Objective: The pathophysiology of uterine scar dehiscence is not yet clear. The aim of this study was to investigate whether preoperative hemogram parameters can be used as predictive markers of uterine scar dehiscence, thus improving prediction and contributing to management of repeat Cesarean section.

Material and Methods: Between 2015 and 2020, 36670 (47.6%) cesarean sections were delivered in our hospital and 16943 of them had a previous Cesarean section. All cases of uterine scar rupture detected during Cesarean section were identified, and a total of 40 patients were included after excluding cases with impairment of the systemic inflammatory response (SIR). Controls consisted of 40 randomly selected, age- and body mass index (BMI)-matched patients, and the groups were compared.

Results: Age, BMI, and gravidity were similar ($p>0.05$). Although the gestational week and Apgar scores were similar between the groups ($p>0.05$), the birth weight amongst controls was significantly higher than the uterine dehiscence group ($p=0.028$). Platelet-to-lymphocyte ratio, neutrophil-to-lymphocyte ratio, and other hemogram values were similar in both groups ($p>0.05$). Mean platelet volume (MPV) in the control group was significantly higher than in the uterine rupture group ($p=0.049$). Regression analysis found no significant result between hemogram parameters, birth weight, and dehiscence.

Conclusion: In this study, which set out to identify predictors of the risk of uterine scar dehiscence with SIR parameters, only the MPV value was lower in the dehiscence group. (J Turk Ger Gynecol Assoc 2024; 25: 38-43)

Keywords: Uterine scar dehiscence, Cesarean scar, neutrophil-lymphocyte ratio, platelet-lymphocyte ratio, mean platelet volume

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Introduction

Uterine rupture can cause adverse consequences for mother and fetus. Uterine rupture is divided into two main types; incomplete uterine rupture or dehiscence refers to the incomplete separation of uterine scar tissue with an intact serosal layer while complete uterine rupture is a catastrophic event where a full-thickness disruption of a scar occurs, especially during labor, responsible for maternal-fetal morbidity and mortality (1). Uterine scar dehiscence can occur during late pregnancy or active labor and, rarely, in the postpartum period. Following any conditions in the pre-pregnancy period, such as myomectomy, Cesarean section, hysterotomy and curettage, that disrupt the integrity of the uterus, uterine scar dehiscence may occur and rupture during the perinatal period. Factors that increase uterine tension, such as fetal macrosomia, polyhydramnios, and multiple pregnancies, increase the risk of uterine rupture and dehiscence (2,3). The pathophysiology of uterine scar dehiscence has not yet fully understood. It is thought that previous uterine infection and/or inflammation can lead to scar tissue weakness, and eventually scar dehiscence occurs (3).

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Previous Cesarean section is a significant independent risk factor for uterine rupture associated with adverse maternal and perinatal outcomes (4). A systematic review showed an average incidence of 0.05% uterine rupture in all pregnancies and 1% in women who had a previous cesarean delivery (5). However, the true incidence of uterine dehiscence is not fully known. In some studies, the reported incidence rates varied from 0.06% up to 3.8% and were predicted to increase in association with the rising cesarean rates (6-8).

White blood cell count (WBC) has been widely used as an inflammatory biomarker in clinical practice for years. Moreover, peripheral blood neutrophil-to-lymphocyte ratio (NLR) and platelet-to-lymphocyte ratio (PLR) are simple systemic inflammatory response (SIR) parameters that can be easily acquired by a simple complete blood count (CBC) test. They are calculated by dividing the neutrophil or platelet count by the lymphocyte count (9). Many studies have been done on the predictive values of these parameters for preeclampsia, tubal ovarian abscess, diabetes mellitus, coronary artery disease, ulcerative colitis, and inflammatory arthritis (10-12). It has been suggested that platelets also play important roles in immune and/or inflammatory processes (12,13). Mean platelet volume (MPV), a measure of platelet size and a good indicator of platelet activation and function, is increasingly becoming a useful marker of inflammation (14-16).

The aim of this study was to examine whether blood parameters produced during a CBC test that are used as markers of inflammation-infection are associated with the risk of uterine scar dehiscence in cases with repeat Cesarean section and to investigate preoperative hemogram parameters in predicting pregnancies with uterine scar dehiscence. Identifying such biomarkers would improve the identification of women at high risk for rupture and contribute to their management.

Material and Methods

The study was planned as a retrospective, observational study. Among the patients admitted to the Department of Obstetrics and Gynecology of the University of Health Sciences Turkey, Etlik Zübeyde Hanım Women's Health Training and Research Hospital between June 2015 and June 2020 and delivered by Cesarean section, cases with uterine scar dehiscence reported intraoperatively were evaluated.

The Local Ethics Committee of the University of Health Sciences Turkey, Etlik Zübeyde Hanım Women's Health Training and Research Hospital granted its approval for the study's conduct, protocol, and procedures (approval number: 14, date: 14.09.2020). This hospital is a tertiary reference center with around 15,000 births per year. To ensure homogenization, women having multiple repeat Cesarean sections who were at high risk for uterine scar dehiscence were excluded. The patients who had only one previous Cesarean section and cases with a single layer of continuous suture in previous Cesarean section surgery notes were included in the study. Informed consent was obtained from patients who participated in this study. Patients who experienced no complications during their pregnancy and were taken to an elective Cesarean section with a previous cesarean indication were divided into two groups:

Group 1, control group (patients with no uterine scar dehiscence); and group 2, patients with uterine scar dehiscence identified and confirmed during their second cesarean delivery.

After the exclusion criteria were applied, the control group was composed of patients who were age- and body mass index (BMI)-matched and had experienced only one Cesarean section with no scar dehiscence. The randomization was based on the chronological order of the hospital data. The first patients meeting the criteria whose Cesarean section came after each dehiscence patient' were taken for inclusion amongst controls until matching group sizes were achieved.

Exclusion criteria

Patients with multifetal pregnancies and comorbid diseases, women who had no cesarean delivery before and experienced more than one cesarean, and whose gestational age at delivery was less than 37 and greater than 42 weeks were excluded. Both low birth weight (<2500 grams) and fetal macrosomia (>4000 grams) at delivery, patients with amniotic fluid abnormalities, pregnancy complications, such as gestational diabetes mellitus, intrauterine growth restriction, preterm premature rupture of the membranes, gestational hypertension, intrahepatic cholestasis and patients with missing data were not included in the study.

All Cesarean sections of the included patients were performed with a locked, single-layer uterine closure. Patients who received the unlocked double-layer closure technique were also excluded. Although there is no known difference in dehiscence between single-layer and double-layer, in order to avoid heterogeneity and biases in the cohorts, the entire population in this study was formed from cases in which single-layer sutures were applied.

Obstetric history (gravida, parity), ultrasonographic findings (biophysical profile, fetal biometry), comorbid diseases, if any, previous surgical procedures, hemogram parameters (WBC, hemoglobin concentration, NLR, PLR, MPV), postoperative blood loss, blood transfusion requirement, number of postoperative hospitalization days, maternal/fetal mortality rates, and neonatal demographics and outcomes (gestational age at birth, birth weight, Apgar scores, neonatal complications, admission rates and length of stay in neonatal intensive care unit) were reported and compared between two groups.

Statistical analysis

Before the data analyses, all data were checked to detect anomalies and inaccuracies. Normality was tested using the Kolmogorov-Smirnov, skewness-kurtosis values, and histogram. An independent samples t-test to compare the two groups' differences for parametric data for all continuous variables. The uterine scar dehiscence rate was calculated by dividing the number of patients with dehiscence by the number of patients with previous Cesarean sections.

For non-parametric data, the Mann-Whitney U test was used to compare the differences between two groups. Differences between categorical data were assessed using Fisher's exact test and reported as frequencies and percentages. The effects of variables, including NLR, PLR, MPV, hemoglobin concentration, WBC, and MPV values and birth weight on the group were investigated by logistic regression. Data were analyzed using SPSS version 23.0 (IBM Inc., Armonk, NY, USA) and a $p<0.05$ was considered statistically significant.

Results

During the study period 77,081 (100%) deliveries occurred in the hospital. Of these, 40,407 (52.4%) were vaginal births, the remaining 36,674 (47.6%) were Cesarean sections, and 16,943 of the Cesarean sections had a previous Cesarean section history (Figure 1). There was a total of 157 uterine scar dehiscences and 40 (25.5%) cases were included in the study group after exclusions. Forty randomly selected controls were also selected. Further, the incidence of uterine scar dehiscence by years is presented in Table 1. From 2015 to 2020, the incidence of uterine dehiscence ranged from 0.26% to 0.55%.

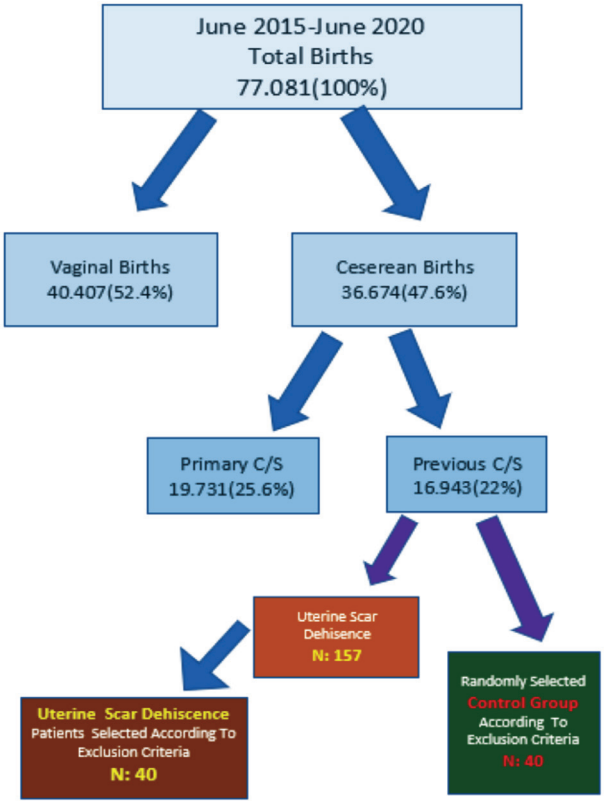

Figure 1. Flow chart of this study

The results of the comparison between the cases with dehisence and the controls are shown in Table 2. The study design ensured that age, BMI, and gravidity values were similar ($p>0.05$). In addition to the gestational week, 1st and 5th-minute Apgar scores, and fetal presentation were also similar between the groups ($p>0.05$). However, the birth weight of babies born in the control group (3397.63±418.15 g) was significantly higher than the uterine dehiscence group (3176.25±462.54 g) ($p=0.028$). SIR parameters such as PLR (147.79±54.72% vs. 132.99±61.24%) and NLR (4.14±1.39% vs. 4.06±1.38%) were similar in both groups ($p>0.05$). Also, there was a similarity between the groups in preoperative and postoperative hemoglobin values and leukocyte counts ($p>0.05$). However, the control group's preoperative MPV level was significantly higher than the uterine dehiscence group ($p=0.049$) (Figure 2). The relationship between the group and the complication and blood transfusion volume (units) could not be conducted because the chi-square analysis assumptions were not met, as seen in Table 3. No complications were detected in 90% of the dehiscence group and 97% of the control group. While two cases in the dehiscence group needed a blood transfusion, transfusion was required in one case in the control group. Postpartum hysterectomy was performed in one patient in the dehiscence group and respiratory arrest occurred in one patient. LR analysis showed variables, including NLR, PLR, MPV, hemoglobin concentration, WBC, and MPV values, and birth weight had no effect ($p>0.05$; Table 4).

Discussion

Maternal and fetal outcomes of uterine rupture can include both morbidity and mortality. The maternal mortality rate was 1/500 in the literature, while the reported perinatal mortality rate associated with uterine rupture ranged from 5% to 26% (17-19).

Table 1. Incidence of cases with uterine scar dehiscence by year

Year of operation	n (%)	Delivery number	Incidence
2015 (last half)	10 (6.4)	8239	0.26
2016	20 (12.7)	16358	0.26
2017	41 (26.1)	16201	0.52
2018	32 (20.4)	15260	0.43
2019	38 (24.2)	13978	0.55
2020 (first half)	16 (10.2)	7045	0.50

Table 2. Comparison of obstetric, demographic and hemogram parameters of the groups

Mean ± SD, median (range) or n (%)		Uterine dehiscence group	Control group	p
Age (years)*		28.43±6.05	29.90±4.19	0.209
BMI (kg/m²)*		28.60±3.83	28.83±3.55	0.786
Gravida**		2 (2-6)	2 (2-6)	0.326
Gestational age (weeks)**		38 (36-39)	39 (34-40)	0.137
Preop Hb (g/dL)*		11.69±1.30	11.75±1.15	0.814
Postop Hb (g/dL)*		10.84±1.21	10.95±1.16	0.677
Preop WBC**		951500 (561000-1964000)	853000 (421000-1721000)	0.071
Preop NLR*		4.14±1.39	4.06±1.38	0.802
Preop PLR*		147.79±54.72	132.99±61.24	0.258
Preop MPV*		8.73±0.80	9.13±0.99	**0.049**
Birth weight (grams)*		3176.25±462.54	3397.63±418.15	**0.028**
Apgar 1 min**		9 (7-9)	9 (9-9)	0.155
Apgar 5 min**		10 (9-10)	10 (10-10)	0.155
Presentation***	Vertex	39 (97.5)	39 (97.5)	0.753
	Breech	1 (2.5)	1 (2.5)	

*Independent sample t-test, **Mann-Whitney U test, ***Fisher's exact test, BMI: Body mass index, Hb: Hemoglobin, WBC: White blood cells, NLR: Neutrophil-to-lymphocyte ratio, PLR: Platelet-to-lymphocyte ratio, MPV: Mean platelet volume, SD: Standard deviation, min.: Minute

Table 3. Complication and transfusion rates of the groups

	Uterine dehiscence group, n (%)	Control group, n (%)
Complication		
None	36 (90.0)	39 (97.5)
Maternal blood transfusion	2 (5.0)	1 (2.5)
Respiratory arrest	1 (2.5)	0 (0.0)
Postpartum hysterectomy	1 (2.5)	0 (0.0)
Blood transfusion volume (units)		
None	38 (95)	39 (97.5)
2	1 (2.5)	1 (2.5)
3	1 (2.5)	0 (0.0)

Table 4. Binary logistic regression analysis

Independent variables	p	OR	95% CI for exp (B)	
			Baseline	Saturated
EFW	0.886	1.000	1.000	1.000
NLR	0.936	1.004	0.907	1.111
PLR	0.664	1.001	0.998	1.004
MPV	0.841	0.995	0.948	1.045
Hb	0.978	0.999	0.963	1.037
WBC	0.693	1.000	1.000	1.000
Dependent Variables: Control & Uterine Dehiscence Groups				

Hb: Hemoglobin, WBC: White blood cells, NLR: Neutrophil-to-lymphocyte ratio, PLR: Platelet-to-lymphocyte ratio, MPV: Mean platelet volume, OR: Odds ratio, CI: Confidence interval

Death is most likely to occur in cases of placental separation and fetal extrusion (20,21).

A challenging decision the surgeon faces in uterine rupture-uterine scar dehiscence is whether the repair of rupture can be facilitated or urgent hysterectomy should be necessary for life-saving measures (21). It should be noted that Vaginal Birth after Cesarean Section has become more popular, particularly in the setting of increased cesarean rates worldwide, leading to an increased risk for maternal, fetal, and neonatal complications. Thus, useful predictive tools are needed to determine if a patient can undergo a trial of labor after cesarean safely. Ultrasonography has been used widely to predict uterine scar rupture. A relationship between the scar thicknesses as measured by sonography and the scar rupture risk was reported in some studies (22,23). Unfortunately, an optimal scar thickness cut-off value specifically designed for predicting increased rupture-dehiscence risk was not established. Therefore, cut-off value and management decisions were left to clinicians.

Studies have shown that maternal infection-inflammation may be associated with uterine scar dehiscence (3). There are many recent studies about NLR and PLR as useful inflammation markers. Some studies were conducted to predict whether these markers were related to pregnancy outcomes, preeclampsia, and fetal loss (24-26). I addition, MPV has been found to be another useful biomarker of inflammation (14). There is no previous study conducted to predict uterine scar dehiscence with these ratios and MPV, to the best of our

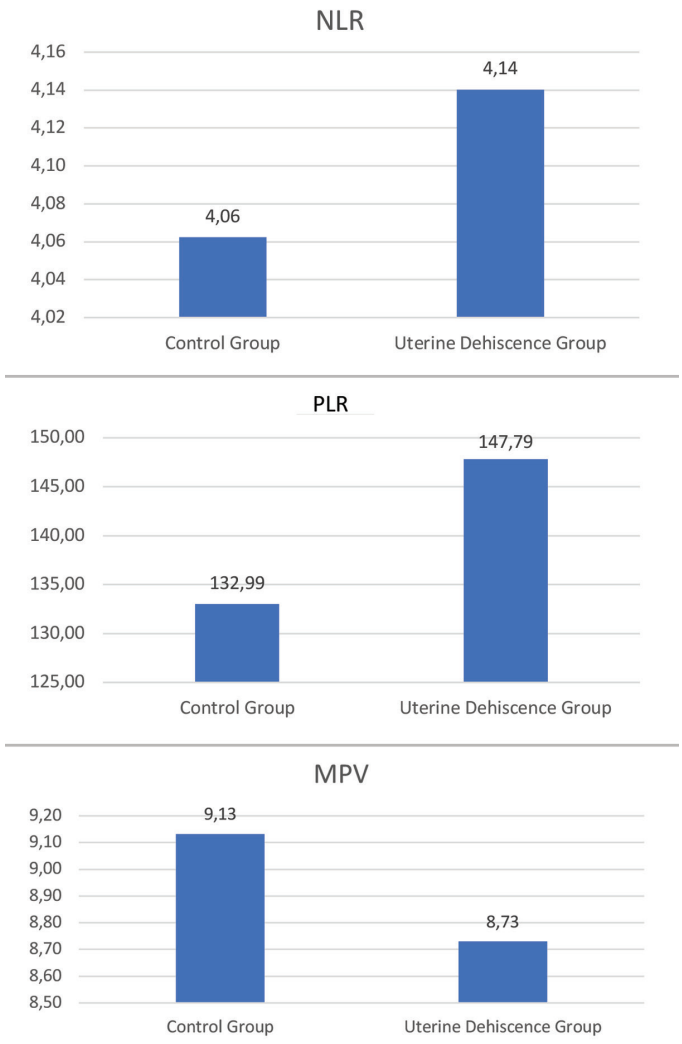

Figure 2. Comparison of NLR, PLR, and MPV levels in control and uterine dehiscence groups

knowledge.

We investigated whether hemogram parameters associated with inflammation can be used as an alternative tool to ultrasonography to predict the increased risk of uterine scar dehiscence. In the present study, we found the difference in MPV values between uterine dehiscence and control groups was significant (p=0.049). However, NLR and PLR values showed no significant difference.

Conclusion

MPV was found to be the only significant predictor of uterine scar dehiscence. Therefore we suggest that MPV may be used to predict uterine scar dehiscence in patients with previous cesarean delivery. Furthermore, a CBC is easy to carry out, easy to evaluate, and affordable compared to other diagnostic tools. We hope our paper will stimulate and guide future larger studies. We are aware that additional, large, well-designed, randomized controlled studies are necessary to confirm our findings.

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