Original Investigation

Importance of Hemogram Parameters for Predicting Uterine Scar Dehiscence

Akdaş Reis et al. Predicting Uterine Scar Dehiscence

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Abstract

Objective: The pathophysiology of uterine scar dehiscence has not been revealed yet. This study aimed to investigate whether preoperative hemogram parameters can be used as predictive markers of uterine scar dehiscence, thus improving the prediction and contributing to managing 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 determined, and a total of 40 patients were included by the exclusion criteria that may impair the systemic inflammatory response(SIR). Furthermore, 40 patients were age and BMI-matched, randomly assigned to the control group, 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 control group's birth weight is significantly higher than the uterine dehiscence group (p=.028). PLR, NLR, and other hemogram values were similar in both groups (p>0.05). MPV in the control group was significantly higher than in the uterine rupture group (p=.049). The regression analysis found no significant result between hemogram parameters, birth weight, and dehiscence.

Conclusion: In this study, which tried to predict the risk of uterine scar dehiscence with SIR parameters, only the MPV value was lower in the dehiscence group.

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

Introduction

Uterine rupture is a condition that can cause adverse consequences as maternal and fetal, divided into two main types. Incomplete uterine rupture or dehiscence refers to the incomplete separation of uterine scar tissue with an intact serosal layer. A 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 prepregnancy 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 uterine rupture and dehiscence risk [2, 3].

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]. On the other hand, 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].

The pathophysiology of uterine scar dehiscence has not been fully revealed yet. It is thought that previous uterine infection and/or inflammation can lead to scar tissue weakness, and eventually scar dehiscence occurs [3].

White blood cell count (WBC) has been widely used as an inflammatory biomarker in clinical practice for years. Moreover, peripheral blood neutrophil/lymphocyte ratio (NLR) and platelet/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, tuba 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 becoming increasingly a popular marker of inflammation [14-16].

This study aimed to examine whether the blood parameters 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, thus improve the identification of women at high risk for rupture cases 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 of the Etlik Zübeyde Hanım Maternity and Women's Health Teaching 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 Etlik Zübeyde Hanım Maternity and Women's Health Teaching and Research Hospital granted its approval for the study's conduct, protocol, and procedures. Our hospital is a tertiary reference center with 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)

Group 2: patients with uterine scar dehiscence identified and confirmed during their second cesarean delivery.

After the exclusion criteria were applied, our control group was composed of patients who were age and BMI (body mass index) matched and experienced only one cesarean section with no scar dehiscence. The randomization was made 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.

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 (GDM), intrauterine growth restriction (IUGR), preterm premature rupture of the membranes (PPROM), gestational hypertension, intrahepatic cholestasis and patients with missing data were not included in the study.

Besides, all cesarean sections of the patients included in the study 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, NLR, PLR, MPV), postoperative blood loss, blood transfusion need, number of postoperative hospitalization days, maternal/fetal mortality rates, and neonatal demographics and outcomes (gestational age at birth, birth weight, APGAR score, 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. We used an independent samples t-test to compare the two groups' differences in 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, we used a Mann-Whitney U test to compare the differences between the two groups. Differences between categorical data were assessed using Fisher's exact test and reported as frequencies and percentages. The effects of variables such as NLR, PLR, MPV, HB, WBC, MPV values and birth weight on the group were investigated with the logistic regression

test. Data were analyzed using SPSS version 23.0, and a p-value of <.05 was considered statistically significant.

Results

Through the study, 77,081 (100%) deliveries occurred in our 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). As seen in Figure 1, there was a total of 157 uterine scar dehiscences and a total of 40 cases were included in the study group according to inclusion and exclusion criteria. Forty randomly selected cases meeting the inclusion and exclusion criteria were also designed as the control group. Further, the incidence of uterine scar dehiscence by years is presented in Table 1. From 2015 to 2020, the incidence of uterine dehiscence in our clinic ranges from 0.26% to 0.55%.

In this study, after excluding all of these predisposing factors mentioned above, we compared 40 patients having uterine scar dehiscence with 40 control patients and reported the results (Table 2). The mean age was 28.43±6.05 years in the dehiscence group, while it was 29.90±4.19 years in the control group. Under the study design, 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 similar between the groups (p>0.05). However, the control group's birth weight (3397.63±418.15 g) is 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 is significantly higher than the uterine dehiscence group (p=.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. 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 detected in one case in the control group. Postpartum hysterectomy was detected in one patient in the dehiscence group and respiratory arrest was found in one patient. According to the logistic regression test results, it was shown variables such as NLR, PLR, MPV, HB, WBC, MPV values, and birth weight had no effect on the group (p>0.05, as shown in Table 4).

Discussion

Maternal and fetal outcomes of uterine rupture can result in morbidity and mortality. The maternal mortality rate was found to be 1/500 in the literature, while the reported perinatal mortality rate associated with uterine rupture ranges from 5 to 26 percent [17-19]. 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].

Besides, vaginal birth after cesarean section (VBAC) became 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 (TOLAC) safely. Ultrasonography has been used widely to predict uterine scar rupture. A relationship between the scar thicknesses measured by sonography and the scar rupture risk was discovered 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 current studies on NLR-PLR as popular inflammation markers. Some studies were conducted to predict whether these markers were related to pregnancy outcomes, preeclampsia, and fetal loss [24-26].On the other hand, MPV was found to be another inflammation marker [14]. There is no previous study conducted to predict uterine scar dehiscence with these ratios and MPV as far as we know.

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 our research, we found the difference in MPV values between uterine dehiscence and control groups was found to be statistically significant (p<0,05). On the other hand, NLR and PLR values showed no significant difference. We aimed to contribute to the literature by sharing the uterine scar dehiscence characteristics and pregnancy outcomes. In this retrospective study, since the factors affecting uterine dehiscence were strictly applied, the sample size was formed with 40 cases, although it is a center where thousands of cesarean sections are performed. Unlike many studies conducted before with different parameters possibly related to uterine scar dehiscence, we studied hemogram parameters that have not been investigated in this issue before.

Conclusion

MPV was found to be significant in predicting uterine scar dehiscence. Therefore MPV can be used to predict uterine scar dehiscence in patients with previous cesarean delivery. Furthermore, a complete blood count is easy to carry out, easy to evaluate, and affordable compared to other diagnostic tools. Our paper will guide future studies. Additional well-designed randomized controlled studies are necessary to confirm our findings.

Acknowledgments

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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

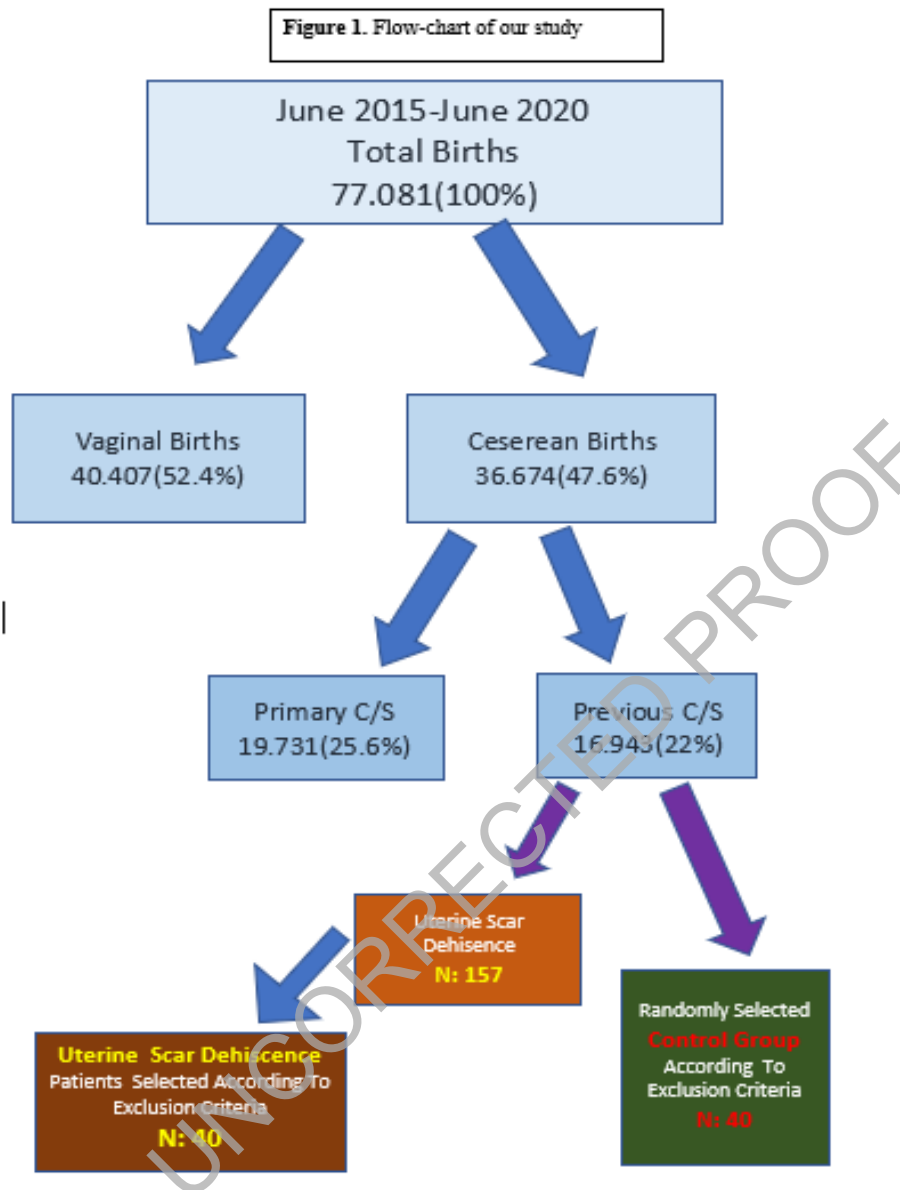| **Table 2.** Comparison of obstetric, demographic and hemogram parameters of the groups		Uterine dehiscence group M ± SD or Median (min.-max.) or n (%)	Control group M ± SD or Median (min.-max.) or n (%)	**P-value**
Age (year)*		28.43±6.05	29.90±4.19	0.209
BMI (kg/m^2)*		28.60±3.83	28.83±3.55	0.786
Gravida**		2.00 (2.00-6.00)	2.00 (2.00-6.00)	0.326
Gestanional Age(week)**		38.00 (36.00-39.00)	39.00 (34.00-40.00)	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**		9515.00 (5610.00-19640.00)	8530.00 (4210.00-17210.00)	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.**		9.00 (7.00-9.00)	9.00 (9.00-9.00)	0.155
APGAR 5 min.**		10.00 (9.00-10.00)	10.00 (10.00-10.00)	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-lymphocyte ratio, PLR: Platelet-lymphocyte ratio, MPV: Mean platelet volume				

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	,907	1,111
PLR	0,664	1,001	,998	1,004
MPV	0,841	,995	,948	1,045
HB	0,978	,999	,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-lymphocyte ratio, PLR: Platelet-lymphocyte ratio, MPV: Mean platelet volume				

Figure 1. Flow-chart of our study

June 2015-June 2020
Total Births
77.081(100%)

Vaginal Births
40.407(52.4%)

Ceserean Births
36.674(47.6%)

Primary C/S
19.731(25.6%)

Previous C/S
16.943(22%)

Uterine Scar
Dehisence
N: 157

Randomly Selected
Control Group
According To
Exclusion Criteria
N: 40

Uterine Scar Dehiscence
Patients Selected According To
Exclusion Criteria
N: 40

Figure 1. Flow chart of this study
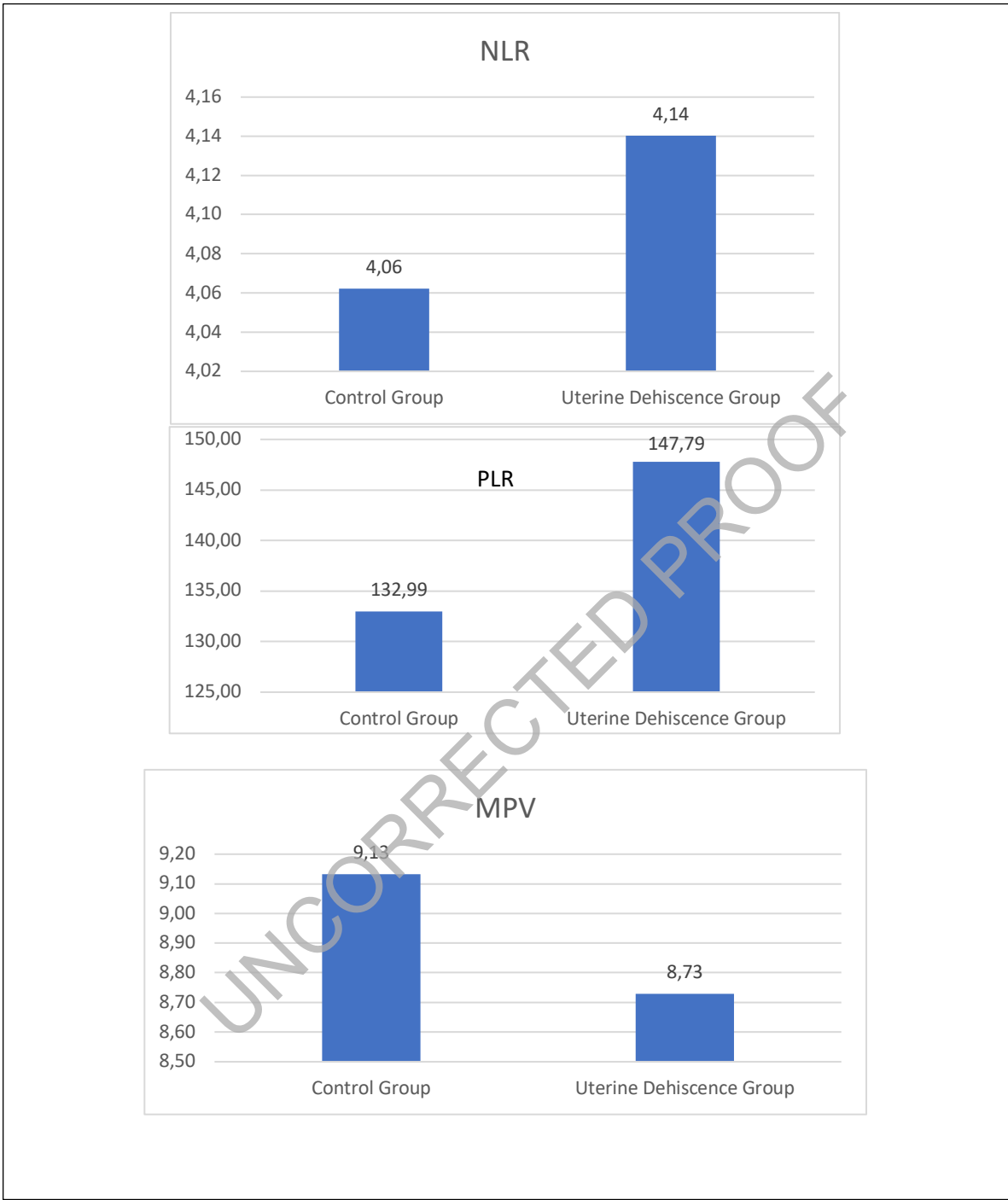
Figure 2. Comparison of NLR, PLR, and MPV levels in control and uterine dehiscence groups