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# Evaluation of the parameters of the inflammatory index in the first trimester in case of placental abruption: An observational matched case-control study

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**Abstract**

To test whether inflammatory indices derived from first-trimester complete blood counts (CBCs) can anticipate placental abruption. We performed an observational matched case–control study (January 2023–February 2025), including 44 histopathology-confirmed placental abruption cases and 44 controls matched on maternal age and gestational week. From first-trimester CBCs we computed neutrophil-to-lymphocyte ratio (NLR), platelet-to-lymphocyte ratio (PLR), systemic immune-inflammation index (SII), systemic inflammatory response index (SIRI) and monocyte-to-lymphocyte ratio (MLR). Group differences and diagnostic utility were assessed, including ROC analyses. Compared with controls, placental abruption cases showed higher neutrophil counts with elevated NLR, PLR, SII and SIRI, while lymphocyte counts were lower (all $p<0.05$). NLR displayed the best discrimination (AUC 0.777; cut-off 2.67; sensitivity 63.6%; specificity 77.3%; $p<0.001$). Simple first-trimester, CBC-based inflammatory indices—particularly NLR—may aid early risk stratification for placental abruption and could serve as an adjunct to established clinical and imaging assessments rather than a stand-alone test, as hypothesis-generating findings that require prospective validation.

**Keywords:** Placental abruption, first trimester, CBC-derived indices, neutrophil-to-lymphocyte ratio

## Introduction

Placental abruption is a critical condition requiring urgent obstetric intervention, characterised by the separation of the placenta from the uterine wall before the second stage of labour is complete. The incidence of this condition ranges from 0.4% to 1% [1–3]. The bleeding that results from this separation can cause hypoxia and ischaemia in the fetus. Clinically, it may present with vaginal bleeding, abdominal pain, tachycardia or hypotension in the mother, late decelerations on the non-stress test, and persistent fetal bradycardia [4]. Maternal complications are associated with a process that progresses to haemorrhage, coagulopathy, hypovolemic shock, and, rarely, maternal mortality. Adverse outcomes for the foetus often include prematurity, intrauterine growth restriction, neonatal asphyxia, and foetal death, and these outcomes are generally related to the severity of the abruption and the gestational week in which it occurs [5,6].

It is believed that microthrombosis forming in the spiral arterioles supplying the decidua layer may predispose to placental abruption, even though the exact cause of this condition is still unknown [7]. Despite numerous studies on predicting placental abruption, early prediction of this complication remains a significant challenge. Beyond the immediate hemodynamic consequences, abruption likely reflects a long-standing placental–maternal maladaptation with inflammatory and thrombotic facets. Findings indicate that this condition may be part of a chronic process rather than just an acute one [8]. Early detection of inflammation can play a key role in preventing potential obstetric complications. The use of various biomarkers thought to reflect chronic inflammatory

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processes has been investigated in this context [9–11]. However, technical difficulties encountered in measuring these biomarkers limit their widespread use.

There are some easily accessible, reproducible, low-cost and informative markers. A complete blood count (CBC) is a simple and inexpensive method that provides important information for the diagnosis of many diseases. Although it has been suggested that inflammatory indices can be used to predict various obstetric complications, the lack of standardisation in the integration of these biomarkers into clinical practice poses a significant problem. Because thresholds may vary across populations, derivation and validation in independent cohorts are essential before any threshold is used for decision support. In particular, there are no definitive guidelines yet on which threshold values should be used as decision support tools in patient management and what level of reliability they have for specific populations.

A practical advantage of CBC-derived indices is their ubiquity in routine antenatal care, which makes them attractive where advanced assays are impractical. At this point, parameters such as the pan-immunological inflammation score (PIV), systemic inflammatory response index (SIRI), and systemic immunological inflammation index (SII) come to the fore. These markers are based on neutrophil (NEUT), lymphocyte (LYM), platelet (PLT), and monocyte (MONO) values and are attracting attention as new-generation prognostic markers due to their non-invasive, economical, and easily measurable nature [12–14]. SII is calculated using the formula "PLT×NEUT/LYM" and has been defined as an ideal biomarker reflecting systemic inflammation and local immune response [8,15]. PIV is a new parameter based on the formula 'NEUT×PLT×MONO/LYM' and has been confirmed to have prognostic value in some oncological diseases [16]. SIRI is an economical serum biomarker determined according to the formula 'NEUT×MONO/LYM' and is associated with the prognosis of malignancy patients [16]. Although these indicators are primarily used in the field of oncology, they have been extensively studied in various medical fields in recent years [8,16].

In the literature, there are studies showing significant relationships between placental abruption and various haematological and inflammatory parameters [2,3,7,16]. There are only a limited number of studies examining inflammation indices associated with placental abruption in the first trimester. Early identification of patients at risk during this period may provide a critical opportunity to improve maternal and neonatal outcomes through close monitoring or early intervention. This research aimed to evaluate whether inflammation-related biomarkers obtained in the first trimester are associated with subsequent placental abruption, within the framework of an observational matched case–control design.

## Material and Methods

This study was designed as an observational matched case–control study conducted at the Perinatology Clinics of Tertiary Center in July 2025 by reviewing medical records from January 2023 to February 2025. The research was approved by the Local Ethics Committee (Approval ID: AEŞH-BADEK2-2025-193). The requirement for informed consent was waived owing to the retrospective design of the study. All patient data were anonymized before analysis to ensure confidentiality, and no identifiable personal information was used at any stage of the research.

### Inclusion and Exclusion Criteria

Participants eligible for inclusion were women aged 18–45 years with singleton pregnancies, whose first-trimester follow-ups and routine complete blood counts (CBC) were performed at our institution. Only those without a history of chronic diseases or ongoing medication use, and without fetal congenital or chromosomal abnormalities, were enrolled. The case group comprised 44 pregnant women with a histopathologically confirmed diagnosis of placental abruption, while 44 healthy pregnant women with similar maternal age and gestational week served as the control group. The control subjects were selected by screening hospital records and ensuring matching for age and gestational age to minimize potential confounding.

Pregnant women were not included in the study if they had multiple gestations, evidence or suspicion of acute or chronic inflammatory diseases, immune system disorders, chorioamnionitis, gestational diabetes, preeclampsia, intrahepatic cholestasis of pregnancy, preterm premature rupture of membranes, or fetal anomalies. To avoid confusion regarding inflammation, women with suspected intra-amniotic infection were excluded from the study during registration.

### Data Collection

A total of 88 women participated in the study. Data extracted from clinical files and laboratory records encompassed maternal demographic characteristics (age, height, weight, gravidity, parity), medical and surgical history, last menstrual period, vital signs, first-trimester laboratory parameters (including CBC), calculated inflammatory indices (SII, SIRI, PIV), and relevant biochemical tests. Obstetric and neonatal outcomes, such as the need for neonatal intensive care unit (NICU) admission, Apgar scores at 1 and 5 minutes, cesarean section rates, fetal distress, and neonatal birth weight, were also recorded. All measurements were obtained in the same laboratory under identical internal quality-control procedures.

### Study Groups and Matching

The case group consisted of patients who were either monitored at the outpatient clinic or admitted to the hospital and delivered in our facility. Controls were randomly chosen from the same institution, matched chronologically by gestational week and maternal age to optimize group comparability and reduce bias. The exclusion criteria were strictly applied during control selection.

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### Calculation of Inflammatory Indices

CBC-derived values for neutrophils, lymphocytes, platelets, and monocytes were used to calculate inflammation indexes (SII:neutrophil×platelet/lymphocyte), (PIV:neutrophil×platelet×monocyte/lymphocyte), and (SIRI:neutrophil×monocyte/lymphocyte). These indices were subsequently compared between the case and control groups.

### Statistical Analysis

Data were analyzed using IBM SPSS-22.0. Normality was assessed via the Kolmogorov-Smirnov test. Descriptive statistics were presented as mean ± standard deviation for normally distributed variables or median (interquartile range) for non-normally distributed data. Comparisons of categorical variables were performed using the chi-square or Fisher's exact test. Continuous variables were analyzed using the independent samples t-test or Mann-Whitney U test as appropriate. Receiver operating characteristic (ROC) curve analysis was conducted to assess the discriminatory power of significant indices and to identify optimal cut-off values. A p-value <0.05 was considered statistically significant throughout the analyses.

### Result

In this study, 44 pregnant women who presented to a tertiary centre with suspected placental abruption between 2023 and 2025 and whose diagnosis was confirmed histopathologically formed the placental abruption group. Forty-four healthy pregnant women included in the study according to the selection criteria formed the control group (Figure 1).

There were no significant differences between the two groups with respect to maternal age, body mass index (BMI), parity, smoking status, history of trauma, use of low molecular weight heparin, need for intensive care, or shock index (all p>0.05). However, the placental abruption group showed higher gravidity, longer duration of hospitalization, elevated systolic and diastolic blood pressure, faster heart rate, and a greater requirement for blood transfusion compared to controls (all p<0.05) (Table 1).

**Table 1.** Demographic characteristics, findings and transfusion needs of the patients

| Parameter | Control Group n=44 (50%) | Placental Abruption n=44 (50%) | P-value |
|---|---|---|---|
| **Age (year)** | 28.1±5.7 | 29.7±5.9 | 0.38[a] |
| **BMI (kg/m2)** | 29.3±4.9 | 28.5±5.2 | 0.446[a] |
| **Gravite (n)** | 2 (2) | 3 (2) | 0.042[b] |
| **Parity (n)** | 1 (2) | 1 (3) | 0.061[b] |
| **Smoking** | 1 (4.3%) | 1 (4.3%) | 1[c] |
| **Presence of trauma** | 0 (0%) | 0 (0%) | NA |
| **History of thrombophilia** | 2 (4.5%) | 0 (0%) | 0.494[c] |
| **Usage of low molecular weight heparin** | 2 (4.5%) | 2 (4.5%) | 1[c] |
| **Admission to intensive care unit** | 0 (0%) | 1 (2.3%) | 1[c] |
| **Hospitalization duration (days)** | 3 (1) | 4 (3) | <0.001[b] |
| **Systolic Blood Pressure (mmHg)** | 115±10.6 | 121±17.4 | 0.063[a] |
| **Diastolic Blood Pressure (mmHg)** | 72±7.6 | 76±11.6 | 0.066[a] |
| **Pulse** | 90±10 | 98±13 | <0.001[a] |
| **Shock index** | 0.79±0.11 | 0.83±0.15 | 0.127[a] |
| **Need for transfusion** | 0 (0%) | 12 (28.4%) | <0.001[c] |
| **Transfusion of erythrocyte** | 0 (0%) | 11 (25%) | <0.001[c] |
| **Transfusion of fresh frozen plasma** | 0 (0%) | 8 (18.2%) | 0.006[c] |

[a]: The Mann–Whitney U test was used for comparisons between groups, as the data were not normally distributed. Data are presented as median (interquartile range), [b]: The Student's t test was used for comparisons between groups, as the data were normally distributed. Data are presented as mean ± standard deviation, [c]: Fisher's exact test was used for comparisons between categorical variables. Data are presented as number (percentage), [d]:The Pearson's chi-square test was used for comparisons between categorical variables. Data are presented as number (percentage), BMI: Body mass index

First-trimester laboratory data revealed that neutrophil (NEUT) counts, systemic immune-inflammation index (SII), systemic inflammatory response index (SIRI), neutrophil-to-lymphocyte ratio (NLR), platelet-to-lymphocyte ratio (PLR), and monocyte-to-lymphocyte ratio (MLR) were significantly elevated in the placental abruption group. Conversely, lymphocyte (LYM) levels and delta NLR were lower in these patients (Table 2).

Neonatal and obstetric outcome comparisons are provided in Table 3. All assessed parameters differed significantly between the two groups, with p-values <0.001.

Receiver operating characteristic (ROC) curve analysis performed for the parameters with significant intergroup differences demonstrated that SII, SIRI, NLR, PLR, and MLR were able to distinguish cases of placental abruption. Among these, NLR achieved the highest area under the curve (AUC:0.777; cut-off value >2.67; p<0.001) with a sensitivity

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of 63.6% and a specificity of 77.3%. Table 4 and Figure 2 summarize the cut-off values, AUCs, confidence intervals (CIs), and diagnostic performance metrics for these markers.

As shown in Table 5, the univariable logistic regression analysis demonstrated that all inflammatory indices were significantly associated with the occurrence of placental abruption. Higher SII (OR=1.004, 95% CI:1.002–1.006, p<0.001), SIRI (OR=2.402, 95% CI:1.283–4.494, p=0.006), NLR (OR=3.755, 95% CI:1.982–7.113, p<0.001), PLR (OR=1.033, 95% CI:1.016–1.050, p<0.001), and MLR (OR=1.065, 95% CI:1.017–1.166, p=0.008) were all significantly associated with increased odds of placental abruption.

In the multivariable models adjusted for maternal age, body mass index, parity, smoking status, and systolic and diastolic blood pressure, these indices remained significant predictors. Specifically, SIRI (aOR=2.766, 95% CI: 1.395–5.486, p=0.004), NLR (aOR=3.980, 95% CI:1.954–8.105, p<0.001), PLR (aOR=1.031, 95% CI:1.013–1.050, p=0.001), and MLR (aOR=1.073, 95% CI:1.022–1.126, p=0.004) were independently associated with placental abruption, while SII also retained statistical significance (aOR=1.004, 95% CI:1.002–1.006, p<0.001). To avoid collinearity, each biomarker was evaluated in a separate multivariable model. For interpretability, MLR values were multiplied by 100 prior to regression, which improved the clarity of effect estimates without altering their statistical significance.

**Table 2.** Laboratory and inflammatory index values of the patients

| Parameter | Control Group n=44 (50%) | PA n=44 (50%) | P-value | Effect Size (95% CI)* |
|---|---|---|---|---|
| **B-HCG** | 39 (30) | 32 (52) | 0.688[a] | |
| **B-HCG (mom)** | 0.90 (0.83) | 0.98 (1.37) | 0.429[a] | |
| **PAPP-A** | 2.30 (2) | 1.52 (2.40) | 0.279[a] | |
| **PAPP-A (mom)** | 0.86 (0.58) | 0.71 (0.26) | 0.053[a] | |
| **1st trimester Hb (g/dL)** | 13.10 (1.35) | 13.20 (1.60) | 0.698[a] | |
| **1st trimester Wbc (x10$^9$/L)** | 8 (3) | 8 (4) | 0.655[a] | |
| **1st trimester Plt (x10$^9$/L)** | 275 (69) | 249 (103) | 0.723[a] | |
| **1st trimester Neutrophile count (x10$^9$/L)** | 6.2 (10) | 6.9 (10) | **<0.001[a]** | **0.547 (0.355-0.695)** |
| **1st trimester Neutrophile (%)** | 4.90 (2.85) | 5.25 (2.30) | 0.156[a] | |
| **1st trimester Monocyte (x10$^9$/L)** | 0.55 (0.30) | 0.55 (0.30) | 0.672[a] | |
| **1st trimester Lymphocyte (x10$^9$/L)** | 2.40 (0.75) | 1.75 (0.90) | **<0.001[a]** | **-0.571 (-0.712-0.385)** |
| **1st trimester SII** | 584.16 (284.08) | 826.99 (554.14) | **<0.001[a]** | **0.471 (0.262-0.637)** |
| **1st trimester SIRI** | 1.16 (0.78) | 1.50 (1.49) | **0.015[a]** | **0.301 (0.067-0.503)** |
| **1st trimester NLR** | 2.15 (0.96) | 3.50 (2.03) | **<0.001[a]** | **0.552 (0.362-0.698)** |
| **1st trimester PLR** | 113.04 (36.85) | 147.01 (51.70) | **<0.001[a]** | **0.542 (0.349-0.691)** |
| **1st trimester MLR** | 0.24 (0.07) | 0.27 (0.18) | **0.016[a]** | **0.299 (0.066-0.501)** |

Values were given as median (interquartile range). p < 0.05 was considered statistically significant. [a:] The Mann–Whitney U test was used for comparisons between groups, as the data were not normally distributed. Data are presented as median (interquartile range). *: Effect size is reported as the rank-biserial correlation with 95% confidence intervals. B-hcg: Beta human chorionic gonadotropin, PAPP-A: Pregnancy associated plasma protein A, Hb: Hemoglobin, Wbc: White blood cell, Plt: Platelet, SII: Systemic immune-inflammation index, SIRI: Systemic inflammatory response index, NLR: Neutrophile to lymphocyte ratio, PLR: Platelet to lymphocyte ratio, MLR: Monocyte to lymphocyte ratio

**Table 3.** Comparison of findings regarding newborn characteristics and labor

| Parameter | Control Group n=44 (50%) | PA n=44 (50%) | P-value |
|---|---|---|---|
| **Gestational age at delivery** | 39 (2) | 37 (7) | <0.001[a] |
| **Birth weight (gr)** | 3399 ± 456 | 2502 ± 898 | <0.001[b] |
| **1st min Apgar** | 9 (0) | 7 (4) | <0.001[a] |
| **5th min Apgar** | 10 (0) | 8 (4) | <0.001[a] |
| **Admission to neonatal intensive care unit** | 3 (6.8%) | 24 (55.8%) | <0.001[c] |
| **Preterm birth** | 4 (9.1%) | 21 (47.7%) | <0.001[c] |
| **Fetal exitus** | 0 (0%) | 6 (13.6%) | <0.001[c] |

[a]: The Mann–Whitney U test was used for comparisons between groups, as the data were not normally distributed. Data are presented as median (interquartile range), [b]: The Student's t test was used for comparisons between groups, as the data were normally distributed. Data are presented as mean ± standard deviation, [c]: Fisher's exact test was used for comparisons between categorical variables. Data are presented as number (percentage)

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**Table 4.** Evaluation of SII, SIRI, NLR, PLR and MLR in the first trimester using ROC analysis for prediction of PA

| Variables | LR+(%95 CI) | LR-(%95 CI) | Cut-off* | Sensitivity(%95 CI) | Specificity(%95 CI) | AUC | %95 CI | P-value |
|---|---|---|---|---|---|---|---|---|
| **SII** | 2.07 (1.28-3.35) | 0.5 (0.32-0.79) | >672.6 | 65.9% (50.1-79.5) | 68.2% (52.4-81.4) | 0.735 | 0.61 – 0.83 | **<0.001** |
| **SIRI** | 1.87 (1.17-2.98) | 0.55 (0.35-0.86) | >1.36 | 63.6% (47.8-77.6) | 65.9% (50.1-79.5) | 0.650 | 0.51 – 0.76 | **0.015** |
| **NLR** | 2.80 (1.49-4.89) | 0.47 (0.33-0.75) | >2.67 | 63.6% (45.5-75.6) | 77.3% (62.2-88.5) | 0.777 | 0.66 – 0.86 | **<0.001** |
| **PLR** | 2.82 (1.63-4.87) | 0.39 (0.24-0.64) | >133.8 | 70.5% (54.8-83.2) | 75% (59.7-86.8) | 0.771 | 0.65 – 0.86 | **<0.001** |
| **MLR** | 1.79 (1.08-2.95) | 0.63 (0.43-0.94) | >0.267 | 56.8% (41.0-71.7) | 68.2% (57.2-85.0) | 0.650 | 0.52 – 0.76 | **0.016** |

Note: 95% confidence intervals for AUC and the optimal cut-off value were calculated using 1000 bootstrap replications (random seed: 978).
*Cut-off values were found according to Youden index. LR+: Positive likelihood ratio, LR-: Negative likelihood ratio, AUC: Area under the curve, CI: Confidence Interval, SII: Systemic immune-inflammation index, SIRI: Systemic inflammatory response index, NLR: Neutrophile to lymphocyte ratio, PLR: Platelet to lymphocyte ratio, MLR: Monocyte to lymphocyte ratio

**Table 5.** Univariable and multivariable analysis of inflammatory markers

| Variables | Univariable | | Multivariable* | |
|---|---|---|---|---|
| | OR (95% CI) | p value | aOR (95% CI) | p value |
| **SII** | 1.004 (1.002–1.006) | **<0.001** | 1.004 (1.002–1.006) | **<0.001** |
| **SIRI** | 2.402 (1.283–4.494) | **0.006** | 2.766 (1.395–5.486) | **0.004** |
| **NLR** | 3.755 (1.982–7.113) | **<0.001** | 3.980 (1.954–8.105) | **<0.001** |
| **PLR** | 1.033 (1.016–1.050) | **<0.001** | 1.031 (1.013–1.050) | **0.001** |
| **MLR**[a] | 1.065 (1.017–1.166) | **0.008** | 1.073 (1.022–1.126) | **0.004** |

Note: Each biomarker (SII, SIRI, NLR, PLR, MLR) was evaluated in a separate multivariable logistic regression model adjusted for Maternal age, body mass index, parity, smoking, systolic and diastolic blood pressures. To avoid collinearity, these biomarkers were not included in the same model.
[a]: In both models, MLR values were multiplied by 100 prior to logistic regression to address the excessively wide odds ratios and confidence intervals, thereby enhancing the interpretability of the estimates without influencing their statistical significance

## Discussion

First-trimester CBC-based indices, show an association with subsequent placental abruption and modest discrimination. Furthermore, statistical analyses indicated that both NLR and PLR maintain significant independent relationships with placental abruption after adjusting for confounding variables. These findings should be viewed as a hypothesis-generating signal and as an adjunct to clinical/imaging assessment, not as a stand-alone predictive tool.

The factors affecting the etiology of placental abruption are not yet clearly understood. Placental implantation disorders, uteroplacental insufficiency and intrauterine hypoxia are probably the most important mechanisms leading to placental abruption [16]. However, early diagnosis of placental insufficiency is clinically important, and changes in inflammatory markers during early pregnancy should be carefully monitored. In addition, impaired trophoblastic invasion of the spiral arteries, an inflammatory process impacting vascularity, and acute vasospasm of the tiny vessels are recognised as distinct mechanisms that may contribute to placental abruption [16]. Which of these mechanisms is more dominant may also explain the heterogeneous clinical presentation of abruptions.

In a study conducted by Rosen and colleagues [17], placental abruption was shown to be associated with an inflammatory process accompanied by thrombin-induced interleukin-8 expression. Due to interleukin-8 being a potent neutrophil chemotactic factor, it has been reported to cause significant neutrophil infiltration in the decidual tissue. However, some studies suggest that placental abruption may be associated with chronic rather than acute inflammatory processes [2,18]. In a study conducted by Pils and colleagues [18], it was found that C-reactive protein (CRP) levels were significantly elevated in pregnant women diagnosed with placental abruption. Furthermore, the absence of a significant difference in CRP levels between cases with and without haemorrhage supports the theory that this condition is associated with a chronic process. Ananth and colleagues [2] investigated the frequency of early placental attachment, represented by vaginal bleeding in the first trimester of pregnancy, and the placental abruption that developed in the subsequent process, and evaluated acute and chronic histopathological lesions in the placenta. The placental infarcts and macrophages in the decidua, amniotic membrane and chorion were evaluated as signs of a chronic process. It has been shown that the rate of placental abruption is significantly higher in fetuses born with chronic placental damage [16]. These two

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studies suggest that there may be a link between inflammation and placental abruption [2,18]. Similarly, inflammatory processes can also trigger uteroplacental insufficiency by disrupting the structural integrity of the placenta. These results support the idea that placental abruption is not just an acute event but may be the result of a chronic inflammatory process that begins in early pregnancy.

The increased incidence of placental abruption in pregnancies with FGR classically suggests that chronic inflammatory events rather than acute inflammatory events are the background for placental abruption [8]. As the results of our study showed, there was a significant increase in inflammatory markers in the first weeks of pregnancy (first trimester) in the cases with placental abruption, especially the values for NEUT, SII, SIRI, NLR, PLR and MLR were significantly higher in the group with placental abruption compared to the control group. Multivariate models showed that first-trimester CBC-derived indices maintained an independent association with abruption when each biomarker was considered separately. In addition, NLR has the highest AUC value for the prediction of placental abruption (AUC:0.777, cut off >2.67, p<0.001, specificity 77.3% and sensitivity 63.6%). Reflecting two different immune responses, neutrophil increase and lymphocyte suppression, at the same time, NLR may be a more dynamic and specific inflammatory marker compared to other composite scores. Physiological alterations during pregnancy must be taken into account when analyzing CBC-derived indices. Normal gestation is marked by progressive neutrophilia, relative lymphopenia, and minor platelet alterations, which inherently affect ratios such as NLR, PLR, and SII. The elevated indices observed in the first trimester among women who subsequently experienced placental abruption indicate an exaggerated inflammatory response that exceeds normal physiological adaptation. This supports the hypothesis that abruption is not merely an acute occurrence but rather signifies chronic maternal–placental maladaptation that commences early in pregnancy.

In recent years, there has been an increase in the number of studies suggesting that inflammatory indices obtained from complete blood count data can be used to predict obstetric complications [19]. The positive results of these studies have raised questions about their ability to predict complications in earlier stages, such as the first trimester. In a case-control study conducted by Özkan and colleagues, it was demonstrated that increases in NLR, SII, and pan-immune inflammation score (PIV) values in the first trimester were significantly associated with PA, and that each unit increase in these parameters approximately 1.8-fold increased the risk of abruption [16]. Similarly, in a multicentre study of European origin, it was found that NLR levels were significantly elevated, particularly in advanced cases of PA, and that this indicator was correlated with disease severity [1]. In addition, a prospective cohort study conducted by Morisaki et al. reported that low NLR and high LMR values measured between the 18th and 21st weeks of pregnancy were significantly associated with ischemic placental diseases (e.g., placental abruption and preeclampsia) that may occur in the later stages [20]. Şener et al. showed that NLR and PLR were significantly elevated in advanced stages of abruption, reflecting the role of inflammation but without providing ROC-based discrimination [21]. Similarly, a study of albumin-related indices (NPAR, BAR, NAR, sACR) demonstrated only moderate discrimination (AUCs~0.66–0.68) and emphasized their adjunctive, hypothesis-generating nature [22]. Together with our data together, indicate that elements of the inflammatory response are measurable in the systemic circulation from early gestation, and that CBC-derived indices can be considered for adjunctive risk assessment during pregnancy surveillance. Using such hematologic indices in early pregnancy could help flag individuals who warrant closer monitoring.

It is known that placental abruption can increase fetal complications such as hypoxia, FGR, prematurity, low birth weight and neonatal asphyxia [23]. In this study, week of gestation at birth, neonatal birth weight, and 1st and 5th minute Apgar scores showed significant differences between the placental abruption and control groups.

In summary, recent studies in the literature show a strong heterogeneity in the clinical processes leading to placental abruption that can be observed in preterm and term births. The results of the study also showed that a chronic inflammatory process was associated with placental abruption, although there was heterogeneity in some inflammatory. However, a prospective follow-up protocol is needed to assess the validity of our findings.

The strengths of our research include the use of well-defined inclusion and exclusion criteria, the evaluation of a relatively homogeneous study population, and the simultaneous examination of multiple inflammatory indices in the first trimester. In addition, the fact that the study was conducted at tertiary care centre where laboratory measurements were standardised increased the reliability of the results. Uniform sampling in a single laboratory reduces analytic variability, which is particularly relevant for ratio-based indices. The use of a matched control group in terms of gestational age and maternal age also minimised the effect of potential confounding factors.

This research possesses multiple limitations. The retrospective case–control design inhibits causal inference and may inflate prediction measures like ROC AUCs, necessitating validation in prospective cohorts. Secondly, despite matching cases and controls for maternal age and gestational week, residual confounding from factors such as subclinical infection, nutritional status, or iron deficiency cannot be ruled out. Third, physiological hematological abnormalities during pregnancy—such as neutrophilia, relative lymphopenia, and platelet modifications—may affect CBC-derived indices, and

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trimester-specific reference values have not been established. The limited sample size, single-centre context, and dependence on cut-off values established by the Youden index may restrict generalisability. In particular, the modest sample size constrained statistical precision: for example, the AUC of NLR (0.777) had a 95% confidence interval of 0.68–0.87, corresponding to a half-width of ~0.10, and odds ratios around the Youden cut-off were accompanied by wide confidence intervals. Larger, prospective cohorts are needed to provide more precise and externally valid estimates.

## Conclusion

In conclusion, our study demonstrates that simple hematological parameters obtained in the first trimester have the potential to be used in predicting serious obstetric complications such as placental abruption. In this context, the evaluation of indices such as SII, NLR and PLR in routine pregnancy follow-ups may be beneficial in the early identification of high-risk pregnancies. Future studies should be repeated in larger patient groups to increase the clinical validity of these findings. Given the multifactorial etiology of placental abruption, it is clear that genetic, epigenetic and environmental factors, as well as inflammatory indices, should be evaluated in risk prediction. Prospective studies should investigate whether combining these parameters to create a risk score improves diagnostic accuracy.

**Conflict of Interests**
*The authors declare that there is no conflict of interest in the study.*

**Financial Disclosure**
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**Ethical Approval**
*This study was designed as an observational matched case–control study conducted at the Perinatology Clinics of Tertiary Center in July 2025 by reviewing medical records from January 2023 to February 2025. The research was approved by the Local Ethics Committee (Approval ID: AEŞH-BADEK2-2025-193).*

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