

Association between Neutrophil-Lymphocyte Ratio and Preeclampsia: A Case-Control Study

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ABSTRACT

Background & objective: Preeclampsia (PE) is a pregnancy-specific disorder characterized by hypertension and multiorgan dysfunction, affecting 2-8% of pregnancies and posing significant risks for maternal and fetal health. This study investigates the association between the neutrophil-lymphocyte ratio (NLR) and preeclampsia, aiming to explore NLR's potential as a cost-effective biomarker for early diagnosis.

Methods: This cross-sectional study was conducted at Sir Salimullah Medical College Mitford Hospital, Dhaka, over 12 a period of months. The study included a total of 78 singleton pregnant women, aged 18 to 35, and between 28 to 40 weeks of gestation. While the case group consisted of 26 women diagnosed with preeclampsia, the control group formed of 52 healthy pregnant women. Pregnant women with known comorbidities, including diabetes, hypertension, hypothyroidism, systemic lupus erythematosus (SLE), or any maternal infections (e.g., respiratory tract infections, urinary tract infections) were excluded from the study.

Results: More than 40% of women with preeclampsia were aged 25 to 30 years, while nearly half of the control group were aged 18 to 25. No significant age difference was found between groups (27.3 ± 5.3 vs. 35.8 ± 3.3 , $p = 0.184$). The case group exhibited significantly higher absolute neutrophil counts (6.83 ± 1.39 vs. $5.56 \pm 1.19 \times 10^9/L$, $p < 0.001$) and NLR (3.7 ± 0.4 vs. 3.0 ± 0.6 , $p < 0.001$) compared to controls. Significant positive correlations were observed between NLR and both systolic ($r = 0.490$, $p < 0.001$) and diastolic blood pressures ($r = 0.587$, $p < 0.001$).

Conclusion: Our findings suggest that elevated NLR is associated with preeclampsia and may serve as a valuable biomarker for its diagnosis. The study highlights the importance of NLR in enhancing early detection and management of preeclampsia, particularly in resource-limited settings.

Key words: Association, Neutrophil-Lymphocyte Ratio, Preeclampsia etc.

INTRODUCTION:

Preeclampsia (PE) is a pregnancy-specific disorder characterized by hypertension and multiorgan dysfunction. It remains one of the leading causes of maternal and fetal mortality, as well as adverse pregnancy outcomes.¹ Preeclampsia affects 2-8% of pregnancies and poses significant risks for

maternal and fetal health, yet early diagnosis remains challenging.^{2,3} Previous research indicates that elevated NLR correlates with increased disease severity and serves as an inflammatory marker, but a specific association of NLR with preeclampsia in the context Bangladeshi population is lacking. This study aims to bridge

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this gap by exploring NLR's potential as a cost-effective and accessible biomarker for PE diagnosis.

Despite the recognition of NLR as an inflammatory marker in various studies, there remains a gap in understanding its specific role in the context of preeclampsia. The pathophysiology of preeclampsia involves hyperactivation of inflammatory responses, leading to increased neutrophil and decreased lymphocyte counts with consequent alterations in the neutrophil-lymphocyte ratio (NLR), which contribute to endothelial damage and dysfunction.^{4,5} A meta-analysis involving 3,982 patients indicated that NLR values are significantly elevated in preeclamptic patients compared to normotensive pregnant women, with even higher values observed in severe cases.⁶ Furthermore, a Chinese study highlighted the effectiveness of NLR in indicating the clinical status, disease severity, and prognosis of PE patients.³ The identification of suitable biomarkers for diagnosing preeclampsia is crucial, especially given the multifactorial nature of the disease, which encompasses both genetic and environmental factors. While genetic markers can provide accurate diagnoses, they are often costly and inaccessible in many regions, including our country. Therefore, exploring NLR as a potential biomarker for preeclampsia is of paramount importance. Measurement of NLR is not only time-saving but also cost-effective, making it a practical tool for clinical settings.

Although previous studies have established a correlation between inflammatory responses and preeclampsia, there is a notable lack of research specifically addressing the association of NLR with preeclampsia in the Bangladeshi context. While NLR has gained attention as a systemic inflammatory response marker in various diseases, including cardiovascular conditions.⁷⁻¹¹ Its predictive value in preeclampsia remains underexplored. This study aims to investigate the association between NLR and preeclampsia, thereby contributing to a deeper understanding of the pathophysiology of the condition. By elucidating this relationship, the findings may

provide valuable evidence for clinicians to enhance diagnostic strategies for preeclampsia, ultimately aiding in the prevention of its serious consequences. Given the increasing recognition of NLR as a significant marker in systemic inflammation, this research could pave the way for more effective monitoring and management of preeclampsia in pregnant women.

METHODS:

This cross-sectional study was conducted in the Department of Obstetrics and Gynaecology at Sir Salimullah Medical College & Mitford Hospital (SSMCMH), Dhaka over a period of 12 months, from January 2022 to December 2022, following approval from the Ethical Review Committee of SSMCMH. A total of 78 participants were included in the study. The case group (n = 26) consisted of singleton patients diagnosed with preeclampsia, aged 18 to 35 years, and between 28 to 40 weeks of gestation. In contrast, the control group (n=52) comprised healthy singleton pregnant women of the same age range and gestational weeks. Pregnant women with known comorbidities, including diabetes, hypertension, hypothyroidism, systemic lupus erythematosus (SLE), or any maternal infections (e.g., respiratory tract infections, urinary tract infections) were excluded from the study.

Data were processed and analyzed using SPSS (Statistical Package for Social Sciences) software. Categorical data were compared between the case and control groups using the Chi-square (χ^2) test, while continuous data were analyzed using the unpaired t-test. A significance level of 0.05 was set, and p-values of < 0.05 were considered statistically significant.

RESULTS:

In the present study, more than 40% of women with preeclampsia were aged between 25 and 30 years, while an additional 30.8% fell within the 31 – 35 years age range. In contrast, the control group showed a different age distribution: nearly half (48.1%) were aged 18 to 25, 26.9% were between 26 and 30, and 25% were in the 31 to 35 age group. Despite these differences in age

distribution, the statistical analysis revealed no significant age difference between the preeclampsia cases and the controls (27.3 ± 5.3 vs. 35.8 ± 3.3 , $p = 0.184$). Furthermore, no significant differences were found regarding the antenatal care (ANC) received ($p = 0.929$). Although primiparity was more prevalent in the case group compared to the control group, this difference did not reach statistical significance ($p = 0.199$). The distribution of gestational age was similar between the groups (35.5 ± 3.1 vs. 35.8 ± 3.3 , $p = 0.935$) (Table I).

The case group exhibited a significantly higher absolute neutrophil count compared to controls (6.83 ± 1.39 vs $5.56 \pm 1.19 \times 10^9/L$, $p < 0.001$). In contrast, the lymphocyte counts were similar between the two groups (1.85 ± 0.38 and $1.8 \pm 0.34 \times 10^9/L$, $p = 0.699$). The neutrophil-lymphocyte ratio (NLR) was also significantly higher in cases compared to controls (3.7 ± 0.4 vs. 3.0 ± 0.6 , $p < 0.001$) (Table II and Fig. 1). Additionally, both systolic and diastolic blood pressures demonstrated significant positive correlations with NLR ($r = 0.490$, $p < 0.001$ and $r = 0.587$, $p < 0.001$, respectively) (Table III and Fig. 2 & 3).

Table I. Comparison of obstetric history between case and control group

Demographic & Obstetric characteristics	Group		*p-value
	Case (n=26)	Control (n=52)	
Age group (years)			
18-25	7(26.9)	25(48.1)	
26-30	11(42.3)	14(26.9)	
31-35	8(30.8)	13(25.0)	
Mean \pm SD	27.3 ± 5.3	25.4 ± 5.5	0.184**
ANC received			
No ANC	4(15.4)	8(15.4)	
Irregular ANC	15(57.7)	32(61.5)	0.929*
Regular ANC	7(26.9)	12(23.1)	
Parity			
Primipara	9(34.6)	11(21.2)	0.199*
Multipara	17(65.4)	41(78.8)	
Gestational age (in weeks)	35.5 ± 3.1	35.8 ± 3.3	0.935#

Figures in the parentheses indicate corresponding%; *Chi-squared (χ^2) Test was don to analyze the data. # Data were analyzed using Unpaired t-Test and were presented as mean \pm SD.

Table II. Comparison of NLR between cases and control group

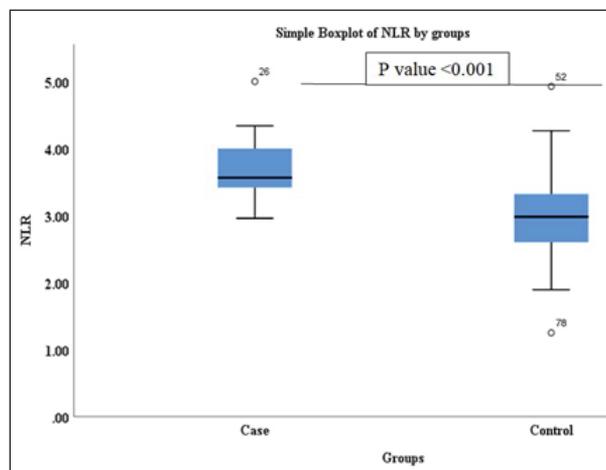
Investigation#	Group		*p-value
	Case (n=26)	Control (n=52)	
Neutrophil count ($\times 10^9/L$)	6.83 ± 1.39	5.56 ± 1.19	< 0.001
Lymphocyte count ($\times 10^9/L$)	1.85 ± 0.38	1.88 ± 0.34	0.699
NLR	3.7 ± 0.4	3.0 ± 0.6	< 0.001

#Data were analyze using Unpaired t-Test and were presented as mean \pm SD.

Table III. Correlation of SBP and DBP with Neutrophil-Lymphocyte ratio (n=78)

Variable	Correlation coefficient (r)	*p-value
SBP	0.490	< 0.001
DBP	0.587	< 0.001

*Spearman rank correlation test was done



p-value was determined by Mann-Whitney U test by comparing median values.

Figure- I : Box and Whisker plot of neutrophil-lymphocyte ratio among cases and controls (n=78)

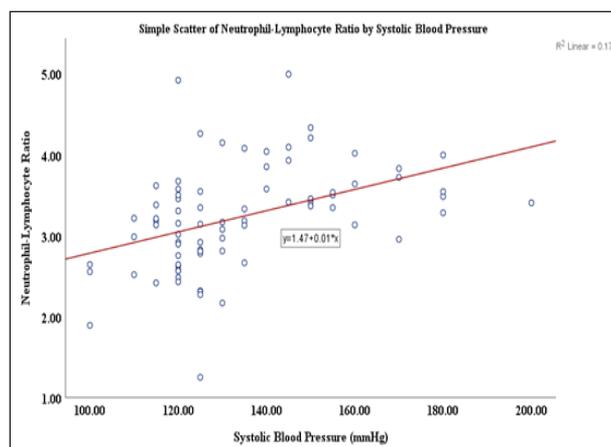


Figure II. Scattered plot diagram showing the correlation between NLR and systolic blood pressure

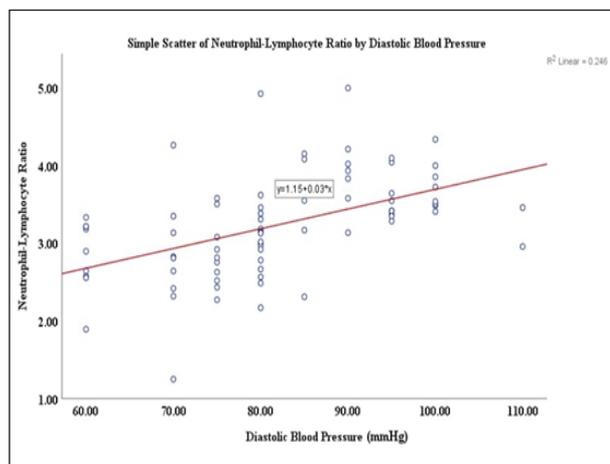


Figure III. Scattered plot diagram showing correlation between neutrophil- lymphocyte ratio and diastolic blood pressure

DISCUSSION:

This study explored the association between the neutrophil-lymphocyte ratio (NLR) & preeclampsia (PE) among pregnant women in Bangladesh. Our findings indicate that women with preeclampsia had significantly higher absolute neutrophil counts and NLR compared to healthy controls, aligning with previous studies.^{6,12} The findings suggest that elevated NLR is indicative of systemic inflammation and may correlate with the severity of preeclampsia. The median(range) NLR was higher in patients with preeclampsia than in healthy pregnant women [3.56(3.41-4.01) and 2.98(2.59-3.33) respectively; $p < 0.001$]. Similarly in Bayram et al¹³ the median NLR values in the preeclampsia and healthy controls were 4.3(1.3-25.1) and 3.9(1.5-17.3) respectively ($p = 0.007$). The significant positive correlations between NLR and both systolic and diastolic blood pressures further support the role of inflammation in the pathophysiology of preeclampsia, as hypertension is a hallmark of this condition.

Despite the higher prevalence of primiparity in the case group, the lack of statistical significance suggests that other factors may contribute to the development of preeclampsia. The similar gestational age distribution between the two groups indicates that our findings are not confounded by differences in pregnancy duration. Given that preeclampsia affects a notable

percentage of pregnancies and poses serious risks, the identification of reliable biomarkers such as NLR could enhance early detection and management strategies.

The significance of NLR as a potential biomarker for preeclampsia is particularly important in the Bangladeshi context, where access to advanced diagnostic tools may be limited. The simplicity and cost-effectiveness of measuring NLR could facilitate its use in routine clinical practice, ultimately improving maternal & fetal outcomes.

CONCLUSION:

The study demonstrates a significant association between elevated NLR and preeclampsia in pregnant women. These findings suggest that NLR may serve as a valuable, cost-effective biomarker for the early diagnosis and monitoring of preeclampsia, particularly in resource-limited settings. Further research is warranted to validate these results and explore the underlying mechanisms linking NLR to the pathophysiology of preeclampsia.

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