

## Original Research Article

# A cross-sectional study of neutrophil to lymphocyte ratio as a reliable inflammatory index among hypertensives in Government Rajaji Hospital, Madurai

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## ABSTRACT

**Background:** Hypertension is a major risk factor to the development of atherothrombosis which is of major health concern today. Neutrophils and platelets play a significant role in the development of atherothrombosis leading to cardiovascular events. Presently, neutrophil lymphocyte ratio and platelet lymphocyte ratio which can be easily calculated from complete blood count have been identified as novel systemic inflammation based indices predictive of cardiovascular risk. This study attempted to assess the relationship between neutrophil lymphocyte ratio and platelet lymphocyte ratio with hypertension.

**Methods:** This cross-sectional study was conducted in 30 hypertensive patients with less than 2 years of duration and in 30 normal healthy adults between ages 40 to 60 years. Anthropometric measurements (height, weight) and blood pressure were measured. Complete blood count was also analyzed. Pearson's correlation factor (r) was used to analyse quantitative data.

**Results:** Both neutrophil lymphocyte ratio and platelet lymphocyte ratio showed a significant positive correlation with systolic BP observed by Pearson's correlation. NLR ( $r=0.847$ ,  $p<0.001$ ) and PLR ( $r=0.209$ ,  $p<0.009$ ).

**Conclusions:** Neutrophil lymphocyte ratio (NLR) and platelet lymphocyte ratio (PLR) can be used as reliable parameters in clinical practice and in epidemiological studies as indices of inflammation among hypertensives.

**Keywords:** Atherothrombosis, Hypertension, Lymphocyte, Neutrophil, Platelet

## INTRODUCTION

Hypertension is a major risk factor to the development of atherothrombosis which is responsible for about 25% of deaths worldwide.<sup>1</sup> Neutrophils and platelets play a major and significant role in the development of atherothrombosis leading to fatal cardiovascular and cerebrovascular events. Presently, neutrophil lymphocyte ratio and platelet lymphocyte ratio which can be easily calculated from complete blood count have been identified as novel systemic inflammation-based indices predictive of cardiovascular risk.<sup>2</sup>

The aim of this study was to assess the relationship between neutrophil lymphocyte ratio (NLR) and platelet lymphocyte ratio (PLR) with blood pressure of both hypertensive patients and normotensive healthy individuals.

## METHODS

### Study design

This study used cross sectional study as the study design and about 60 persons (30 normotensives and 30 hypertensives) were selected as study population.

### Study group

They were divided into two groups. Group I included 30 normotensive healthy individuals of age 40-60 years, both males and females with systolic blood pressure less than 140 mmHg and diastolic blood pressure less than 90 mmHg (BP<140/90 mmHg).

Group II included 30 hypertensive patients of age 40-60 years, both genders with systolic blood pressure more than 140 mmHg and diastolic blood pressure more than 90 mmHg (BP>140/90 mmHg).

### Study period

The study period spanned over a period of 5 months from April to August 2019. The study was conducted at the non-communicable diseases out patient department (NCD OPD) inside the premises of Government Rajaji Hospital, Madurai.

### Inclusion criteria

30 normotensive subjects aged 40-60 years were recruited from medicine out patient department.

30 hypertensive patients with blood pressure more than 140/90 mm Hg (according to Joint National Commission JNC 7 guidelines) aged 40-60 years, both males and females with duration of HT with less than 2 years duration and with treatment were recruited from non-communicable diseases OPD at Government Rajaji Hospital, Madurai.

### Exclusion criteria

Persons with the following diseases were excluded from this study namely 1) diabetes mellitus, 2) inflammatory conditions like tuberculosis (TB), rheumatoid arthritis (RA), systemic lupus erythematosus (SLE) and osteoarthritis (OA), 3) acute coronary syndrome, 4) cerebrovascular disease 5) history of glucocorticoid

therapy 6) any recent acute infection, 7) chronic renal disease, hepatic disease.

### Materials and methodology

After getting ethical clearance from the Institutional Ethics Committee, Informed oral and written consent were obtained from all study participants. A detailed clinical history was elicited from both the normotensive (group I) and hypertensives individuals (group II). Anthropometric parameters like height was measured using Stadiometer and weight was measured using digital weighing scale. Body mass index was calculated using Quetlet's index  $BMI (kg/m^2) = \text{Weight in kg}/(\text{Height in m})^2$ .

Blood pressure was measured using mercury sphygmomanometer in the sitting position in both arms after 5 minutes of rest and higher reading of the two was considered. A thorough general and systemic examination was also done. Under strict aseptic precautions 2 ml venous blood sample was collected from the medial cubital vein in a EDTA test tube and sent to Central Laboratory at Government Rajaji Hospital, Madurai. Complete blood count was measured using the auto analyzer. The ratio between neutrophil and lymphocyte and the ratio between platelet and lymphocyte was calculated.

The normal value of neutrophil lymphocyte ratio is 0.78 to 3.53 and that of platelet lymphocyte ratio is 36.6 to 149.13.<sup>3</sup>

Student t test and Pearson's correlation coefficient test was applied to evaluate the correlation by SPSS software 17. P value <0.05 was considered significant.

The mean and standard deviation of the above measured parameters like body mass index, blood pressure, neutrophil lymphocyte ratio and platelet lymphocyte ratio were calculated in both the groups and are as follows as shown in Table 1.

**Table 1: Descriptive measurements of group I and group II.**

	Group I normotensives		Group II hypertensives		P value	Significance
	Mean	SD	Mean	SD		
Age	50.8	6.08	50.36	6.37	0.789	Not significant
BMI	22.74	3.09	24.59	3.139	0.025	Significant
BP	118/75	11.36	146/91	12.28	<0.001	Significant
NLR	1.557	0.37	2.991	0.496	<0.001	Significant
PLR	80.164	17.4	69.849	11.516	<0.001	Significant

## RESULTS

NLR was increased in hypertensives (group II- 2.99) than the normotensives (group I- 1.56).

About 20% of hypertensives were at increased risk of atherothrombosis. Hypertensives who took regular treatment for BP control, have less NLR, indicating lesser chance of developing atherosclerosis.

Also patients who were obese (body mass index >30) had increased chances of developing atherothrombosis (higher NLR) and is shown as follows in Table 2.

**Table 2: Correlation of body mass index with neutrophil lymphocyte ratio and platelet lymphocyte ratio in hypertensives.**

Case	Correlation coefficient	Correlation
<b>BMI versus NLR</b>	0.634	Good
<b>BMI versus PLR</b>	0.14	Low

## DISCUSSION

Hypertension is one of the commonly occurring chronic inflammatory disease.

Inflammatory response is the prime mechanism in the pathogenesis and its progression to atherosclerotic events.<sup>4</sup>

High blood pressure more than 140/90 mmHg in any individual stretches the arterial wall more. Vascular remodeling occurs. Media thickness increases constantly and extracellular matrix gets deposited. Vasoactive peptides get released and forms reactive oxygen species. This causes endothelial damage leading to oxidation of LDL. Leukocytes get recruited. Neutrophils secrete inflammatory mediators like cytokines, chemokines, leukotrienes and prostaglandins especially IL-8, TNF alpha, GM-CSF, LTB<sub>4</sub> and PGE<sub>2</sub>.<sup>5</sup> These cause degenerative changes in the vascular wall. Plaque starts building up and finally they are prone for rupture leading to fatal cardiovascular and cerebrovascular events. Lymphocytes have antiatherosclerotic role and modulates immunological response while increased platelet activation triggers atherosclerosis by forming platelet-rich thrombi.<sup>6</sup> Therefore high neutrophil and platelet counts reflect the underlying inflammatory response and low lymphocyte count is an index of physiologic stress and systemic failure.

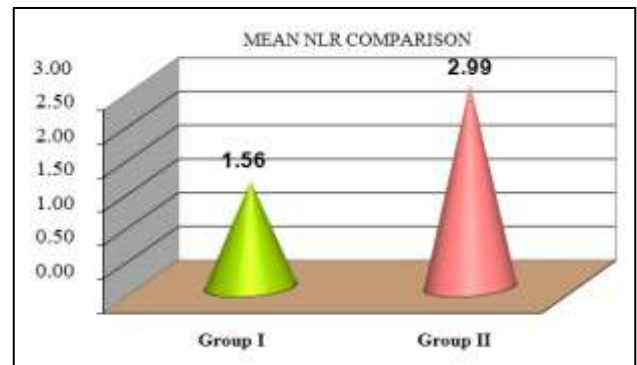
Neutrophil lymphocyte ratio (NLR) is a simple ratio that is calculated between the neutrophil and lymphocyte counts measured in peripheral blood.<sup>7</sup> Platelet lymphocyte ratio (PLR) can also be calculated in a similar way. NLR reflects the balance between systemic inflammation and immunity. Presently neutrophil lymphocyte ratio, platelet lymphocyte ratio have been proposed as inflammatory indices and potential predictors of risk and prognosis of cardiovascular and cerebrovascular diseases.<sup>8</sup>

Normally C-reactive protein and carotid intima media thickness have been considered as the best predictors of cardiovascular risk.<sup>9</sup> While these investigations are too expensive in day to day practice, the total WBC count and the differential count are very cost effective and easy to perform investigations. The neutrophil lymphocyte

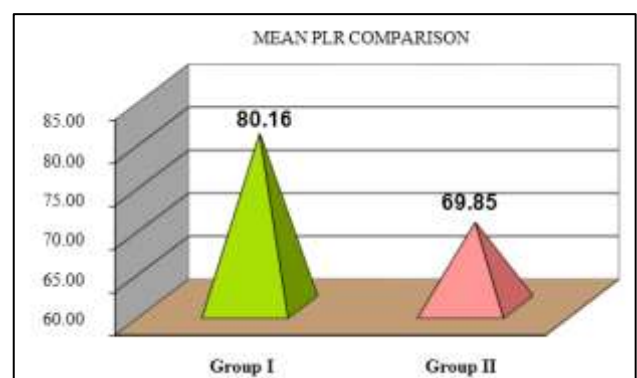
ratio (NLR) and platelet lymphocyte ratio (PLR) can easily be calculated from the differential count. So neutrophil lymphocyte ratio (NLR) and platelet lymphocyte ratio (PLR) which are cost effective can be used as indicators and predictors of cardiovascular risk.<sup>10</sup>

In this study, about 30 normotensive healthy individuals and 30 hypertensive patients were included. Anthropometric parameters like height, weight and blood pressure were recorded for all participants. Blood sample was also taken. Neutrophil lymphocyte ratio and platelet lymphocyte ratio were calculated. It was evidenced that body mass index (BMI) was higher in hypertensive group (group II) than in normotensive group (group I).

On analysing the blood counts, the present study showed significantly higher neutrophil and lymphocyte counts in hypertensive patients (group II) than in normotensive subjects (group I) which is in accordance with following studies such as Kumar et al and Balta et al.<sup>11</sup> This fact has been reinforced in Figures 1 and 2.



**Figure 1: Comparison of mean neutrophil lymphocyte ratio between group I normotensives and group II hypertensives.**



**Figure 2: Comparison of mean platelet lymphocyte ratio between group I normotensives and group II hypertensives.**

Limitations of this study are that this study has to be done on a large population. The markers mentioned in this study needs to be compared with standard inflammatory markers like C-reactive protein to enhance its validity.

## CONCLUSION

In this study, neutrophil lymphocyte ratio has a strong correlation with hypertension than platelet lymphocyte ratio. Neutrophil lymphocyte ratio and platelet lymphocyte ratio are simple, available, economic, non-invasive, practical, reproducible and easily measurable tools. Hence in epidemiological studies and clinical practice, these parameters can be recommended in all Hypertensive patients in routine clinical setting as potential predictors of cardiovascular risk. Also since NLR is a routinely performed test it can be used as a disease monitoring tool to emphasize on the strict control of Hypertension so as to prevent future complications.

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