

Study of Neutrophil to Lymphocyte Ratio and Platelet to Lymphocyte Ratio in Hypertensives and Normotensives

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ABSTRACT

Background and Aim: Long-term hypertension proceed to development of atherothrombotic disease and it's a major healthcare problem worldwide. Platelets and neutrophils play an important role in Cardiovascular (CV) events and development of atherothrombotic disease. Recently, Neutrophil/Lymphocyte Ratio (NLR) and Platelet/Lymphocyte Ratio (PLR), which can be easily calculated from the differential blood count, have been proposed as novel systemic inflammation-based markers predictive of thrombotic events. The aim of the present study was to explore the association between NLR and PLR with hypertension and as an indicator of cardiovascular risk. **Methods:** It's a cross sectional study. 50 Hypertensive patients aged 40 – 60 years, males and females with the history of Previously diagnosed hypertension >1 year duration or taking anti-hypertensive medications with blood pressure Systolic BP > 140 mm Hg, Diastolic BP > 90 mmHg were taken as study group. 50 normotensives aged 40 – 60, males and females with Systolic BP < 140 mmHg, Diastolic BP < 90 mmHg were taken as control group, who were matching socio-economically with study group. A detailed history and physiological parameters were taken. Blood pressure was measured via auscultatory method using sphygmomanometer. Under aseptic precautions, 3 ml of venous blood samples were collected and analysed. **Results:** Neutrophil to Lymphocyte Ratio (NLR) was significantly higher ($p < 0.01$) in study group. Platelet to Lymphocyte Ratio (PLR) was also higher in study group but statistically not significant ($p > 0.05$). **Conclusion:** Hypertensives with higher NLR have greater risk for athero-thrombotic and atherosclerotic events.

Key words: Hypertension, Neutrophil, Lymphocyte, Platelet.

INTRODUCTION

Hypertension (HT) is a modern day's epidemic. In an analysis of worldwide data for the global burden of HT, 20.6% of Indian men and 20.9% of Indian women were suffering from HT in 2005. The rates for HT in percentage are projected to go up to 22.9% and 23.6% for Indian men and women, respectively by 2025.^[1,2]

Long-term hypertension proceeds to development of atherothrombotic disease. Atherothrombotic diseases are a major healthcare problem and are responsible for >25% of all deaths worldwide. The development of a clot in the coronary or cerebral circulation causes acute myocardial infarction or ischemic stroke, is now the single most common cause of morbidity and mortality globally and the prevalence of these diseases continues to rise, particularly in developing nations.^[3]

Platelets and neutrophils play an important role in Cardiovascular (CV) events and development of atherothrombotic disease.^[4,5] Recently, Neutrophil/Lymphocyte Ratio (NLR) and Platelet/Lymphocyte ratio (PLR), which can be easily calculated from the differential blood count, have been proposed as novel systemic inflammation-based markers predictive of thrombotic events.^[6] NLR reflects inflamma-

tion and physiologic stress PLR reflects platelet and clotting system activation, local vessel wall inflammation and endothelial dysfunction. NLR and PLR is a ratio, it is relatively more stable than individual blood parameters that can be altered by several variables.^[5,7,8] So our study is required to explore the association between NLR and PLR with hypertension and as an indicator of cardiovascular risk.

MATERIALS AND METHODS

The study was approved by the Institutional Ethical Committee of Government Medical College of Surat. Written informed consent was obtained from each participant prior to the study.

Two groups were taken. 50 Hypertensive patients aged 40 – 60 years, males and females with the history of Previously diagnosed hypertension >1 year duration, or taking anti-hypertensive medications with blood pressure Systolic BP > 140 mm Hg, Diastolic BP > 90 mmHg were taken as study group. They were recruited from out-patient clinics of medicine department, New Civil Hospital Surat. 50 normotensives aged 40 – 60, males and females with Systolic BP < 140 mmHg, Diastolic BP < 90 mmHg were taken as control group, who were matching

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socio-economically with study group. Any systemic disease other than hypertension like Diabetes mellitus, Tuberculosis, Rheumatoid arthritis, Osteoarthritis, systemic lupus erythematosus etc., patients using medical treatment affecting WBC count like hematopoietic disorders, treatment with chemotherapy, any present illness, acute infection in last 6 months (typhoid, malaria, pharyngitis etc), acute coronary syndrome, etc., history of using glucocorticoid therapy within past 3 months, history of heart failure, chronic renal disease, hepatic disease, cerebrovascular disease were excluded from the study.^[9]

A detailed history of both hypertensives and normotensives were taken. The physiological parameters like height, weight, pulse rate, blood pressure were taken. Blood pressure was measured in sitting position after 5 min rest via auscultatory method using sphygmomanometer (mercury manometer) in both the arms. Higher of the two readings was taken and if the systolic and diastolic BP were in different categories, the higher of 2 was classified. General and systemic examinations were done thoroughly. 3 ml of venous blood samples were collected in EDTA vacuttes from median cubital vein under aseptic precautions and analysed by ABX MICROS 60 hematology-autoanalyser in haematology laboratory, Department of Pathology, New Civil Hospital Surat.

BMI, pulse pressure, mean arterial pressure, neutrophil to lymphocyte ratio and platelet to lymphocyte ratio were calculated. The data between two groups were compared by using unpaired t-test. *P* value < 0.05 was considered as statistically significant. In the study group, Correlation between blood pressure and neutrophil, lymphocyte, platelets, NLR and PLR were found by calculating Pearson's correlation factor (*r*). All statistical analysis were done in SPSS software version 17.

RESULTS

Table 1 shows the comparison of age, height, weight, BMI between two groups weren't statistically significant (*p*>0.05). Both groups were comparable to each other.

Table 2 shows the pulse, systolic blood pressure, diastolic blood pressure, pulse pressure, mean arterial pressure in study and control groups.

When compared to normotensives, Neutrophil, lymphocyte and platelet counts were significantly higher (neutrophil-*p*<0.01, lymphocyte-*p*<0.05, platelet-*p*<0.01) in study group (Table 3)

Table 4 shows that Neutrophil to Lymphocyte Ratio (NLR) was significantly higher (*p*<0.01) in study group. Platelet to Lymphocyte Ratio (PLR) was also higher in study group but statistically not significant (*p*>0.05).

Table 5 shows that Neutrophil counts were showing significant positive correlation with SBP (*p*<0.01), DBP (*p*<0.01), PP (*p*<0.01) and MAP (*p*<0.01). Lymphocyte counts were showing significant positive correlation with SBP (*p*<0.01), DBP (*p*<0.01), PP (*p*<0.01) and MAP (*p*<0.01). Platelet counts were showing significant positive correlation with SBP (*p*<0.01), DBP (*p*<0.01), PP (*p*<0.05) and MAP (*p*<0.01). NLR was showing significant positive correlation with SBP (*p*<0.01), DBP (*p*<0.01), PP (*p*<0.05) and MAP (*p*<0.01). PLR was showing significant positive correlation with DBP (*p*<0.05) and MAP (*p*<0.05).

DISCUSSION

In the present study, 50 hypertensives and 50 normotensives were taken. Age, height, weight, blood pressure were recorded and blood samples were analysed from all the participants. BMI were calculated from height and weight. In the present study we found that age, height, weight and BMI between two groups weren't statistically significant. (Table 1) Both the groups, Hypertensives (study group) and normotensives (control group) were comparable to in terms of age, height, weight and BMI. we found pulse rate, Systolic blood pressure, diastolic blood pressure, pulse

Table 1: Comparison of age, height, weight and BMI between study and control groups.

	Study group	Control group	P value
Age	48.88±7.18	47.84±7.04	>0.05
Height	154.16±7.64	153.8±8.77	>0.05
Weight	67.78±10.58	65.34±6.72	>0.05
BMI	28.56±4.18	27.73±3.13	>0.05

Table 2: Pulse, systolic blood pressure, diastolic blood pressure, pulse pressure, mean arterial pressure in study and control groups.

	Study group	Control group	P value
Pulse	83.08±4.39	79.6±4.16	<0.01
Systolic blood pressure	146.24±6.53	119.16±3.43	<0.01
Diastolic blood pressure	91.56±1.95	78.4±2.09	<0.01
Pulse Pressure (PP)	54.68±5.21	40.76±2.61	<0.01
Mean Arterial Pressure (MAP)	109.79±3.27	91.98±2.31	<0.01

Table 3: Neutrophil, lymphocyte and platelet counts in study and control groups.

	Study group	Control group	P value
Neutrophil	5977.82±1242.66	4027.9±707.76	<0.01
Lymphocyte	2458±712.83	2122.4±554.33	<0.05
Platelets	296060±85821.9	245840±52600	<0.01

pressure and mean arterial pressure were significantly higher in hypertensives (Table 2) which is in accordance with the study of Pusuroglu H *et al.* who had shown Isolated systolic hypertensive and Systo-diastolic hypertensive groups have higher SBP, DBP and PP as compare to Normotensive group.^[10]

Hypertension is a chronic inflammatory condition. The total white blood cell (WBC) count and its subtypes (e.g. neutrophil, lymphocyte) can be used as an indicator of systemic inflammation.^[11,12] Present study shows significantly higher Neutrophil and Lymphocyte counts in hypertensive than Normotensive (Table 3) which is in accordance with following studies. Tatsukawa Y *et al.* were observed a significant association between increased neutrophil counts and hypertension incidence among Japanese population especially in women. They concluded that neutrophils are the major WBC component contributing to the increased risk.^[13] Platelets are also playing an important role in Cardiovascular (CV) events. Activated platelets stimulate thrombus formation in response to rupture of atherosclerotic plaques or endothelial cell erosion, promoting athero-thrombotic disease.^[5] Study conducted by Nadar S *et al.* had shown decreased platelet counts but significantly increased mean platelet volume in hypertensive patients with end organ damage. Mean platelet volume has been shown to be a marker of platelet activation, which plays important role in pathophysiology of atherosclerosis.^[14]

Present study shows significantly higher NLR in hypertensives (Table 4) which is in accordance with the following studies. Park B *et al.* found that higher NLR was independently associated with arterial stiffness and they concluded that high NLR is an additional measure in assessing cardiovascular risk in clinical practice.^[15] Sunbul M *et al.* reported that non-dipper hypertensive have significantly higher NLR.^[9] Study conducted

Table 4: Neutrophil to Lymphocyte Ratio (NLR) and platelet to lymphocyte ratio (PLR) in study and control groups.

	Study group	Control group	P value
NLR	2.55±0.61	1.97±0.41	<0.01
PLR	129.25±48.49	122.51±36.49	>0.05

Table 5: Correlation between systolic blood pressure, diastolic blood pressure, pulse pressure and mean arterial pressure with neutrophil, lymphocyte, platelets, NLR and PLR in study group.

		SBP	DBP	PP	MAP
Neutrophil	r	0.535**	0.522**	0.519**	0.530**
Lymphocyte	r	0.401**	0.368**	0.432**	0.383**
Platelet	r	0.412**	0.442**	0.324*	0.430**
NLR	r	0.414**	0.439**	0.335*	0.429**
PLR	r	0.256	0.308*	0.140	0.287*

r- Pearson's correlation factor

*- Significant ($P < 0.05$), **- Highly significant ($P < 0.01$)

by Pusuroglu H *et al.* had shown significantly higher NLR in isolated systolic hypertensive groups.^[10] Cem O *et al.* found that NLR is a marker of chronic low grade inflammation and play a role in the pathogenesis of aneurysm of the ascending aorta in hypertensive patients.^[16] This studies showing that hypertensives have higher NLR, which has been demonstrated to have the greatest predictive power of death, myocardial infarction and high risk for coronary artery disease and it's an independent predictor of long-term mortality.^[17]

Research has shown that increased PLR value without absolute thrombocytosis is associated with thrombosis and inflammation, which might be due to an increase in platelet activity.^[18-20] Present study shows higher PLR in hypertensives but it's not statistically significant. (Table 4) Sunbul M *et al.* reported that PLR was significantly higher in dipper hypertensives.^[9] Bayrakci N *et al.* found that PLR was significantly higher in the non-dipper hypertension group than the dipper hypertension group and they concluded that the PLR can be used in daily practice as a marker of inflammation. This study also shows that a high PLR might be indicative of high atherosclerotic risk in hypertensive patients.^[21] This study showing that hypertensives have higher PLR and it reflects platelet and clotting system activation, local vessel wall inflammation and endothelial dysfunction.^[8]

In the present study (Table 5), Neutrophil counts showing significant positive correlation with SBP, DBP, PP and MAP which is in accordance with the study conducted by Pusuroglu H *et al.* Lymphocyte counts were showing significant positive correlation with SBP, DBP, PP and MAP. NLR showing significant positive correlation with SBP, DBP, PP and MAP. Belen E *et al.* had shown that NLR was positively correlated with SBP and DBP. Pusuroglu H *et al.* found significant positive correlation of NLR with SBP and PP.^[10,22] In our study platelet counts showing significant positive correlation with SBP, DBP, PP and MAP. PLR showing significant positive correlation with DBP and MAP.

Nowadays, interest in the study of NLR and PLR increased because absolute neutrophil and lymphocyte counts as well as platelet counts are easy to obtain as parts of Complete Blood Count (CBC) analysis and their ratios found to be predictive of the prognoses of patients with diverse inflammatory and ischemic conditions. It is a cost effective measure, which we can apply to all patients.^[23,24]

CONCLUSION

The present study was conducted to explore the association between NLR and PLR with hypertension. We found that hypertensives have significantly higher NLR and non-significantly higher PLR as compare to normotensives. Therefore, it can be concluded that hypertensives with higher NLR have greater risk for athero-thrombotic and atherosclerotic events. NLR reflects inflammation and physiologic stress and it is relatively more stable than individual blood parameters. NLR is a reliable inflammatory index and have high predictive power to detect adverse cardiovascular events in hypertensive patients. Regarding this, we can add NLR to routine investigating strategy for hypertensive patients to predict cardiovascular risk early and more accurately. These results can be used on regular basis. As our study consist of small groups, it requires to be studied on a wider scale and clinically.

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None

CONFLICT OF INTEREST

None

ABBREVIATIONS

NLR: Neutrophil/lymphocyte ratio; **PLR:** Platelet/lymphocyte ratio.

SUMMARY

Long-term hypertension proceed to development of atherothrombotic disease and it's a major healthcare problem worldwide. Platelets and neutrophils play an important role in Cardiovascular (CV) events and development of atherothrombotic disease. Recently, Neutrophil/Lymphocyte Ratio (NLR) and Platelet/Lymphocyte Ratio (PLR), which can be easily calculated from the differential blood count, have been proposed as novel systemic inflammation-based markers predictive of thrombotic events. The aim of the present study was to explore the association between NLR and PLR with hypertension and as an indicator of cardiovascular risk.

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Neutrophil to Lymphocyte Ratio (NLR) was significantly higher ($p < 0.01$) in study group. Platelet to Lymphocyte Ratio (PLR) was also higher in study group but statistically not significant ($p > 0.05$).

Hypertensives with higher NLR have greater risk for athero-thrombotic and atherosclerotic events.

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