Original Research Article

# Comparative study on neutrophil-lymphocyte ratio (NLR) among diabetic cases with and without diabetic retinopathy

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## ARTICLE INFO

## ABSTRACT

**Background:** White blood cells especially neutrophils and lymphocytes play a major role in modulating the inflammatory response and thus it could be a potential inflammatory marker. To assess the same this study was conducted to compare the Neutrophil-Lymphocyte Ratio (NLR) among the type 2 diabetes mellitus cases with and without diabetic retinopathy.

**Materials and Methods:** This case control study was conducted among the patients with diabetes mellitus attending the outpatient and inpatient department of Ophthalmology, Karpaga Vinayaga Institute of Medical Sciences and Research Center, Tamil Nadu during months of October 2019 to December 2019. A total of 160 patients were included in the study of whom 80 were cases of diabetes mellitus with diabetic retinopathy and another 80 were cases of diabetes mellitus without diabetic retinopathy (DR). Data was entered in Microsoft excel and data analysis was done using Statistical Package for Social Sciences (SPSS) version 20.

**Results:** Total white blood cells, neuterophils, lymphocytes and neutrophil - lymphocyte ratio (NLR) were found to be statistically significant between the diabetic retinopathy and diabetes mellitus groups. NLR among the diabetic retinopathy and diabetes mellitus group was found to be 2.15 ± 0.5 and 1.91 ± 0.61, respectively (p<0.000).

**Conclusion:** NLR is an efficient and stable marker of inflammation, can serve as an important predictor in the assessment of diabetic retinopathy among cases with type 2 diabetes mellitus.

**Key message:** Cases with DR were found to have increased NLR than the cases with diabetes mellitus alone. Hence NLR can be added to routine screening process of all diabetes mellitus cases and if elevated cases can be subjected to ophthalmologist.

## 1. Introduction

Diabetes is a major public health concerns worldwide, especially type 2 DM.[1] The world health organisation (WHO) estimated the increase in type 2 DM approximately 46%, from 55 million in 2000 to 83 million in 2030 in developed nation; whereas, developing nation may increase approximately from 30 million in 2000 to 80 million in 2030, accounting for 150% increase.[1] India being top in the chart with estimated tendency to increase from 31.7 million in 2000 to 79.4 million out of 366 million worldwide by 2030, making India in the process of making diabetic capital of the world.[1,2]

One of the common complications of diabetic mellitus on eye is diabetic retinopathy. Its manifestation is linked to the duration of diabetes, as proved by Wisconsin epidemiological study. Hence the occurrence of the retinopathy cannot be prevented; its sight-threatening complication can be lowered. Diabetic retinopathy is also anticipated to be increasing in alarming fashion. It accounts for 4.8% of the global cause for blindness.[3] Prevalence in India ranges from 7.3% to 25% from various regions of India, with higher rate in west and south India.[4–6]

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Diabetic macular edema is commonest cause of visual impairment in diabetic patient[7]. Many studies have shown the inflammation has important role in pathogenesis of diabetic retinopathy as its pathogenesis is yet to be fully understood.[8] WBC count and its subtypes are classic inflammatory markers in cardiovascular disease.[8] The novel neutrophil to lymphocyte ratio (NLR) is a potential, reliable, predictive marker of inflammation in cardiac and non-cardiac diseases.[9] NLR is found to be superior to routine total leucocyte count in various studies.[10] In recent study the systemic neutrophil count was found to be elevated and associated with diabetic retinopathy and severity of diabetic retinopathy[11] The deranged immune cellular component with its chemical mediators has been associated with arterial stiffness, the early indicator for subclinical atherosclerosis and altering blood retinal barrier resulting in chronic inflammatory arrays of comorbidities.[12] Hence it could serve as an independent predictor of vascular co-morbidities in diabetic retinopathy as it does in cardiovascular events[12] NLR is basic, standard and cost effective laboratory investigation and it could help in diagnosing and progress of complication in follow up in diabetic patients. As NLR is not widely studied in Indian population, we would like to compare the NLR among diabetic patients with and without diabetic retinopathy.

## 2. Objectives

To compare the Neutrophil-Lymphocyte Ratio among the type 2 diabetes mellitus cases with and without diabetic retinopathy.

## 3. Materials and Methods

This case control study was conducted among the patients with diabetes mellitus attending the outpatient and inpatient department of Ophthalmology, Karpaga Vinayaga Institute of Medical Sciences and Research Center, Maduranthagam, Tamil Nadu during months of October 2019 to December 2019. All cases with diabetic retinopathy attending the department of ophthalmology during the study period were included as cases and each case was age matched (± 2 years) with one control, who were known case of diabetes mellitus without diabetic retinopathy. Cases with known inflammatory or infectious diseases and cases on treatment with chronic anti-inflammatory and Immuno-suppressant drugs were excluded from the study. A total of 160 patients were included in the study of whom 80 were cases of diabetes mellitus with diabetic retinopathy and another 80 were cases of diabetes mellitus without diabetic retinopathy.

The principal investigator explained the purpose of the study to each participant and a written consent was obtained from the participants prior to the commencement of the study. The participants were also informed that their participation was voluntary and that they could withdraw from the interview at any time without consequences. Every effort was made, to be sure that all information collected from the participants, remain confidential.

The study was conducted using a questionnaire, covering particulars related to clinical profile of the patients. Following which venous blood samples were collected and analysed for complete blood counts (CBC), fasting blood sugars (FBS), post prandial blood sugars (PPBS), HbA1c and fasting lipid profile (FLP). All results were entered in the same proforma.

Data was entered in Microsoft excel and data analysis was done using Statistical Package for Social Sciences (SPSS) version 20. Statistical tests like descriptive statistics, independent sample t test and chi square test were done appropriately. P value of less than 0.05 (p< 0.05) is considered as significant, in this study.

## 4. Results

In this study the mean age of the study participants in the diabetic retinopathy and diabetes mellitus group was 57.36 ± 8.35 years and 55.24 ± 10.83 years, respectively. Also both the groups were male predominant with 57.5% and 52.5% of participants in diabetic retinopathy and diabetes mellitus group, respectively. Hypertension was reported among 15% and 13.7% of cases in diabetic retinopathy and diabetes mellitus group, respectively. Mean duration of diabetes mellitus was found to be 11.6 ± 3.25 years and 5.45 ± 3.61 years in diabetic retinopathy and diabetes mellitus group, respectively. Also the differences in duration of diabetes mellitus between both groups were found to be statistically significant (p< 0.000). There was no difference between the two groups with respect to age, gender, body mass index, family history of diabetes mellitus, smoking and alcohol consumption.

On comparing the complete blood count parameters, total white blood cells, neuterophils, lymphocytes and Neutrophil-lymphocyte ratio (NLR) were found to be statistically significant between the diabetic retinopathy and diabetes mellitus groups. NLR among the diabetic retinopathy and diabetes mellitus group was found to be 2.15 ± 0.5 and 1.9 ± 0.61, respectively.

On comparing the blood sugars between diabetic retinopathy and diabetes mellitus groups, all the parameters like fasting blood sugars, post prandial blood sugars and HbA1c were found to be significantly high among the diabetic retinopathy group compared to diabetes mellitus alone group. Whereas lipid parameters like total cholesterol, high density lipoproteins, low density lipoproteins and triglycerides does not show any significant difference between diabetic retinopathy and diabetes mellitus groups.

**Table 1:** Clinical profile of the study participants

| Variables | Diabetic retinopathy (N=80) | Diabetes mellitus (N=80) | P value |
|---|---|---|---|
| **Mean Age (in years)** | 57.36±8.35 | 55.24±10.83 | 0.167 |
| **Gender** | | | |
| Male | 46 (57.5) | 42 (52.5) | 0.525 |
| Female | 34 (42.5) | 38 (47.5) | |
| **Mean Body Mass Index** | 28.65±3.11 | 27.93±4.30 | 0.226 |
| **Hypertension** | | | |
| Present | 12 (15) | 11 (13.7) | 0.821 |
| Absent | 68 (85) | 69 (86.3) | |
| **Mean duration of DM (in years)** | 11.6±3.25 | 5.45±3.61 | 0.000* |
| **Family history of DM** | | | |
| Present | 28 (35) | 31 (38.7) | 0.623 |
| Absent | 52 (65) | 49 (61.3) | |
| **Smoking habit** | | | |
| Yes | 12 (15) | 9 (11.3) | 0.482 |
| No | 68 (85) | 71 (88.7) | |
| **Alcohol consumption** | | | |
| Yes | 10 (12.5) | 14 (17.5) | 0.375 |
| No | 70 (87.5) | 66 (82.5) | |

*Significant

**Table 2:** Comparison of Hemoglobin and blood counts among cases with and without diabetic retinopathy

| Hemoglobin and blood counts | Diabetic retinopathy (N=80) | Diabetes mellitus (N=80) | P value |
|---|---|---|---|
| Hemoglobin (g/dl) | 12.45 ± 2.7 | 12.7 ± 2.5 | 0.544 |
| Total WBC (x$10^3$/$\mu$L) | 7.01 ± 2.43 | 8.14 ± 2.4 | 0.003* |
| Neutrophils (x$10^3$/$\mu$L) | 4.12 ± 1.24 | 3.04 ± 0.76 | 0.000* |
| Lymphocytes (x$10^3$/$\mu$L) | 2.31 ± 0.71 | 1.92 ± 0.34 | 0.000* |
| Neutrophil-lymphocyte ratio (NLR) | 2.15 ± 0.5 | 1.91 ± 0.61 | 0.006* |

*Significant

**Table 3:** Comparison of sugar and cholesterol profile among cases with and without diabetic retinopathy

| Laboratory investigations | Diabetic retinopathy (N=80) | Diabetes mellitus (N=80) | P value |
|---|---|---|---|
| FBS (mg/dl) | 194.5 ± 24.3 | 156.7 ± 20.5 | 0.000* |
| PPBS (mg/dl) | 247.45 ± 43.4 | 221.45 ± 33.8 | 0.000* |
| HbA1c (%) | 8.13 ± 0.7 | 6.8 ± 0.4 | 0.000* |
| Total cholesterol (mg/dl) | 185.4 ± 53.3 | 180.3 ± 48.3 | 0.526 |
| High Density Lipoprotein (mg/dl) | 41.3 ± 13.5 | 43.1 ± 11.4 | 0.363 |
| Low Density Lipoprotein (mg/dl) | 124.6 ± 47.8 | 131.5 ± 41.9 | 0.333 |
| Triglycerides (mg/dl) | 142.8 ± 56.3 | 149.3 ± 50.3 | 0.442 |

*Significant

## 5. Discussion

The present study showed that neutrophil-lymphocyte ratio was significantly higher in patients with diabetic retinopathy than the cases with diabetes mellitus alone. White blood cells and their subtypes play a major role in modulating the inflammatory response in cardiovascular disease.[9] Among the white blood cells neutrophils and lymphocytes plays a vital role as an inflammatory marker.

Neutrophil-lymphocyte ratio was defined as a novel potential marker to determine inflammation in cardiac and noncardiac disorders.[13] Neutrophil-lymphocyte ratio can be easily calculated by the ratio of neutrophils to lymphocytes in peripheral blood. Calculation of Neutrophil-lymphocyte ratio is a very simple method compared with assessment of other inflammatory markers.[14,15]

Clinical studies have shown elevated levels of pro-inflammatory cytokines in the vitreous fluid of patients

with proliferative diabetic retinopathy, which are related to the activity and progression of retinal injury. These data highlighted the central and causal role of chronic low-grade subclinical inflammation in the pathogenesis of diabetic retinopathy. [16]

In our study, the mean Neutrophil-lymphocyte ratio among diabetic patients with retinopathy was significantly higher compared to patients with diabetes mellitus alone (p < 0.001).

The findings of this study is consistent with the study conducted by Ulu S et al who reported that Neutrophil-lymphocyte ratio values of the diabetic patients with diabetic retinopathy were higher than those of patients without retinopathy. [17]

Another study, conducted by Yue S et al also had reported similar finding that patients with diabetic retinopathy had higher neutrophil-lymphocyte ratio levels than diabetic patients without evidence of the disease. [18]

## 6. Conclusion

This study proves that NLR is significantly elevated among cases with diabetic retinopathy than cases with diabetes mellitus alone. NLR can be included in the routine screening assessment for diabetes mellitus patient as it can be easily calculated from a simple peripheral blood count and cost effective measure than measuring other inflammatory markers. Hence we conclude that neutrophil-lymphocyte ratio (NLR), is an efficient and stable marker of inflammation, can serve as an important predictor in the assessment of diabetic retinopathy among cases with type 2 diabetes mellitus.

## 7. Acknowledgment

## 8. Source of Funding

## 9. Conflict of Interest

None declared.

## 10. Ethical approval

This study was registered with Institutional Human Ethical Committee.

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## Author biography

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