Effect of Non-surgical Periodontal Therapy on Platelet-to-Lymphocyte Ratio and Neutrophil-to-Lymphocyte Ratio in Chronic Periodontitis

Nida Malik1,*, Veena Kalburgi1, Saba Malik1, Sumeedha Srivastava1, Harshita Verma1, Kalpana Sharma Rai1

1 Department of Periodontology, People’s College of Dental Sciences and Research Centre, Bhopal, Madhya Pradesh, INDIA.
2 Department of Periodontology, People’s College of Dental Sciences and Research Centre, Bhopal, Madhya Pradesh, INDIA.
3 Consultant Postgraduate, Bhopal, Madhya Pradesh, INDIA.
4 Department of Periodontology, People’s College of Dental Sciences and Research Centre, Bhopal, Madhya Pradesh, INDIA.
5 Department of Periodontics, Bhabha Toothpaste Dental College, Pune, Maharashtra, INDIA.
6 Department of Endodontics, People’s College of Dental Science and Research Center, Bhopal, Madhya Pradesh, INDIA.

ABSTRACT

Introduction: Haematological investigations have for long being considered as potential diagnostic and prognostic markers in the pathogenesis of Chronic Periodontitis. An exaggerated understanding of these markers with the consideration of relatively new markers Neutrophil to Lymphocyte Ratio (NLR) and Platelet to Lymphocyte Ratio (PLR) obtained from the peripheral blood count may serve as a potential marker in the understanding of the correlation of Chronic Periodontitis and Systemic Inflammatory Response. These markers haven’t been extensively studied in context to Periodontitis. Materials and Methods: 60 Patients were enrolled and 90 samples were collected. Group A-Experimental (30 Patients) and Group B-Control (30 Patients). GL, PI, PPD, CAL, Neutrophil Count, Lymphocyte Count and Platelet counts were obtained. NLR was calculated as the ratio to Neutrophil to Lymphocyte and PLR was calculated as the ratio of Platelet to Lymphocyte. Statistical analysis of the data was performed. Results: The results varied significantly in both the groups and in the diseased group at baseline and post-treatment. The ROC cut off values for NLR and PLR was found to be 1.5 and 92.5 respectively which may be used as prognostic values for Chronic Periodontitis. Conclusion: Both the novel markers, NLR and PLR can successfully be used in the assessment of Chronic Periodontitis with the ease of applicability and can also be used further to rule out any ongoing systemic inflammatory challenge. Keywords: Chronic Periodontitis, Neutrophil, Lymphocyte, Platelet, Systemic Inflammatory response, Inflammatory markers.

INTRODUCTION

Periodontitis is a multifactorial infectious disease that manifests itself as the inflammation and destruction of the supporting structures of the teeth.1 Inflammation and inflammatory cells are the mainstay in the aggravation or regression of periodontal destruction. Recent studies suggest a strong correlation between Periodontitis and systemic well-being of the patient, that is, it not only affects the local integrity and function of the Periodontal apparatus but also results in a notable increase in systemic inflammatory burden.2 Peripherical blood parameters undergo a lot of changes in response to periodontal destruction and are frequently associated with an increase in systemic Inflammatory response.2 In light of Extensive microbial plaque associated with Periodontal Destruction, the chronic nature of the disease and the exuberant local and systemic response to microbial assault, it is reasonable to hypothesize that this infection may influence the overall health and the course of some systemic diseases. Recently several research groups have demonstrated that periodontitis is associated with elevated numbers of White blood cells. These observations indicate that periodontitis patients may have a subclinical inflammatory reactions. Neutrophils and Lymphocytes along with their role in Innate and adaptive immunity respectively, also hold a key position in the pathogenesis of periodontitis.3 Platelets, too, have an important role in inflammation as they are involved in the formation to platelet-leukocyte aggregate and T-cell mediated immune responses leading to the expression of a variety of pro-inflammatory cytokines. WBC, for long has been considered as a primitive marker of systemic inflammation and also correlates to host response to a variety of stimuli.4 The host reaction to gingival microorganisms is characterized in part by increase in the polymorphonuclear leukocyte counts, which is one of the most important steps in host defence. An exaggeration of leukocytes and neutrophils of has been noted in the pathogenesis of Periodontitis.5-7 Neutrophil-to-Lymphocyte ratio (NLR) and Platelet-to-Lymphocyte ratio (PLR), in addition to the above mentioned parameters may be considered as potential markers to assess inflammatory response in chronic periodontitis patients.1-2

Both, NLR and PLR are reported and published markers of systemic inflammatory response including a wide range of systemic diseases like Rheumatoid Arthritis,5 Hematological malignancies, respiratory, gastrointestinal, cardiovascular dysfunctions like acute coronary syndrome and the most recent being, the SARS Covid 19.3-10 NLR and PLR can be easily calculated as a simple ratio of neutrophil and lymphocyte counts and platelet and lymphocyte counts in a peripheral blood.2,10 NLR may serve as a promising marker for predicting the severity of tissue destruction in Periodontitis. It is directly or indirectly related to systemic inflammation due to its biochemical and cellular activities and

This is an open access article distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as the author is credited and the new creations are licensed under the identical terms.
also for its strong correlation to inflammatory markers like CRP. This ratio reflects two complimentary immune pathways as the biologic effect of Neutrophil includes curbing of apoptosis and phagocytosis, while that of Lymphocyte includes adaptive immune responses.11 Platelets regulate the release of pro-inflammatory mediators such as chemokines and cytokines which play a vital role in the progression of Periodontitis through the activation of acquired immune system. As the immune response worsens its leads to a permanent damage of the bone as well as an irreparable attachment loss. Cytokines are the peptide mediators with the key function of cell signalling and communication. Their function varies from cell proliferation, cell differentiation, immune responses to inflammatory responses. Chemokines, on the other hand, are a large sub group of cytokines with the ability to regulate leukocytes and their activation.12 Since NLR and PLR are ratios, they are relatively more stable when compared to individual parameters which may otherwise be altered under specific conditions like dehydration, over hydration.15

MATERIALS AND METHODS

60 participants were recruited in the study after obtaining the Institutional Ethical Clearance (EC201915). Group A- Experimental comprised of 30 Chronic Periodontitis patients whose NLR and PLR was assessed at baseline and 4 weeks post treatment. Group B- Control comprised of 30 systemically and periodontally healthy patients whose NLR and PLR was assessed at baseline.

Inclusion Criteria

Patients aged between 25-60 years with severe periodontitis having more than 20 teeth with no systemic involvement and a probing pocket depth of ≥ 5 mm in more than 30% of the teeth involved.

Exclusion Criteria

Smokers, Medically compromised patients, Pregnant or lactating females or patients who have undergone periodontal therapy or antibiotic prophylaxis in last 6 months were excluded from the study.

Clinical Parameters to be measured

Gingival Index, Plaque Index, Probing Pocket Depth (PPD), Clinical Attachment level (CAL), Complete blood count to calculate NLR and PLR of the patients.

Data Collection

5ml of Blood was drawn from the antecubital fossa of the arm using a 21 Gauge syringe at the baseline before non-surgical periodontal therapy and patients were given oral hygiene instructions. Four Weeks later, samples were collected again for chronic periodontitis patients after non-surgical periodontal therapy. After withdrawal, blood was transported to an anticoagulant vial to prevent clotting and sent to the laboratory. The vial consisted 2ml of K3-EDTA (Ethylene Diamine Tetra-acetic Acid). After proper mixing, the vial was placed in the automated cell counter. Horiba Yumizen H500 automated cell counter was used.

Statistical Analysis

Statistical analysis of data is done by SPSS 23.0 Software. Unpaired t-test, Correlation, Paired t-test, Chi Square test and ROC Curve was used in data analysis. P value <0.05 was considered as significant.

RESULTS

The mean age in years of Group A was 40.66±6.19 and that of Group B was found to be 38.5±4.85 and each group comprised of 15 Males and 15 females (Table 1). Both NLR and PLR in experimental and control group differed significantly, the latter group having a relatively lower NLR and PLR as compared to former. In the Experimental group both NLR and PLR are significantly reduced after treatment when assessed after 4 weeks (Table 2, 3). The 4 week's time after phase 1 therapy may be a justifiable time frame for achieving reduction in gingival inflammation and thereby reducing systemic inflammation (reduction in TLC and platelet counts).14

The ROC cut off value in the Experimental Group for NLR (Sensitivity-0.933 and Specificity-0.9) was 1.51 and that for PLR (Sensitivity-0.9 and Specificity-0.867) was 92.5. Hence these values can be used as prognostic values for Chronic Periodontitis (Table 4).

DISCUSSION

On evaluation of the study, it was revealed that Age and gender had no constraints on the study, where the mean age of the Experimental group was found to be 40.66 and that of the Control group was found to be 38.5. In the light of epidemiological studies there is a strong relation between age and gender predilection towards oral disease. Interestingly, periodontitis has a documented higher prevalence in men as compared to women signifying a possible sex/gender entanglement in the disease pathogenesis however in the present study this correlation is not in accordance with previous work and that there is no statistically significant relation between age and gender predilection towards oral disease. On evaluation of the study, it was revealed that Age and gender had no constraints on the study, where the mean age of the Experimental group was found to be 40.66 and that of the Control group was found to be 38.5. In the light of epidemiological studies there is a strong relation between age and gender predilection towards oral disease. Interestingly, periodontitis has a documented higher prevalence in men as compared to women signifying a possible sex/gender entanglement in the disease pathogenesis however in the present study this correlation is not in accordance with previous work and that there is no statistically significant relation between age and gender predilection towards oral disease.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Total NLR</th>
<th>NLR in Healthy</th>
<th>NLR (Baseline)</th>
<th>NLR (Post Treatment)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>r value</td>
<td>p value</td>
<td>r value</td>
<td>p value</td>
</tr>
<tr>
<td>GI</td>
<td>0.561</td>
<td>&lt;0.0001*</td>
<td>0.007</td>
<td>0.972</td>
</tr>
<tr>
<td>PI</td>
<td>0.566</td>
<td>&lt;0.0001*</td>
<td>-0.029</td>
<td>0.881</td>
</tr>
<tr>
<td>Cal</td>
<td>0.608</td>
<td>&lt;0.0001*</td>
<td>0.208</td>
<td>0.269</td>
</tr>
<tr>
<td>PPD</td>
<td>0.600</td>
<td>&lt;0.0001*</td>
<td>0.080</td>
<td>0.675</td>
</tr>
<tr>
<td>Neutrophil</td>
<td>0.658</td>
<td>&lt;0.0001*</td>
<td>0.327</td>
<td>0.078</td>
</tr>
<tr>
<td>Lymphocyte</td>
<td>-0.274</td>
<td>0.034*</td>
<td>-0.387</td>
<td>0.035*</td>
</tr>
<tr>
<td>Platelet</td>
<td>0.060</td>
<td>0.648</td>
<td>-0.422</td>
<td>0.020*</td>
</tr>
</tbody>
</table>

Table 1: Distribution of NLR and PLR according to Baseline and Post Treatment in Group A (Column Width).

<table>
<thead>
<tr>
<th>Mean</th>
<th>N</th>
<th>Std. Deviation</th>
<th>t value</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline NLR</td>
<td>2.56</td>
<td>30</td>
<td>1.168</td>
<td></td>
</tr>
<tr>
<td>Post Treatment NLR</td>
<td>1.46</td>
<td>30</td>
<td>1.86</td>
<td>5.307</td>
</tr>
<tr>
<td>Baseline PLR</td>
<td>117.65</td>
<td>30</td>
<td>17.023</td>
<td></td>
</tr>
<tr>
<td>Post Treatment PLR</td>
<td>88.25</td>
<td>30</td>
<td>8.44</td>
<td>8.817</td>
</tr>
</tbody>
</table>

Table 2: Analysis of NLR & its correlation with clinical parameters before & after Non-Surgical Periodontal Therapy (Column Width).
null
REFERENCES


