

Correlation of Disease Severity and Systemic Inflammatory Markers in Patients with Chronic Rhinosinusitis with Nasal Polyps

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Abstract

Objective: The aim of this study is to evaluate the relationship between Lund-Mackay scores, osteitis severity, and neutrophil lymphocyte ratio, platelet lymphocyte ratio, basophil lymphocyte ratio, eosinophil lymphocyte ratio, and systemic immune inflammation index in patients with chronic rhinosinusitis with nasal polyps.

Methods: Patients who were diagnosed with chronic rhinosinusitis with nasal polyps and underwent endoscopic sinus surgery between 2014 and 2020 were evaluated retrospectively. Lund-Mackay scores and osteitis severity (Hounsfield Unit) were determined separately for each nasal cavity by examining preoperative computed tomography images. Lund-Mackay and Hounsfield Unit scores were compared with the preoperative neutrophil lymphocyte ratio, platelet lymphocyte ratio, basophil lymphocyte ratio, eosinophil lymphocyte ratio, and systemic immune inflammation index.

Results: A total of 39 patients (24 males, 15 females) (78 sides) enrolled in the study. There was a positive correlation between right-sided Lund-Mackay scores and ipsilateral Hounsfield Unit ($r = 0.343, P = .033$). Similarly, there was a positive correlation between left nasal cavity Lund-Mackay scores and ipsilateral Hounsfield Unit ($r = 0.376; P = .018$). No statistically significant correlation between Lund-Mackay scores and Hounsfield Unit values, and neutrophil lymphocyte ratio, platelet lymphocyte ratio, basophil lymphocyte ratio, eosinophil lymphocyte ratio, and systemic immune inflammation index values were detected.

Conclusion: In the present study, no correlation between chronic rhinosinusitis with nasal polyps severity and systematic inflammatory markers was demonstrated.

Keywords: Chronic rhinosinusitis with nasal polyps, Lund-Mackay score, osteitis, systemic inflammatory ratio.

INTRODUCTION

Chronic rhinosinusitis with nasal polyps (CRSwNP) is a disease characterized by chronic inflammation of the nasal and paranasal mucosa. It usually has a negative impact on the patient's quality of life.¹ The success of CRSwNP treatment is generally related to the severity and extension of the disease.

Currently, despite several biomarkers, there is no consensus on the evaluation of the severity of CRSwNP. Of note, the presence of osteitis in patients with CRSwNP may reduce the treatment success and correlate with the severity of the disease.² Moreover, the presence of opacification in the affected sinuses may be a criterion for determining the severity of the disease.³ However, radiological imaging techniques such as computed tomography are required for these evaluation methods. The disadvantages of this method are cost, radiation exposure, and the need for a specialized team.

Platelet lymphocyte ratio (PLR), neutrophil lymphocyte ratio (NLR), and systemic immune inflammation index (SII) have been examined as inflammatory markers in the evaluation of systemic inflammation in several diseases.⁴⁻⁶ Abovementioned and novel biomarkers such as basophil lymphocyte ratio (BLR) and eosinophil lymphocyte ratio (ELR) were also investigated in patients with CRSwNP to determine the severity and recurrence of the disease.⁷

To the best of our knowledge, there is no clinical study in which the relationship between osteitis and systemic inflammatory markers was evaluated in the literature. Therefore, the aim of this study was to determine the relationship

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between Lund-Mackay (LM) scores, osteitis severity, and systemic inflammatory biomarkers (NLR, PLR, BLR, ELR, and SII) in patients with CRSwNP.

METHODS

In the present study, patients with CRSwNP, who underwent endoscopic sinus surgery between 2014 and 2020, were evaluated retrospectively. The diagnosis of CRSwNP was performed according to the European Position Paper on Rhinosinusitis and Nasal Polyps 2012 guideline.¹ Patients with chronic rhinosinusitis without nasal polyps, recurrent CRSwNP, a history of nasal operation, taking systemic steroids before surgery, fungal sinusitis, complications related to rhinosinusitis, younger than 18 years old, unilateral polyp or tumor, systemic disease or malignancy, and patients with morbid obesity were excluded. Informed consent form was obtained, and the local ethics committee approved this study.

Paranasal sinus computed tomography was taken before surgery. In computed tomography, axial sections were reformed to include the sinonasal area from the frontal sinus roof to the hard palate, and coronal and sagittal sections were obtained. Hounsfield Unit (HU) was measured by pixel probing in the bulla ethmoidalis to demonstrate the presence of osteitis.⁸ The measurement was performed randomly 3 times and the mean average was taken. Opacifications in the sinonasal area were evaluated using the LM staging system.³ The findings on the right and left sides of each case were determined individually. The total LM score was obtained by summing the LM scores on both sides.

The biomarkers such as NLR, ELR, BLR, PLR, and SII (formula = neutrophil count \times platelet count/lymphocyte count), which are systemic inflammatory biomarkers, were calculated over the values included in the preoperative hemogram tests.

Statistical Analysis

Statistical Package for Social Sciences for Mac version 20.0 (IBM Corp.; Armonk, NY, USA) was used for statistical analysis. Pearson and Spearman correlation tests and paired samples t-tests were used for the statistical analysis. A value of $P < .05$ was considered statistically significant.

RESULTS

A total of 39 patients (24 males, 15 females) who met the inclusion criteria were evaluated. The mean age of the study group was 45.2 ± 13.43 (18-66) years. Considering the LM scores of the patients, it was observed that the average score was 8.1 ± 2.86 for the right nasal cavity and 7.9 ± 3 for the left nasal cavity. The total LM score was found to be 16 ± 5.64 . The mean HU level was 584.2 ± 146.38 (281-880) for the right nasal cavity and 577.5 ± 149.46 (295-862) for the left nasal cavity.

There was no difference in comparison of LM scores ($P = .426$) and HU ($P = .698$) between the right and left sides. A positive correlation was found between LM scores and HU ($r = .360$; $P = .001$).

Main Points

- Lund-Mackay scores and osteitis index were correlated in patients with chronic rhinosinusitis with nasal polyps.
- Systematic inflammatory markers were not correlated with Lund-Mackay scores and osteitis index in patients with chronic rhinosinusitis with nasal polyps.
- Systematic inflammatory markers might not be related to the severity of chronic rhinosinusitis with nasal polyps.

Table 1. Correlation between Lund-Mackay Scores—Hounsfield Units and Systemic Inflammatory Markers

| | Lund-Mackay Score | | | Hounsfield Unit | |
|-----|-------------------|------------|------------|-----------------|------------|
| | Right Side | Left Side | Total | Right Side | Left Side |
| NLR | $P = .131$ | $P = .380$ | $P = .184$ | $P = .167$ | $P = .088$ |
| ELR | $P = .518$ | $P = .635$ | $P = .562$ | $P = .229$ | $P = .121$ |
| BLR | $P = .791$ | $P = .988$ | $P = .996$ | $P = .710$ | $P = .741$ |
| PLR | $P = .495$ | $P = .865$ | $P = .596$ | $P = .072$ | $P = .234$ |
| SII | $P = .346$ | $P = .728$ | $P = .470$ | $P = .077$ | $P = .125$ |

BLR, basophil lymphocyte ratio; ELR, eosinophil lymphocyte ratio; NLR, neutrophil lymphocyte ratio, PLR, platelet lymphocyte ratio; SII, systemic immune inflammation index.

When the sides were evaluated separately, there was a statistically significant positive correlation between LM scores of the right side and ipsilateral mean HU ($r = 0.343$, $P = .033$). Similarly, a statistically significant positive correlation was found between LM scores of the left side and ipsilateral HU ($r = 0.376$; $P = .018$).

The mean value of NLR was found to be 2.3 ± 1.5 , ELR was 0.16 ± 0.1 , BLR was 0.017 ± 0.03 , PLR was 121.6 ± 53.17 , and SII was 619 ± 488.5 . No correlation was found between LM scores and HU and systemic inflammatory markers (Table 1).

DISCUSSION

Chronic rhinosinusitis with nasal polyps is a disease with unknown etiology which remarkably reduces the patient's quality of life and has no curative treatment modality. Many factors such as asthma, acetylsalicylic acid tolerance, eosinophil basophil concentration in nasal tissue and blood, and IgE values were evaluated and studied in the course of the severity and recurrence of CRSwNP.^{9,10} On the other hand, there is no consensus on an ideal biomarker to assess the severity and risk recurrence of the CRSwNP.

Osteitis emerges as an important prognostic factor showing the severity and recurrence of chronic rhinosinusitis (CRS).² In patients with CRS, osteitis was detected in 1 of the 3 patients who underwent endoscopic sinus surgery; this ratio may rise up to 2/3 in revision sinus surgeries. Although histopathological evaluation is essential to determine the presence of osteitis, it is not applicable in the preoperative period. Currently, some measurement parameters are generally used to evaluate the presence of preoperative osteitis. Although several methods have been determined to evaluate the presence of osteitis using computed tomography imaging, the measurement of HU is very popular today.^{8,11-13} It is known that the severity of CRS correlates with the presence of osteitis.^{2,14,15} It has been shown that HU levels are higher in cases with new bone formation, and HU values were found to increase in patients with higher LM scores.¹¹ Similarly, a significant positive correlation was obtained between LM scores and HU levels in the right and left nasal cavities in our study.

In literature, NLR has been proposed as a potential biomarker for recurrence in patients with CRSwNP, as suggested by several literature sources.^{16,17} However, it has been reported that other systemic biomarker such as PLR did not indicate recurrence in patients with CRSwNP.¹⁶ Although NLR, ELR, and BLR were found to be elevated in patients who experienced a recurrence of CRSwNP, their discriminatory power was not considered satisfactory.⁷ Furthermore, while ELR did not demonstrate a link to recurrence in

the non-eosinophilic form of CRSwNP, it did show a significant decrease after sinus surgery in the eosinophilic form.^{7,18} Moreover, it is noteworthy that NLR, PLR, and SII were found to be statistically higher in the eosinophilic form of CRSwNP compared to the non-eosinophilic form.¹⁹ However, the recurrence status was not determined in that study.

To the best of our knowledge, there was no clinical study showing the relationship between osteitis and systemic inflammatory biomarkers in patients with CRSwNP. In the present study, no correlation was detected between the osteitis index and blood systemic inflammatory biomarkers. The possible reason for these results is that there is no consensus on using HU.¹² Another important reason is that these systemic inflammatory biomarkers, which are affected by almost every conditions such as body mass index, poor nutrition, weight loss, drug regimens, sleep apnea, and cigarette consumption, might not be effective to show recurrence in CRSwNP.²⁰⁻²² In the present study, the risk of abovementioned conditions was minimized; patients with systemic disease, who received non-standardized medical treatment, morbidly obese, and the sign of sleep apnea or sleep-related disease were excluded from the study. Along with these findings, the present study showed that there was no correlation between NLR, ELR, BLR, PLR, and SII values and LM scores. These findings were similar to the literature.²³ Our study showed that NLR, ELR, BLR, PLR, and SII were not correlated with the severity of the disease.

Ethics Committee Approval: Ethical committee approval was received from the Ethics Committee of Manisa Celal Bayar University, (Date: July 7, 2021, Number: 882).

Informed Consent: Informed consent was obtained from all participants.

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