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Evaluation of Radiological Images of Cases Operated for Nasal Polyp

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ABSTRACT

Objective: In this study, we aimed to evaluate the differential diagnosis of nasal polyps and infected nasal polyps before the operation with density measurement in paranasal sinus computed tomography examination.

Methods: The study included 129 patients (93 men and 36 women; mean age 41.00 years; range 13 to 82 years) diagnosed as nasal polyps (nasal polyps group) and 26 patients (17 men, 9 women; mean age 42.50 years; range 16 to 74 years) diagnosed as infected nasal polyps. In the preoperative paranasal computed tomography examination, the nasal polyps density of the patients was scored according to the Lund-Mackey system. To measure the volume of inflammatory opacification, the soft tissue density ratio (%) was measured. Neutrophil to lymphocyte ratio, mean platelet volume values, Lund-Mackey system, and soft tissue density ratio scores were statistically compared in all the groups.

Results: The median mean platelet volume value was 9.40 (6.4-12.0) in the nasal polyps group and 10.20 (7.9-12.1) in the infected nasal polyps group with a statistically significant difference (P = .007). There was a significant positive correlation between infected nasal polyps and mean platelet volume (P = .006, r = 0.219**), Lund-Mackey system total, and soft tissue density ratio total (P = .000, r = 0.797**). According to the results of receiver operating curve analysis in patients with infected nasal polyps, sensitivity 61.5% and specificity 60.5% for mean platelet volume (P = .007, area under curve: 0.669 [0.574–0.763]) were found. The cut-off point for mean platelet volume value was > 9.95.

Conclusion: If there is an infection in patients with nasal polyps, surgery should be considered after antibiotic therapy. The use of mean platelet volume as a marker of inflammation in these patients appears to be more reliable than the Lund-Mackey system and soft tissue density ratio scores.

Keywords: Lund-mackey system, mean platelet volume, nasal polyps, neutrophil lymphocyte ratio, soft tissue density ratio

Introduction

Nasal polyps (NP) is a disease characterized by progressive inflammation in which eosinophils, T cells, neutrophils, and plasma cells are seen in the nasal mucosa and paranasal mucosa.[1] Nasal polyp is seen in 5%-12% of the population and is often associated with chronic rhinosinusitis.[2] Nasal polyps is more common with asthma, aspirin hypersensitivity, cystic fibrosis, and Churg-Strauss syndrome.[2] Nasal congestion, runny nose, bad smell, and sneezing are the main complaints in patients. Nasal endoscopic examination and computed tomography (CT) are used in the diagnosis of NPs.[3]

The pathophysiology of NP is not fully understood. NP is a multifactorial disease affected by atopy, inflammation, genetic factors, and environmental factors.[2] Inflammation has an important place in NP pathophysiology. T helper 1 (Th1) cytokines, Th2 cytokines, and chemokines were found to be high in the nasal secretion in patients with NP.[4]

Neutrophil lymphocyte ratio (NLR) can be determined from the hemogram analysis of the peripheral blood. Neutrophil lymphocyte ratio value was found to be high in systemic inflammation, peripheral vascular diseases, diabetes mellitus, coronary artery diseases, some gynecological and hepatobiliary malignancies; and this situation was associated with poor prognosis.[5-7]

Platelets play an important role in the pathogenesis of local and systemic inflammation-related disorders. Mean platelet volume (MPV) shows platelet function and indicates increased platelet activation.[8] It has been recently reported that MPV can be used as a risk indicator in some diseases and also reflects inflammation.[9,10]

Rhinosinusitis (RS) is defined as the inflammation of the nasal and paranasal sinus mucosa.[3] Computed tomography examination is the frequently used imaging method in paranasal sinus pathologies in patients where diagnosis or surgery is planned.[11] Nasal polyps and rhinosinusitis are seen as soft

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tissue density (isodense) on CT examination. We can reveal the difference between the density measurement made from the workstation and the soft tissue density. Although there are studies on diffusion-magnetic resonance imaging in the diagnosis of rhinosinusitis in the literature, we have not encountered any studies on CT density measurement in the literature. Preoperative differential diagnosis of NPs and rhinosinusitis is important in terms of surgical information.

In this study, we aimed to evaluate the differential diagnosis of NP and infected NP (rhinosinusitis) before the surgery with density measurement, MPV, and NLR levels in paranasal sinus CT examination.

Methods

Study Participants

One hundred and twenty nine patients (NP group; 93 men, 36 women; mean age 41.00 years; range 13 to 82 years) and 26 patients with infected NPs (infected NP group; 17 men, 9 women; mean age 42.50 years; range 16 to 74 years) who were operated upon with a diagnosis of NP and whose pathology was reported as NP at the University Faculty of Medicine Ear Nose and Throat (ENT) Clinic between June and October 2020 were included in the study. Endoscopic examination and paranasal CT examinations were first performed on patients who were planned for surgical treatment for NP. Local and systemic steroid therapy was given to all the patients before surgery. Informed consent was not necessary owing to the nature of this study. This study was approved by the university of Mustafa Kemal non-interventional research ethics committee (Approval number: 06/07/2020, 08-32).

Exclusion Criteria

Patients with systemic diseases such as uncontrolled diabetes mellitus, uncontrolled hypertension, acute coronary artery disease, active connective tissue disease, connective tissue disease, vasculitis, inflammatory bowel disease, chronic renal failure, and chronic liver failure were excluded from the study.

Lund-Mackey System

In the preoperative paranasal CT examination, the NP density of the patients was scored according to the Lund-Mackey system (LMS).[11] For each nasal cavity, the maxillary sinus, anterior ethmoid sinus, posterior ethmoid sinus, frontal sinus, and sphenoid sinus were scored as 0 points if there were no polyps, 1 point if limited polyps, and 2 points if there were polyps filling the sinus completely. It was scored as 2 points in the presence of polyps in the osteomeatal complex. Both nasal cavity scores were calculated separately, and the total score was recorded by summing up (as shown in Supplemental Table 1).

Main Points

- If there is an infection in patients with nasal polyps (NP), surgery should be considered after antibiotic therapy.
- Mean platelet volume (MPV) values were higher in patients with infected NPs. Mean platelet volume, which is used as a marker for inflammation, is still controversial.
- The use of MPV as a marker of inflammation in patients with infected NP appears to be more reliable than the Lund-Mackey system and soft tissue density ratio scores.

Table 1. Lund-Mackey System

Sinus	Right Sinus	Left Sinus
Frontal	0-2	0-2
Anterior ethmoids	0-2	0-2
Posterior ethmoids	0-2	0-2
Maxillary	0-2	0-2
Sphenoid	0-2	0-2
Ostiomeatal complex	0 or 2	0 or 2

For the sinuses: 0 = no inflammation; 1 = partial inflammation; 2 = 100% inflammation.
For the ostiomeatal complex: 0 = not occluded; 2 = occluded; Maximum total score: 24.

Table 2. Soft Tissue Density Rate

Sinus	Right Sinus	Left Sinus
Frontal	0-4	0-4
Anterior ethmoids	0-4	0-4
Posterior ethmoids	0-4	0-4
Maxillary	0-4	0-4
Sphenoid	0-4	0-4
Ostiomeatal complex	0 or 2	0 or 2

For the sinuses: 0 = 0% inflammation; 1 = 1%-33% inflammation; 2 = 34%-66% inflammation; 3 = 67%-99% inflammation; 4 = 100% inflammation.
For the ostiomeatal complex: 0 = not occluded; 2 = occluded; Maximum total score: 44.

Soft Tissue Density Rate

To measure the volume of inflammatory opacification, the soft tissue density ratio (STDR) (%) was evaluated with a computer workstation. Axial images were obtained preoperatively with multi-slice CT spiral scanning. Imaging was performed on a 64-slice CT device (Toshiba Aquilion 64 MDCT, Toshiba Medical Systems, Otawara, Japan) in the supine position without contrast. The scanning parameters were 120 kV, 80 mAs, 0.35 second spin time, and pitch 1.5. The images obtained were reconstructed with a slice thickness of 1 mm using a high frequency reconstruction algorithm. The images obtained were evaluated retrospectively with the Osirix MD (Pixmeo Labs, Geneva, Switzerland) program on the imaging monitors in our unit. Density measurements were made on axial plane images. The approximate values for the volume of each sinus and the soft tissue density in each sinus were then calculated by adding the relevant areas for each slice and multiplying by the slice width. Computed tomography axial section slice width varied from an average of 4.1 mm to 3 to 5 mm. Soft tissue density ratio was calculated by dividing the soft tissue density in each sinus by the volume of each sinus (STDR = soft tissue density in each sinus/volume of each sinus × 100%). In STDR, the volume of inflammatory disease in each sinus was classified into 4 strata using intervals of 33% and was evaluated the inflammation score using a 4-point system (as shown in Supplemental Table 2).[11]

Statistical Analysis

IBM Statistical Package for the Social Sciences version 25.0 software program (IBM Corporation, Armonk, New York, USA)

Table 3. Comparison of Nasal Polyp (NP) and Infected NP

	Nasal Polyp (NP) (n = 129)	Infected NP (n = 26)	*P*
Sex (n, %)			
Male	93 (72.1%)	17 (65.4%)	.493
Female	36 (27.9%)	9 (34.6%)	
Age (years, min-max)	41.00 (13-82)	42.50 (16-74)	.647
NLR	2.26 (0.4-13.1)	1.92 (1.2-13.9)	.458
MPV	9.40 (6.4-12.0)	10.20 (7.9-12.1)	.007
LMS Total	13.00 (2-24)	11.00 (3-24)	.357
STDR Total	16.00 (2-29)	15.00 (4-23)	.208

NLR, neutrophil to lymphocyte ratio; MPV, mean platelet volume; LMS, Lund-Mackey system; STDR, soft tissue density rate.

Table 4. Correlation Analysis Results According to Infected Nasal Polyp (NP)

	Infected NP	LMS Total
	P, Correlation Coefficient (*r*)	
Age	.649. *r* = 0.037	.600. *r* = 0.042
NLR	.460. *r* = −0.060	.080. *r* = −0.141
MPV	.006. *r* = 0.219**	.462. *r* = 0.060
LMS Total	.359. *r* = −0.074	-
STDR Total	.209. *r* = −0.101	.000. *r* = 0.797**

NLR, neutrophil to lymphocyte ratio; MPV, mean platelet volume; LMS, Lund-Mackey system; STDR, soft tissue density.

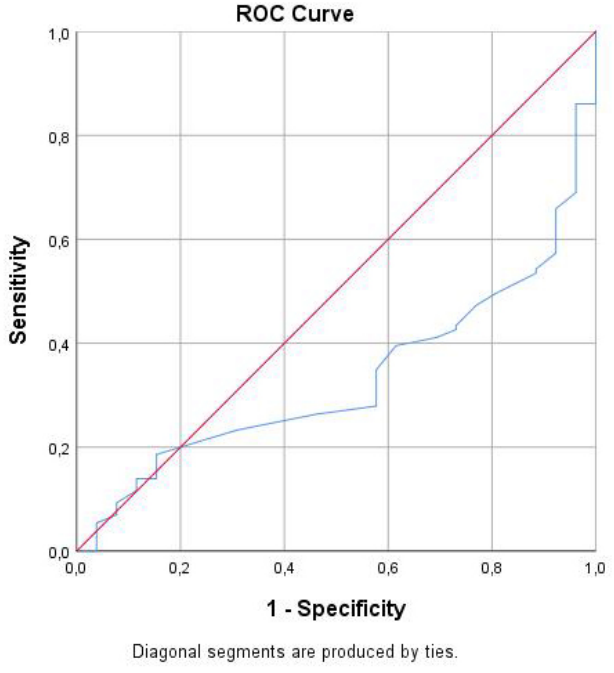

Figure 1. Receiver operating curve for mean platelet volume in the infected nasal polyp (*P* = .007, area under curve 0.669 [0.574–0.763])

was used for statistical analysis. Continuous variables were expressed as median (minimum–maximum). Categorical variables were expressed in percentages. Kolmogorov-Smirnov test was used to evaluate the distribution of variables. Student's *t* test was used for normal distribution of continuous variables, and Mann-Whitney *U* test was used for non-normal distribution. The chi-squared test was used for categorical variables. Pearson's correlation was used to evaluate statistical analysis relationships. A *P* value of < .05 was considered significant.

Results

Comparison of Laboratory Values and Clinical Outcomes Between Patients with NP and Infected NP

In the statistical evaluation, the NP group and the infected NP group were found to be similar in terms of age and sex (*P* = .647 and *P* = .493). The median value of the NLR was 2.26 (0.4-13.1) in the NP group and 1.92 (1.2-13.9) in the infected NP group. Although the NLR value was not statistically significant in the NP group, it was found to be higher (*P* = .458). The median MPV was 9.40 (6.4-12.0) in the NP group and 10.20 (7.9-12.1) in the infected NP group. The MPV value was found to be statistically significantly higher in the infected NP group (*P* = .007). In the NP group, the median value of Lund-Mackay CT total scores was 13.00 (2.0-24.0). The median value of Lund-Mackay CT scores in the infected NP group was 11.00 (3.0-24.0). Although the LMS value of patients with infected NP was lower than that of the NP group, it was not statistically significant (*P* = .357). In the NP group, the STDR total median value was 16.00 (2.0-29.0). In the infected NP group, the STDR total median value was 15.00 (4.0-23.0). Although the STDR value of the patients with infected NP was lower than that of the NP group, it was not statistically significant (*P* = .208) (as shown in Supplemental Table 3).

Correlation Analysis and Receiver Operating Curve Analysis

Correlation analysis results according to the infected NP and LMS total scores are shown in Supplemental Table 4. There was a significant positive correlation between infected NP and MPV (*P* = .006, *r* = 0.219**), LMS total and STDR total (*P* = .000, *r* = 0.797**).

According to the results of receiver operating curve analysis (ROC) analysis in patients with infected NP, sensitivity 61.5% and specificity 60.5% for MPV (*P* = .007, area under curve [AUC] 0.669 (0.574-0.763]) were found. The cut-off point for MPV value was > 9.95 (Figure 1).

Discussion

It is important to inform the surgeon about the preoperative differential diagnoses of NP and infected NP (rhinosinusitis). Rhinosinusitis is difficult to diagnose according to symptom criteria. Radiological classifications were made depending on the presence or absence of polyps. Confirmatory radiographic evidence is required to diagnose rhinosinusitis before prolonged treatment or surgery.[12] In our study, although STDR measurement and LMS score were lower in patients with infected NP in the paranasal sinus CT examination, we could not obtain statistically significant results in the evaluation of the differential diagnosis with NP. We believe this is because of the low number of patients in the sample group.

Neutrophil lymphocyte ratio is easily calculated and is not an expensive test. Neutrophil lymphocyte ratio has been suggested as a new marker for systemic inflammation.[13] It has been shown that the NLR value can be helpful in determining the short- and long-term mortality in acute coronary syndrome. Mortality also increases in patients with high NLR.[13] In the study of Ulu et al,[14] the NLR value was found to be statistically significantly higher in patients with sudden hearing loss than in the control group. In the same study, a decrease in response to treatment was observed in patients with high NLR values, and this was stated as a poor prognostic factor.[14] In the study of Bucak et al,[15] the neutrophil and NLR values in patients with Bell's palsy were compared with the healthy control group, and it was found that the neutrophil and NLR values were statistically significantly higher in the former group than the latter. In the study of Atan et al,[5] the neutrophil and NLR values were found to be statistically significantly higher in 105 patients with NP than those in the control group. Unlike the studies in the literature, in our study, the NLR value was found to be higher in the NP group than that in the infected NP group, although it was not statistically significant (P = .458).

Mean platelet volume is a machine-calculated measurement of the average platelet size. It also shows the activation of platelets. Recent studies show that MPV is increased in patients with Crohn's disease, rheumatoid arthritis, familial Mediterranean fever, ulcerative colitis, diabetes, acute pancreatitis, and acute ischemic stroke.[9,16-18] Mean platelet volume is currently used as an inflammatory marker in patients with inflammatory disease.[19,20] Sagit et al[18] reported that MPV levels were significantly higher in patients with NP than in the control group. They also reported that there was no significant relationship between MPV and paranasal sinus CT scores. In the study of Aktaş et al,[21] it was revealed that MPV levels were significantly lower in patients with NP than those in the control group. In the study of Çevik et al,[22] it was revealed that MPV levels in patients with NP were significantly lower than in the control group. In our study, the MPV value was found to be statistically significantly higher in the infected NP group than that in the NP group (P = .007).

Sagit et al. reported that there was no significant correlation between paranasal sinus CT scores (LMS scores) and MPV values.[18] In our study, we detected strong positive correlation between LMS and STDR scores calculated by paranasal sinus CT (P = .000, r = 0.797**). However, in our study, there is no significant relationship between MPV values and LMS and STDR scores. In addition, there was a significant positive correlation between infected NP and MPV (P = .006, r = 0.219**). According to the results of ROC analysis in patients with infected NP, sensitivity 61.5% and specificity 60.5% for MPV (P = .007, AUC: 0.669 [0.574–0.763]) were found. The cut-off point for MPV value was >9.95.

Our study had a few limitations. First, this study was limited by the small sample size of patients with NP. Second, MPV values in patients with NP were not evaluated after the operation. However, the strength of our study was that it is the first study in which the differential diagnosis of NP and infected NP was evaluated together with LMS and STDR scores calculated by paranasal sinus CT and MPV.

In conclusion, if there is an infection in patients with NP, surgery should be considered after antibiotic therapy. In our study, the MPV values were higher in patients with infected NP. Mean platelet volume, which is used as a marker of inflammation, is still controversial. The use of MPV as a marker of inflammation in patients with infected NP appears to be more reliable than LMS and STDR scores. However, there are very few studies regarding this subject and further studies are needed.

Ethics Committee Approval: This study was approved by Ethics committee of Mustafa Kemal University (Approval number: 06/07/2020, 08-32).

Informed Consent: Informed consent was not necessary owing to the nature of this study.

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References

1. del Toro E, Portela J. Nasal polyps. [Updated 2021 Aug 6]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2021 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK560746/
2. Chiarella E, Lombardo N, Lobello N, et al. Nasal polyposis: insights in epithelial-mesenchymal transition and differentiation of polyp mesenchymal stem cells. Int J Mol Sci 2020; 21: 6878. [Crossref]
3. Kariyawasam HH, James LK. Chronic rhinosinusitis with nasal polyps: targeting ige with anti-ige omalizumab therapy. Drug Des Devel Ther 2020;14: 5483-94. [Crossref]
4. Fujieda S, Imoto Y, Kato Y, et al. Eosinophilic chronic rhinosinusitis. Allergol Int 2019; 68: 403-12. [Crossref]
5. Atan D, Ozcan KM, Koseoglu S, et al. [New predictive parameters of nasal polyposis: neutrophil to lymphocyte ratio and platelet to lymphocyte ratio]. Kulak Burun Bogaz Ihtis Derg 2015; 25: 97-101. [Crossref]
6. Yenigun A. Assessment of patients with nasal polyposis by the neutrophil-to-lymphocyte ratio and eosinophil-to-lymphocyte ratio. Kulak Burun Bogaz Ihtis Derg 2015; 25: 193-9. [Crossref]
7. Brescia G, Sfriso P, Marioni G. Role of blood inflammatory cells in chronic rhinosinusitis with nasal polyps. Acta Otolaryngol 2019; 139: 48-51. [Crossref]
8. Sahin A, Bayar F, Dokumacioğlu E. HBsAg pozitif hastaların Trombosit/Lenfosit, Trombosit/Nötrofil, Nötrofil/Lenfosit ve PLT/MPV düzeylerinin araştırılması. STED/Sürekli Tıp Eğitimi Derg 2019; 29: 276-80. [Crossref]
9. Ulutas KT, Dokuyucu R, Sefil F, et al. Evaluation of mean platelet volume in patients with type 2 diabetes mellitus and blood glucose regulation: a marker for atherosclerosis? Int J Clin Exp Med 2014; 7: 955-61.
10. Ozer S, Yilmaz R, Sonmezgoz E, et al. Simple markers for subclinical inflammation in patients with Familial Mediterranean Fever. Med Sci Monit 2015; 21: 298-303. [Crossref]
11. Okushi T, Nakayama T, Morimoto S, et al. A modified Lund-Mackay system for radiological evaluation of chronic rhinosinusitis. Auris Nasus Larynx 2013; 40: 548-53. [Crossref]

12. Bhattacharyya N. Clinical and symptom criteria for the accurate diagnosis of chronic rhinosinusitis. Laryngoscope 2006; 116(7 Pt 2 Suppl 110): 1-22. [Crossref]
13. Sivrice ME, Okur E, Yasan H, Tuz M, Kumbul YC, Akin V. Can the systemic immune inflammation index preoperatively predict nasal polyp subtypes? Eur Arch Otorhinolaryngol 2020; 277: 3045-50. [Crossref]
14. Ulu S, Ulu MS, Bucak A, Ahsen A, Yucedag F, Aycicek A. Neutrophil-to-lymphocyte ratio as a new, quick, and reliable indicator for predicting diagnosis and prognosis of idiopathic sudden sensorineural hearing loss. Otol Neurotol 2013; 34: 1400-4. [Crossref]
15. Bucak A, Ulu S, Oruc S, et al. Neutrophil-to-lymphocyte ratio as a novel-potential marker for predicting prognosis of Bell palsy. Laryngoscope 2014; 124: 1678-81. [Crossref]
16. Yazici S, Yazici M, Erer B, et al. The platelet indices in patients with rheumatoid arthritis: mean platelet volume reflects disease activity. Platelets 2010; 21: 122-5. [Crossref]
17. Sagit M, Korkmaz F, Kavugudurmaz M, Somdas MA. Impact of septoplasty on mean platelet volume levels in patients with marked nasal septal deviation. J Craniofac Surg 2012; 23: 974-6. [Crossref]
18. Sagit M, Cetinkaya S, Dogan M, Bayram A, Vurdem UE, Somdas MA. Mean platelet volume in patients with nasal polyposis. B-ENT 2012; 8: 269-72.
19. Jaszczura M, Gora A, Grzywna-Rozenek E, Barc-Czarnecka M, Machura E. Analysis of neutrophil to lymphocyte ratio, platelet to lymphocyte ratio and mean platelet volume to platelet count ratio in children with acute stage of immunoglobulin A vasculitis and assessment of their suitability for predicting the course of the disease. Rheumatol Int 2019; 39: 869-78. [Crossref]
20. Korniluk A, Koper-Lenkiewicz OM, Kaminska J, Kemona H, Dymicka-Piekarska V. Mean Platelet Volume (MPV): new perspectives for an old marker in the course and prognosis of inflammatory conditions. Mediators Inflamm 2019; 2019: 9213074. [Crossref]
21. Aktas G, Sit M, Tekce H, et al. Mean platelet volume in nasal polyps. West Indian Med J 2013; 62: 515-8. [Crossref]
22. Cevik C, Yengil E, Akbay E, Arlı C, Gulmez MI, Akoglu E. Comparison of mean platelet volume values between patients with nasal polyp and healthy individuals. Turk Arch Otolaryngol 2013; 51: 106-9. [Crossref]