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ORIGINAL

EXAMINING ATHLETE MENTAL HEALTH AND POSTOPERATIVE RECURRENCE IN CHRONIC SINUSITIS WITH NASAL POLYPS: AN ANALYSIS OF CLINICAL TREATMENT STRATEGIE

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ABSTRACT

Objective: This study aims to investigate the intersection of athlete mental health and postoperative recurrence in athlete's patients with chronic sinusitis and nasal polyps (CRSwNP), focusing on the analysis of clinical treatment strategies. **Methods:** A cohort of 400 athletes diagnosed with CRSwNP, who underwent nasal endoscopic surgery at our hospital between March 2021 and March 2022, was included in this investigation. Retrospective analysis of clinical treatment data was conducted. Athletes Patients were categorized into the recurrent group (n=136) and the non-recurrent group (n=264). Univariate analysis was applied to identify factors influencing postoperative recurrence among CRSwNP patients. Subsequently, multivariate logistic regression analysis was carried out to determine the independent risk factors. Based on these findings, clinical treatment strategies were devised to address athlete mental health and enhance patient outcomes. **Results:** The study revealed a postoperative recurrence rate of 34.0% in CRSwNP patients. Athletes Patients in the recurrent group exhibited a longer disease duration compared to their non-recurrent counterparts. Notably, the recurrent group displayed significantly higher proportions of eosinophil (EOS) infiltration in nasal polyps, bronchial asthma, allergic rhinitis, peripheral blood EOS > 5.3%, and peripheral blood

neutrophils (Neu) > 55.5% than the non-recurrent group (P<0.05). Conversely, the proportion of tissue lymphocytes < 30% was lower in the recurrent group. Furthermore, scores for anterior ethmoids (AE), posterior ethmoids (PE), ostiomeatal complex (OMC), and total scores in the recurrent group were significantly elevated compared to the non-recurrent group, with statistically significant differences (P<0.05). Logistic regression results identified concurrent allergic rhinitis, bronchial asthma, EOS infiltration in nasal polyps, sinus CTAE score, PE score, OMC score, total score, tissue lymphocyte proportion <30%, peripheral blood EOS >5.3%, and peripheral blood Neu proportion <55.5% as independent risk factors for postoperative recurrence of chronic sinusitis with nasal polyps (P<0.05).**Conclusion:** In the context of athlete mental health and postoperative recurrence in CRSwNP patients, factors such as athlete mental resilience, psychological well-being, and clinical treatment strategies play pivotal roles. This analysis highlights the significance of athlete-specific considerations and recommends the development of tailored prevention and treatment protocols to address both mental health and medical outcomes effectively in this population.

KEY WORDS: Athlete mental health**,** Chronic sinusitis; Nasal polyps; Postoperative recurrence

INTRODUCTION

Chronic sinusitis with nasal polyps (CRSwNP) is a prevalent condition in otorhinolaryngology, characterized by its persistent nature and frequent occurrence. Recent epidemiological data indicates a significant increase in its clinical incidence, ranging from 8% to 15%. This rise in cases underscores the need for comprehensive research to understand the disease's impact, particularly on the sensory function of olfaction, which is closely linked to chronic sinusitis and can severely affect the quality of life for over 10 million individuals. (Hopkins, 2019; Hoy, 2020).

Olfaction is a vital human function responsible for perceiving external stimuli and is closely associated with chronic sinusitis. Not only does it play a role in distinguishing the environment and stimulating appetite, but it also contributes to the complex neuromodulatory system, influencing physiological rhythms and personal emotions. Given the growing emphasis on quality of life, olfaction has garnered increased attention. Furthermore, as a prominent symptom of chronic sinusitis, assessing olfactory function holds clinical significance in predicting surgical outcomes(Bachert et al., 2021). In China, large-scale epidemiological investigations on chronic sinusitis with nasal polyps remain scarce. Given the disease's high prevalence and its substantial impact on patients' quality of life, it has garnered increased societal attention. Clinical research now focuses on alleviating symptoms, promoting rehabilitation, and controlling the risk of recurrence through effective treatment strategies(Gomes,

Melo, Carnei, Pinho, & Teixeira, 2019).

The etiology of chronic rhinosinusitis with nasal polyps stems from various factors, resulting in the formation of polypoid tissue on the nasal mucosal surface, leading to clinical symptoms such as nasal congestion, headache, and rhinorrhea. These symptoms significantly disrupt daily activities. Endoscopic surgery is the primary treatment for chronic sinusitis with nasal polyps, as it offers more thorough polyp removal and minimal invasiveness. This approach provides clearer visualization and avoids complications associated with traditional open surgery. (Laidlaw & Buchheit, 2020; Mullol et al., 2022; Scangas et al., 2021), Despite the effectiveness of nasal endoscopic surgery, postoperative recurrence remains a challenge. Approximately 15% of athletic patient's experience recurrence, influenced by factors such as self-induced behaviors, a history of allergic rhinitis, delayed treatment of allergic asthma, the level of medical care, and inappropriate postoperative medication. Identifying these factors is crucial for taking targeted measures to reduce recurrence rates. (Gonzalez-Diaz, Acevedo-Duque, Martin-Fiorino, & Cachicatari-Vargas, 2022). In this study, we retrospectively analyze clinical data from 400 athletes with chronic sinusitis and nasal polyps who underwent endoscopic nasal surgery between March 2021 and March 2022. We aim to explore the factors contributing to postoperative recurrence of CRSwNP after endoscopic sinus surgery and their potential impact on athlete mental health.

1. MATERIALS AND METHODS

A total of 400 patients with CRSwNP who underwent nasal endoscopic surgery in our hospital from March 2021 to March 2022 were enrolled in this study. The clinical treatment was collected and analyzed retrospectively. The patients were divided into two groups, including recurrent group (n=136) and non-recurrent group (n=264). The age of the recurrent group was 1270 years old; the average age was 45.73 ±1.04 years old. There was no significant difference in sex and age between the two groups (P>0.05). This study has been reviewed by the Medical Ethics Review Committee of our hospital.

Inclusion criteria: (1) patients with varying degrees of nasal congestion, runny nose, dyssomnia and other symptoms;(2) drug treatment was ineffective, nasal endoscopic examination showed nasal polyps; (3) sinus CT scan showed ostiomeatal complex with or without inflammatory lesions of nasal sinus mucosa, in line with the diagnostic criteria of chronic sinusitis with nasal polyps (Yilmaz, 2019); (4) the indication of nasal endoscopic surgery was accorded; (5) the patient had clear consciousness and good cognitive ability, and the experimental consent form was signed.

Exclusion criteria: (1) patients with fungal sinusitis; (2) patients with tumors of nasal cavity or paranasal sinuses; (3) patients with immune system

diseases; (4) patients with mental disorders or cognitive impairment; (5) people who had participated in similar research programs.

1.2 Methods

All patients were given oral macrolide antibiotics and budesonide nasal spray and other standard pre-hospital intervention one week before operation. The functional nasal endoscopic surgery was given after excluding contraindications, and regularly revisited to half a year after operation. The basic information of the patients was collected immediately after admission. The relevant data were accurately recorded. The survey factors were determined, such as sex; age; smoking; drinking, allergic rhinitis; bronchial asthma. Sinus CT scan results, eosinophil (EOS) infiltrating nasal polyps, tissue lymphocytes, peripheral blood eosinophils (Eos) > 5.3% (⩽ 5.3% in normal population), peripheral blood neutrophils (Neu) < 55.5% (⩾ 55.5% in normal population) were collected and recorded.

Evaluation criteria of recurrence: during the postoperative revisit period (half a year after operation), the patient complained of foreign body sensation in nasal cavity and symptoms such as runny nose and stuffy nose. CT examination showed soft tissue shadow in nasal cavity, high density in paranasal sinuses and increased mucous membrane. Sinus CT scan results (sinus CT scan performed 6 months after operation), combined with Lund-Mackay scoring criteria for maxillary sinus (M), anterior ethmoid (AE), posterior ethmoid (PE), ostiomeatal complex (OMC) and the total score were scored. According to the following scoring criteria, complete turbidity, partial turbidity, and no turbidity of the sinuses correspond to 2, 1, and 0 points respectively. OMC blockage was scored as 2 points; the patency was 0 points.

1.3 Statistical analysis

SPSS 22.0 statistical software was used to process the data. The measurement data with normal distribution and homogeneous variance were expressed as ($\bar{x}$±s), the independent sample t test was used for comparison between groups. The count data was expressed as n/%, the χ2 test was used for comparison between groups. Additionally, the single factor affecting postoperative recurrence was analyzed. The single factor with P<0.05 was analyzed by multivariate logistic regression, P<0.05 was considered to be statistically significant.

2 RESULTS

2.1 Comparison of the general situation between the two groups

In this study, 400 patients with chronic sinusitis with nasal polyps were treated with nasal endoscopic surgery. 136 patients recurred after operation,

with a recurrence rate of 34.00%. Patients were divided into recurrence and non-recurrence groups according to their recurrence status. There was no significant difference in the general data such as age, gender, drinking history, and smoking history between the two groups (P>0.05). The patients in the recurrence group had a longer disease course than those in the non-recurrence group. The proportion of patients with EOS infiltrating nasal polyps, complicated bronchial asthma, allergic rhinitis and peripheral blood Eos>5.3%. In addition, peripheral blood Neu>55.5% were all higher than those in the non-recurrence group. The recurrence group was significantly higher, and the proportion of tissue lymphocytes <30% was lower than that of the non-recurrence group, and the difference was statistically significant (P<0.05, Table 1.).

Table 1: The general situation between the two groups

VARIABLE	RELAPSE GROUP（N=136）	NON-RECURRENT GROUP（N=264）	*T/X2*	*P*
Age (years)	45.73±1.04	46.15±4.07	1.183	＞0.05
Gender（n/%）			0.687	＞0.05
Male	76（55.88）	136（51.52）		
Female	60（44.12）	128（48.48）		
body mass index (BMI)（kg/m²）	23.35±4.10	23.41±4.15	0.138	＞0.05
Course of disease (year)	7.21±1.15	3.72±1.41	24.907	＜0.05
History of drinking（n/%）			2.750	＞0.05
Yes	48（35.29）	72（27.27）		
No	88（64.71）	192（72.73）		
Smoking history（n/%）			0.117	＞0.05
Yes	41（30.14）	84（31.82）		
No	95（69.85）	180（68.18）		
EOS infiltrating nasal polyps（n/%）			22.827	＜0.05
Yes	96（70.59）	120（45.45）		
No	40（29.41）	144（54.55）		
Bronchial asthma（n/%）			18.181	＜0.05
Yes	40（29.41）	32（12.12）		
No	96（70.59）	232（87.88）		
Allergic rhinitis（n/%）			27.007	＜0.05
Yes	52（38.24）	40（15.15）		
No	84（61.76）	224（84.85）		
Tissue lymphocyte ratio＜30%（n/%）			29.729	＜0.05
Yes	16（11.76）	100（37.88）		
No	120（88.24）	164（62.12）		
Percentage of Eos in peripheral blood ＞ 5.3%（n/%）			145.671	＜0.05
Yes	112（82.53）	52（19.70）		
No	24（17.65）	212（80.30）		
Percentage of Neu in peripheral blood ＞ 55.5%（n/%）			51.407	＜0.05

Yes	80（58.82）	60（22.73）		
No	56（41.18）	204（77.27）		
Number of years of education (years)	10.22±2.16	10.29±2.19	0.304	＞0.05

2.2 CT scan of paranasal sinuses between the two groups

The AE score, PE score, OMC score and total score of the recurrence group were significantly higher than those of the non-recurrence group, and the difference was statistically significant (P<0.05, Fig.1).

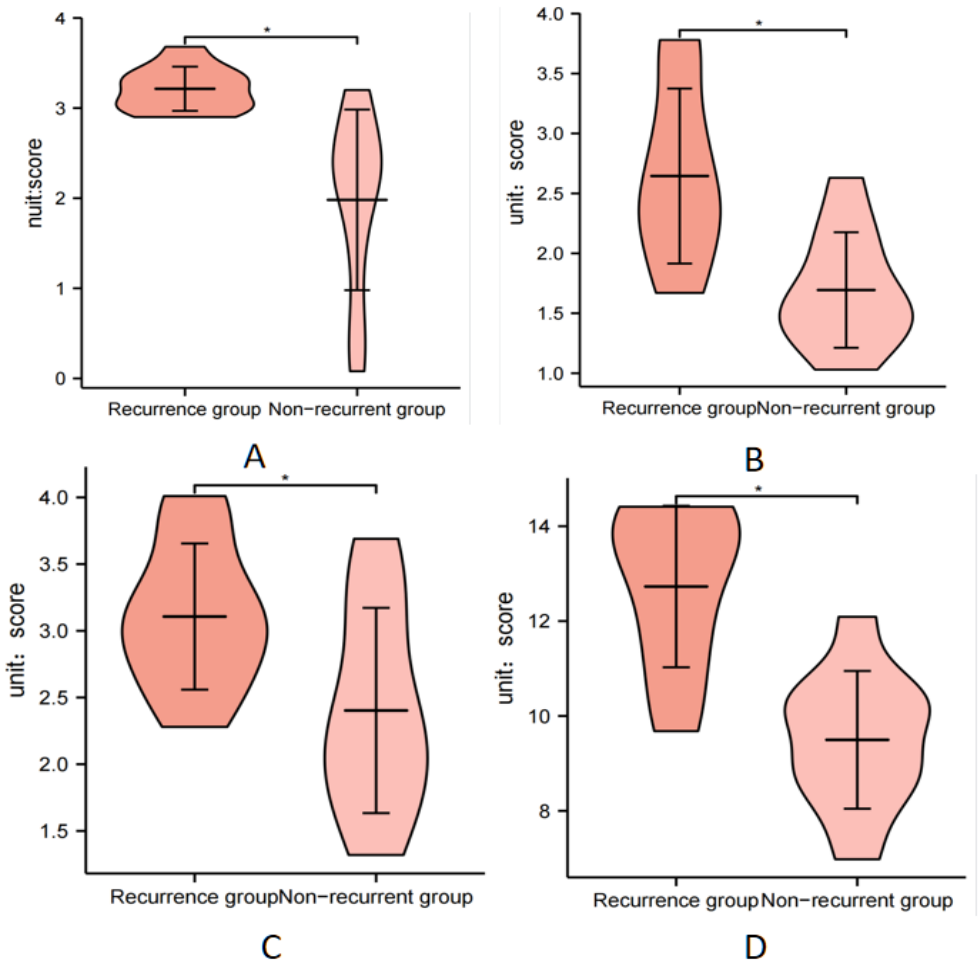

Figure 1: CT scan of paranasal sinuses between the two groups

Note: *A: AE points; B: PE points; C: OMC points; D: total points*

2.3 Multivariate analysis of postoperative recurrence of chronic sinusitis with nasal polyps

We used the statistically significant factors in the univariate analysis as independent variables and suited a multi-factor logistic regression model of the corresponding variables of the influencing factors (Table2).

The results showed that concurrent allergic rhinitis, bronchial asthma, EOS infiltrating nasal polyps, sinus CTAE score, PE score, OMC score, total score, the proportion of tissue lymphocytes <30%, the proportion of peripheral blood Eos>5.3%.

The factors of peripheral blood such as the proportion of blood Neu <55.5% were independent risk factors for postoperative recurrence of chronic sinusitis with nasal polyps (P<0.05). All results are shown in Table 2 and Table 3.

Table 2: The factors of peripheral blood affecting postoperative recurrence of chronic sinusitis with nasal polyps

RELATED FACTORS	VARIABLE ASSIGNMENT
Course of disease	Continuous variable
Allergic rhinitis	1= Yes，0= No
Bronchial asthma	1= Yes，0= No
EOS infiltrative nasal polyp	1= Yes，0= No
AE integration	Continuous variable
PE integration	Continuous variable
OMC integration	Continuous variable
Total integral	Continuous variable
Percentage of tissue lymphocytes	1=＜30%，0=≥30%
Percentage of Eos in peripheral blood	1=＞5.3%，0=≤5.3%
Percentage of Neu in peripheral blood	1=＞55.5%，0=≤55.5%

Table 3: Logistic regression analysis of factors related to postoperative recurrence of chronic sinusitis with nasal polyps

Variable	B	S.E.	Waldx^2	P Value	OR Value（95%CI）
Course of disease	0.410	1.024	0.160	0.689	1.507（0.202-11.213）
Allergic rhinitis	1.065	0.406	6.881	0.009	2.901（1.309-6.429）
Bronchial asthma	1.524	0.480	10.081	0.001	4.591（1.792-11.761）
EOS infiltrative nasal polyp	1.520	0.482	9.945	0.002	4.572（1.778-11.760）
AE integration	1.238	0.566	4.784	0.029	3.449（1.137-10.458）
PE integration	1.118	0.405	7.620	0.006	3.059（1.383-6.765）
OMC integration	1.087	4.515	4.455	0.035	2.965（1.081-8.137）
Total integral	1.493	0.481	9.635	0.002	4.450（1.734-11.424）
Percentage of tissue lymphocytes	1.224	0.428	8.179	0.004	3.401（1.470-7.869）
Percentage of Eos in peripheral blood	1.154	0.373	9.572	0.002	3.171（1.526-6.587）
Percentage of Neu in peripheral blood	1.738	0.556	9.771	0.002	5.686（1.912-16.908）

3. DISCUSSION

Sinusitis is an inflammatory disease of the paranasal sinuses and is related to the ciliary cleansing function of the mucous membranes in the sinuses, the anatomy of the paranasal sinus openings, and the resistance of the entire body to infection. Bronchial asthma is a common bronchial allergic

disease, which is a chronic airway inflammation with the participation of a variety of cells, especially mast cells, eosinophils and T lymphocytes. Symptoms can last from minutes to hours and in severe cases from days to weeks. Chronic bronchitis and emphysema are often complications in patients with long-term recurrent attacks (Marcus et al., 2020). Respiratory diseases are closely related and similar in many aspects of pathogenesis, pathology, physiology, and anatomy (Avdeeva & Fokkens, 2018; Podwysocka, Dąbrowska, Fendler, Pagacz, & Pietruszewska, 2019). The nasal mucosa has the functions of filtering, cleaning, heating and humidifying the air, and plays an important role in protecting the lower respiratory tract. When patients have symptoms such as nasal congestion, nasal breathing is changed to oral breathing, resulting in dry cold air and various allergens or pathogens directly reaching the lower respiratory tract, which may induce airway hyperresponsiveness and airflow limitation, thus increasing the possibility of lower respiratory tract lesions (Bai et al., 2022). Eosinophil infiltration was mainly seen in the upper and lower respiratory tract mucosa of CRSwNP patients with lower respiratory tract inflammatory reaction, while eosinophil infiltration was significantly alleviated in patients without lower airway hyperresponsiveness. It has been proposed that CRSwNP complicated by asthma is a manifestation of the systemic immune response in the inflammation of the upper and lower respiratory mucosa, and is an important reason why CRSwNP is prone to recurrence or becomes refractory to sinusitis. Nasal and paranasal sinus diseases may cause asthma to be difficult to control. Patients with severe asthma often have obvious abnormal manifestations of paranasal sinuses. Therefore, the relationship between CRS and asthma is very important in clinic. However, questions remain as to whether CRS exacerbates asthma, whether they have the same disease progression in different parts of the respiratory tract, and whether sinusitis and nasal polyps with asthma have a higher recurrence rate after surgery (Hong et al., 2019; Lu et al., 2017).

In this study, patients who underwent endoscopic sinus surgery were selected as the research objects, grouped according to whether there was recurrence or not, and compared the relevant data. The multivariate logistic regression analysis showed that concurrent allergic rhinitis, bronchial asthma, EOS infiltrating nasal polyps, and sinus CTAE score, PE score, OMC score, total score, proportion of lymphocytes in tissue <30%, proportion of Eos in peripheral blood >5.3%, proportion of Neu in peripheral blood <55.5% and other factors are important factors affecting postoperative recurrence in patients with endoscopic sinus surgery factor. This study found that concurrent asthma and allergic rhinitis increase the risk factor of postoperative recurrence, which may be due to the aggregation of similar lesions in the sinus mucosa and bronchial mucosa of patients with asthma and allergic rhinitis, which leads to pathological changes. In terms of EOS, many researchers have suggested that the increased detection of EOS in tissue or immunology is a prompting factor for patients with severe disease and poor prognosis (Laidlaw, Mullol, Woessner,

Amin, & Mannent, 2021). Nasal polyps are covered with respiratory epithelium, matrix edema will be accompanied by a large number of EOS infiltration. EOS will also release a variety of cytokines to stimulate epithelial proliferation, so it is considered that EOS infiltrating nasal polyps have a higher risk of recurrence. Others have suggested that the number of EOS infiltrates exceeds 350 and that there is a strong association between EOS-infiltrated nasal polyps and recurrence. However, the effect of EOS on the outcome of the disease was not analyzed in this study, which should be further discussed in the follow-up. Through multivariate logistic regression analysis, some scholars found that tissue EOS nasal polyps are the influencing factors of nasal polyp recurrence (Salomon et al., 2021). Smoking was not found to be a factor leading to disease recurrence in this study, probably due to the limitation of the study scope and number of Athletic patients, which needs to be further improved. In ENT clinical follow-up work, patients with chronic rhinosinusitis combined with nasal polyps treated by nasal endoscopy should pay attention to investigate the past medical history, guide discharge and instruct Athletic patients to review regularly to reduce the risk of recurrence.

Allergic rhinitis can easily lead to stress in sinuses and ostium, prolong the disappearance time of mucosal redness and swelling, which is conducive to bacterial reproduction (Ta, 2019). Patients with bronchial asthma have abnormal respiratory system function and cannot expel secretions in time. It can increase the risk of inflammatory reaction and recurrence. High OMC scores suggest anatomical abnormalities that compress or even obstruct the anterior ethmoid sinus and maxillary sinus orifices, affecting sinus drainage and causing sinus orifice inflammation or paranasal sinus cysts. During invasion by septic bacteria, Neu in the peripheral blood accumulates at the site of inflammation, indicating difficulty in defending against pathogens when nonspecific cellular immune function is reduced. Eos is a common type of leukocytes, which can act on vascular mediators, secrete a large amount of peroxidase and alkaline protein, cause mucosal edema and prolong the disappearance time of inflammation. Clinicians should pay more attention to the above risk factors. Preoperatively, management measures should be taken for Athletic patients with asthma and allergic rhinitis, and changes in the Eos ratio in peripheral blood should be closely monitored to minimize the risk of postoperative recurrence. At the same time, Athletic patients should also consciously correct bad living habits and avoid bad behaviors such as smoking.

In this study, the increase of total CT score in paranasal sinuses was highly correlated with postoperative recurrence. The complex of middle nasal meatus and sinus has been proved to play a key role in the pathogenesis of sinusitis. If the middle nasal meatus that brings together multiple sinuses is damaged, the sinuses will inevitably be damaged. Based on this pathogenesis, AE is the first to be injured, but medial turbinate edema or polypoid degeneration may be a more important factor in the pathogenesis of recurrent

Athletic patients (Yang et al., 2018). Therefore, some scholars have found that there is a significant positive correlation between the sinus CTPE score and the recurrence of nasal polyps. The reasons for inferences that are inconsistent with the results of this study may be influenced by the range of Athletic patient selection. According to the research of scholars (Enache et al., 2020; Mitroi et al., 2019; Soklic et al., 2019), B lymphocytes (CD20) and T lymphocyte subsets (CD4 and CD8) play the important roles in the expression and inflammatory response in chronic rhinosinusitis. The results of this study showed that the percentage of tissue lymphocytes < 30% in the recurrent group was significantly lower than that in the non-recurrent group, indicating that there was a close correlation between postoperative recurrence of sinusitis and nasal polyps and tissue lymphocyte infiltration. It should be noted that due to the operational norms of doctors and other objective reasons, the author did not include improper surgical operation, Athletic patient mood and medication into the study of related factors, which need to be improved in the next study. The prognosis of patients is improved by measures related to surgery. In view of the above risk factors for recurrence, clinicians should pay due attention to them and take appropriate measures. For example, smoking patients should be advised to quit smoking or reduce tobacco smoking; for patients with high OMC score, abnormal anatomical structures should be corrected during operation to reduce the recurrence rate. For postoperative nasal polyps and allergic rhinitis, appropriate anti-inflammatory and anti-asthmatic treatments should be taken according to the characteristics of bronchial asthma. Their conditions should be monitored in a timely manner and abnormal problems should be detected and dealt with in a timely manner in order to improve the prognosis of Athletic patients. There are still some inevitable limitations in this study. For instant, the serum index detected is only the value on the cross section of a certain time. In addition, the sample size in this study is small and regional. Therefore, the sample size needs to be further expanded to ensure the accuracy of the results.

The postoperative recurrence of chronic sinusitis with nasal polyps is the result of a combination of factors. Among them, allergic rhinitis, bronchial asthma, EOS infiltrating nasal polyps, paranasal sinus CTAE score, PE score, OMC score, total score, tissue lymphocyte proportion < 30%, peripheral blood Eos percentage > 5.3%, peripheral blood Neu proportion < 55.5% and other factors are significantly related to postoperative recurrence, which provide reference information for the prognosis of chronic sinusitis with nasal polyps. In clinical practice, corresponding prevention and treatment measures should be taken according to these recurrence factors to reduce recurrence and ensure the normal life of patients.

4. Conclusion

The intricacies of chronic sinusitis with nasal polyps (CRSwNP) have become increasingly apparent. This comprehensive analysis, undertaken from

March 2021 to March 2022, explored the factors contributing to postoperative recurrence in 400 athletes who underwent endoscopic nasal surgery for CRSwNP. Our study not only sheds light on the challenges faced by athletes dealing with this condition but also highlights the critical interplay between their physical health and mental well-being. The prevalence of CRSwNP, with its long-lasting and recurring nature, has raised concerns about the quality of life for millions of individuals. Olfactory function, often impaired in these cases, serves as an essential human sensory mechanism that extends beyond mere perception. It influences physiological rhythms and personal emotions, emphasizing the importance of comprehensive care.

Endoscopic surgery, recognized as the primary mode of treatment, has proven effective in removing nasal polyps and minimizing trauma. However, despite its successes, our study revealed that approximately 15% of athletes still experience postoperative recurrence. Factors contributing to recurrence range from individual behaviors to allergic history and medical care standards. Recognizing and addressing these factors can significantly impact patient outcomes. As the boundaries between medicine and sports continue to blur, our findings underscore the need for a holistic approach to athlete health. Balancing physical recovery with mental well-being is essential in optimizing an athlete's performance and quality of life. Athletes with CRSwNP face unique challenges, and our study illuminates the connection between their mental health and the potential for surgical recurrence.

In conclusion, this research emphasizes the importance of individualized treatment plans and mental health support for athletes dealing with CRSwNP. By addressing the factors contributing to postoperative recurrence and nurturing athlete mental health, we can enhance the overall well-being and athletic performance of this special population. As we move forward, further investigations and tailored interventions will be essential in improving the lives of athletes facing the challenges of CRSwNP.

REFERENCE

Avdeeva, K., & Fokkens, W. (2018). Precision medicine in chronic rhinosinusitis with nasal polyps. *Current allergy and asthma reports, 18*, 1-8.

Bachert, C., Han, J. K., Wagenmann, M., Hosemann, W., Lee, S. E., Backer, V., . . . Prokopakis, E. (2021). EUFOREA expert board meeting on uncontrolled severe chronic rhinosinusitis with nasal polyps (CRSwNP) and biologics: definitions and management. *Journal of Allergy and Clinical Immunology, 147*(1), 29-36.

Bai, J., Huang, J. H., Price, C. P., Schauer, J. M., Suh, L. A., Harmon, R., . . . Shintani-Smith, S. (2022). Prognostic factors for polyp recurrence in chronic rhinosinusitis with nasal polyps. *Journal of Allergy and Clinical Immunology, 150*(2), 352-361. e357.

Enache, I., Ioniţă, E., Anghelina, F., Mogoantă, C. A., Ciolofan, M. S., Căpitănescu, A. N., . . . Simionescu, C. E. (2020). Involvement of inflammatory cells in chronic rhinosinusitis with nasal polyps. *Romanian Journal of Morphology and Embryology, 61*(3), 871.

Gomes, V. R., Melo, M. C. S., Carnei, H. C., Pinho, J. E. T., & Teixeira, M. A. (2019). Hyperplastic dental follicle: case report. *Jornal Brasileiro de Patologia e Medicina Laboratorial, 55*, 315-320. doi:10.5935/1676-2444.20190025

Gonzalez-Diaz, R., Acevedo-Duque, Á., Martin-Fiorino, V., & Cachicatari-Vargas, E. (2022). Latin American professors' research culture in the digital age. *Comunicar, 30*(70), 71-83.

Hong, B. S., Ryu, H. S., Kim, N., Kim, J., Lee, E., Moon, H., . . . Kim, S. (2019). Tumor suppressor miRNA-204-5p regulates growth, metastasis, and immune microenvironment remodeling in breast cancer. *Cancer Research, 79*(7), 1520-1534.

Hopkins, C. (2019). Chronic rhinosinusitis with nasal polyps. *New England Journal of Medicine, 381*(1), 55-63.

Hoy, S. M. (2020). Dupilumab: a review in chronic rhinosinusitis with nasal polyps. *Drugs, 80*(7), 711-717.

Laidlaw, T. M., & Buchheit, K. M. (2020). Biologics in chronic rhinosinusitis with nasal polyposis. *Annals of Allergy, Asthma & Immunology, 124*(4), 326-332.

Laidlaw, T. M., Mullol, J., Woessner, K. M., Amin, N., & Mannent, L. P. (2021). Chronic rhinosinusitis with nasal polyps and asthma. *The Journal of Allergy and Clinical Immunology: In Practice, 9*(3), 1133-1141.

Lu, Y., Qin, T., Li, J. e., Wang, L., Zhang, Q., Jiang, Z., & Mao, J. (2017). MicroRNA-140-5p inhibits invasion and angiogenesis through targeting VEGF-A in breast cancer. *Cancer gene therapy, 24*(9), 386-392.

Marcus, S., Schertzer, J., Roland, L. T., Wise, S. K., Levy, J. M., & DelGaudio, J. M. (2020). *Central compartment atopic disease: prevalence of allergy and asthma compared with other subtypes of chronic rhinosinusitis with nasal polyps.* Paper presented at the International forum of allergy & rhinology.

Mitroi, M., Albulescu, D., Capitanescu, A., Docea, A. O., Musat, G., Mitroi, G., . . . Spandidos, D. A. (2019). Differences in the distribution of CD20, CD3, CD34 and CD45RO in nasal mucosa and polyps from patients with chronic rhinosinusitis. *Molecular Medicine Reports, 19*(4), 2792-2800.

Mullol, J., Bachert, C., Amin, N., Desrosiers, M., Hellings, P. W., Han, J. K., . . . Daizadeh, N. (2022). Olfactory outcomes with dupilumab in chronic rhinosinusitis with nasal polyps. *The Journal of Allergy and Clinical Immunology: In Practice, 10*(4), 1086-1095. e1085.

Podwysocka, M., Dąbrowska, K., Fendler, W., Pagacz, K., & Pietruszewska, W. (2019). Analysis of the impact of bronchial asthma and hypersensitivity

to aspirin on the clinical course of chronic sinusitis with nasal polyps. *Polish Journal of Otolaryngology, 73*(5), 37-43.

Salomon, J. J., Albrecht, T., Graeber, S. Y., Scheuermann, H., Butz, S., Schatterny, J., . . . Mall, M. A. (2021). Chronic rhinosinusitis with nasal polyps is associated with impaired TMEM16A-mediated epithelial chloride secretion. *Journal of Allergy and Clinical Immunology, 147*(6), 2191-2201. e2192.

Scangas, G. A., Wu, A. W., Ting, J. Y., Metson, R., Walgama, E., Shrime, M. G., & Higgins, T. S. (2021). Cost utility analysis of dupilumab versus endoscopic sinus surgery for chronic rhinosinusitis with nasal polyps. *The Laryngoscope, 131*(1), E26-E33.

Soklic, T. K., Silar, M., Rijavec, M., Koren, A., Kern, I., Hocevar-Boltezar, I., & Korosec, P. (2019). CD3+ CD4− CD8− mucosal T cells are associated with uncontrolled chronic rhinosinusitis with nasal polyps. *Journal of Allergy and Clinical Immunology, 143*(3), 1235-1237. e1235.

Ta, N. (2019). Will we ever cure nasal polyps? *The Annals of The Royal College of Surgeons of England, 101*(1), 35-39.

Yang, H., Fang, H., You, Q., Han, L., Yang, Z., Yu, L., & Zhang, Y. (2018). Predictive study on recurrence of chronic sinusitis with nasal polyps by tissue eosinophils and sinus CT. *Zhonghua er bi yan hou tou Jing wai ke za zhi= Chinese Journal of Otorhinolaryngology Head and Neck Surgery, 53*(11), 842-846.

Yilmaz, İ. (2019). Eosinophilic asthma with chronic rhinosinusitis/nasal polyps and biologic agents. *TUBERKULOZ VE TORAK-TUBERCULOSIS AND THORAX, 67*(4).