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A Cross-Sectional Study On The Prevalence Of Fungal Infection In Nasal Polyposis Among Patients Attending A Tertiary Care Center In South India.

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ABSTRACT

Nasal polyposis, characterized by benign growths in the nasal passages due to chronic inflammation, remains a complex condition with multifactorial origins. This study explored the prevalence and implications of fungal involvement in nasal polyposis. This descriptive cross sectional study was conducted at Department of ENT, Bangalore Medical College. Personal details, clinical history and examination findings were noted for all consenting, immunocompetent patients with nasal polyps between age 15-65. Post-polypectomy, the specimens were sent for histopathological examination, microscopy with KOH wet mount and fungal culture in Sabouraud's medium. The patients were followed for 6 months period to detect recurrence. Among 100 participants with antrochoanal (n=15) and ethmoidal polyps (n=85), fungal-specific cultures were conducted on resected polyps. The mean age of participants was 39.29 (± 13.99) years, with nasal obstruction as the most common symptom (97%). Histopathology revealed inflammatory (86%) and allergic (14%) polyps. Fungal elements were detected in 12% by KOH microscopy and 17% through cultures, primarily *Aspergillus* genus (50%), especially *Aspergillus flavus*. Notably, recurrence occurred in 8% post-surgery, and in 3 of these, fungal growth was detected, underscoring the link between fungal colonization and recurrence. Fungal infection in nasal polyposis presents challenges in management, worsening symptoms, impeding treatment responses, and elevating recurrence risks. To mitigate this, differentiating fungal colonization from infection during diagnosis is crucial.

Keywords: Nasal polyp, fungal infection, FESS, Fungal sinusitis, Chronic rhinosinusitis

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INTRODUCTION

Nasal polyposis is a condition characterized by the development of soft, non-cancerous growths in the nasal passages resulting from chronic inflammation [1]. The prevalence of nasal polyps in chronic rhinosinusitis [CRS] varied between 6 to 30 percent [2]. The etiology of such chronic inflammatory reaction remains less understood. Being a multifactorial condition [3] associated with numerous diseases and pathogenic disorders, including allergy, infection, allergic fungal sinusitis, cystic fibrosis, asthma, and aspirin intolerance [4] recent interest have circled around fungal aetiology.

The prevalence of fungal infection in nasal polyposis varies among different populations and geographic regions. Studies have shown that patients with nasal polyposis may have evidence of fungal colonization or infection [5]. Fungal sinusitis can take different forms, including allergic fungal sinusitis (AFS), fungal ball (mycetoma), and invasive fungal sinusitis (IFS) [6]. AFS, an entity first described by Safirstein in 1976 [7] characterized by an exaggerated allergic response to fungal antigens, is the most common form associated with nasal polyposis. Fungal infection in nasal polyposis has important implications for patient management and treatment outcomes. Fungal sinusitis can contribute to more severe symptoms, increased recurrence of polyps after surgery, and poorer response to standard medical therapies [8]. Furthermore, it can complicate the management of nasal polyposis by causing persistent inflammation, recurrence and impairing the effectiveness of corticosteroid therapy.

Diagnosing fungal infection in nasal polyposis requires a comprehensive evaluation, including patient history, physical examination, imaging studies, and fungal cultures. Bent & Kuhn proposed the major and minor diagnostic criteria's for AFS [9]. Of all those criteria's non-invasive fungal colonies on smear, culture and histopathology remains the key areas of interest for research. Identifying the presence of fungi and differentiating between colonization and infection is crucial for determining appropriate treatment strategies.

Hence this study was undertaken with the objectives

- To estimate the coexistence of fungal elements in patients with nasal polyposis by fungal specific culture method
- To estimate the prevalence of the types of fungal colonization

MATERIALS AND METHODS

A cross-sectional study was conducted after obtaining ethical clearance from the Institutes Ethical Committee of Bangalore Medical College and Research Institute, Bangalore, between October 2013 and May 2015. Consecutive samples of 100 immuno-competent patients, aged 15 years and above, diagnosed with antrochoanal and ethmoidal polyposis, with or without prior history of polypectomy and currently planned for surgery, and willing to consent for surgery and participate in the study were included. For participants less than 18 years of age informed consent was obtained from available parent and assent from the participants. Participation in the study was completely voluntary and not consenting to participate in the study had no impact on their treatment and care. The study was conducted at Sri Venkateshwara ENT Institute and Bowring and Lady Curzon Hospital, Bangalore Medical College and Research Institute, Bangalore.

A consecutive series of 100 patients with nasal polyposis were evaluated prospectively after obtaining relevant history and clinical examination, with diagnostic nasal endoscopy and computerized tomography of paranasal sinuses.

All these patients underwent polypectomy (functional endoscopic sinus surgery, endoscopic polypectomy and Caldwell-Luc surgery) at the institute and the resected polyp samples were sent in sterile container with normal saline for fungal culture in Sabouraud's dextrose agar medium under standard conditions and microscopic examination in wet KOH mount preparation. All these patients were treated with systemic antibiotics and steroid nasal sprays in the immediate post-operative period and followed for 6 months period to detect recurrence.

The data were analyzed using SPSS software version 20.0 (IBM SPSS Statistics for Windows, Version 20.0, Armonk, New York, USA). Descriptive statistics used include mean and standard deviation

for continuous variables, frequency and percentage for categorical variables.

RESULTS

Table 1: Socio-demographic and clinical characteristics of study participants

S.no	Variables	Categories	Mean/ Median (SD) Frequency (%)N=100
1	Age (in years)		39.29 (13.99)
2	Age groups		
		≤ 20 y	8
		21-40y	40
		41 -60y	38
		>60y	6
3	Sex		
		Male	51
		Female	49
4	Symptoms		
		Nasal obstruction	97
		Nasal discharge	77
		Headache	59
		Watering of eyes	27
		Impaired sense of smell	25
		Facial pain	12
5	Duration of symptoms		
		≤ 6 months	17
		7m-1y	56
		1 -2y	20
		>2y	7
6	Previous history of polyp surgery		17
7	Medical comorbidities		
		Hypertension	20
		Asthma	3
8	Significant family history		6
9	Cold Spatula Test		
	Decreased	Unilateral	16
		Bilateral	62
	Absent	Unilateral	26
		Bilateral	10
10	Anterior rhinoscopy		
		No mass	2
		Unilateral polypoidal mass	28
		Bilateral polypoidal mass	70
11	Posterior rhinoscopy		
		Normal	73
		Mass	7
		Discharge	20
12	Diagnostic nasal endoscopy		
		Unilateral polyp-right	8
		Unilateral polyp- left	7
13	Diagnosis		
		Bilateral polyp	85
		Bilateral ethmoidal polyp	85
		Antrochoanal polyp- right	8
		Antrochoanal polyp- left	7

The mean age of our study participants was 39.29 (±13.99) years. Half of our participants were

in the age group of 31-50 years. Female participants accounted for 49% of the study population. Nasal obstruction was the most common symptom (97%) followed by nasal discharge (77%) and headache (59%). Seventy three percent of the study participants presented with a symptom duration of less than 1 year and 7 percent had symptoms for more than 2 years. Seventeen patients underwent surgery for the same complaints in the past. Medical comorbidities were present in 23 participants, of which 20 were diagnosed with hypertension and 3 with bronchial asthma. Bilateral polypoidal mass was seen in anterior rhinoscopy in 70% of the participants and no mass in 2% participants. Posterior rhinoscopy revealed discharge and mass in 20% and 7 % respectively. In diagnostic nasal endoscopy unilateral antro-choanal polyp and bilateral ethmoidal polyposis were detected respectively in 15 and 85% of study participants. Details provided in table 1.

Functional endoscopic sinus surgery was the preferred approach in 60% followed by Endoscopic polypectomy and Caldwell-Luc procedure in 37 and 3% participants respectively. The histopathological examination of the resected mass indicated that 86% of participants had inflammatory polyps, and 14% had allergic polyps, with eosinophilic infiltrations observed in allergic cases. KOH mount was positive in 12% of the participants. During the 6- month follow-up, recurrence occurred in 8% of the patients in the study group.

Polyp samples underwent fungal culture on Sabouraud's medium, resulting in fungal organism isolation in 17 patients. Overall prevalence of fungal elements in the study participants was 17%, and 17.65% (n=15) and 13.33% (n=2) in bilateral ethmoidal and unilateral antrochoanal polyps respectively. The prevalence of fungal growth in culture among participants with history of previous surgery (n=17) was 23.53% (n=4).

During follow-up post-surgery 3 out of 8 patients with recurrence found positive for fungal growth increasing the prevalence to 37.5%. The predominant organism isolated was *Aspergillus* genus, accounting for 9% of cases. Among *Aspergillus* genus, *Aspergillus flavus* was the most prevalent species, followed by *Aspergillus terreus*. Details presented in table 2.

Table 2: Fungal culture findings of polyp samples

Fungal Culture	Gender		Total N=100
	Male (n=51)	Female (n=49)	
No growth	42(82.4%)	40(81.6%)	82(82.0%)
Fungal colonies	9 (17.4%)	8 (18.4%)	17 (17%)
<i>Aspergillus terreus</i>	1(2%)	1(2%)	2(2%)
<i>Aspergillus flavus</i>	2(3.9%)	3(6.1%)	5(5%)
<i>Aspergillus niger</i>	1(2%)	0(0%)	1(1%)
<i>Aspergillus fumigatus</i>	0(0%)	1(2%)	1(1%)
<i>Alternaria species</i>	0(0%)	1(2%)	1(1%)
<i>Acremonium species</i>	1(2%)	0(0%)	1(1%)
<i>Rhizopus species</i>	1(2%)	1(2%)	2(2%)
<i>Penicillium species</i>	1(2%)	0(0%)	1(1%)
<i>Chrysosporium species</i>	0(0%)	1(2%)	1(1%)
<i>Fusarium species</i>	1(2%)	0(0%)	1(1%)
<i>Curvularia species</i>	1(2%)	0(0%)	1(1%)
<i>Sterile Hyphae</i>	0(0%)	1(2%)	1(1%)

Direct microscopy was positive in 12 patients and they were positive for fungal culture as well but in 5 patients who were negative for KOH, fungal elements were isolated in fungal culture in these 5 patients. Direct microscopy using KOH wet mount is more specific, but fungal culture is a more sensitive test. Chi square test was applied for direct microscopy and fungal culture. The p value obtained was <.0001 implying that there is a significant difference between the two tests in detecting fungal elements in the study conducted.

DISCUSSION

Chronic rhinosinusitis (CRS) is a complex disease with multifactorial etiology. The progression of

CRS differs among patients, with some developing nasal polyposis, while others do not. Nasal polyps are growths that develop from the nasal mucosa or the lining of the paranasal sinuses. They are more prevalent among adults and often emerge as a consequence of diverse inflammatory conditions affecting the paranasal sinuses. Extensive research has been conducted to understand its pathogenesis, disease progression, and treatment optimization [10].

The mean age of our study participant was 39.29 years and half of our study participants were in their fourth and fifth decade which is similar to the findings of a study from Pondicherry [11] and Pakistan [12, 13]. There was no difference in the sex ratio similar to other studies [11-13]. Nasal obstruction followed by nasal discharge and headache were the most common presenting symptoms in our study. These findings were similar to the clinical presentations in studies from Delhi [14], Vellore [15] and Karachi [16]. Bilateral ethmoidal polyp was the most common diagnosis in our study similar to the other [14].

Histopathological examination of the tissue samples showed inflammatory polyp in 86 percent of the times in our study. A study by Telmesani [17] and Shetty et al., [18] found histopathological diagnosis of allergic fungal sinusitis in 12.1 and 16 percent respectively of the samples similar to our study which reported 14 percent.

The prevalence of fungal infection in patients with sinusitis often experience persistent inflammation, leading to increased nasal congestion, nasal discharge, facial pain, and decreased sense of smell. The presence of fungi can also impair the effectiveness of standard medical therapies, including corticosteroids, making the management of nasal polyposis more challenging. Fungal infection in nasal polyposis can contribute to more severe symptoms and have implications for treatment outcomes.

Fungal elements in KOH mount were detected in 12 percent of the tissue samples a finding similar to that reported from Nepal [5] and less than those reported from South India [18]. In fungal culture 17 percent of them grew a fungal colony. This finding is similar to that reported from Karachi [16] and Western Rajasthan [19]. Among chronic rhinosinusitis fungal growth were seen in 36 and 28 percent in adult [15] and pediatric [20] population respectively. *Aspergillus* genus was the most common growth in 50 percent, followed by *Rhizopus* growth in 12 percent of the tissue samples. Among the genus *Aspergillus*, *Aspergillus flavus* species accounted for more than half of those. These findings were consistent with those reported by other Indian studies [15, 19, 21].

Fungal infection has been linked to an increased risk of polyp recurrence following surgical intervention. A multicenter trial in USA reported a recurrence rate of 35% at 6 month follow-up after endoscopic sinus surgery polypectomy [22] and Eosinophil cationic protein in the uncinata tissue and not nasal polyp tissue predicted recurrence [23]. Surgery temporarily alleviates nasal polyps, but persistent fungal colonization or infection can lead to regrowth. Addressing fungi during surgery via culture-guided methods or antifungals may curb recurrence. Diagnosing fungal infection in nasal polyps involves history, examination, endoscopy, imaging, and cultures. Distinguishing colonization from infection guides treatment. Antifungals and nasal corticosteroids form a multimodal approach to manage fungal infection, lessening inflammation. Severe cases may require surgery to clear fungal debris, enhance drainage, and restore nasal function.

Strengths and Limitations

This was one of the few studies which attempted to detect fungal elements in immunocompetent patients with nasal polyposis. Owing to the study design causality could not be established. Domiciliary and socioeconomic factors were not included in the preliminary assessment hence risk factors could not be determined.

CONCLUSION

In conclusion, fungal infection is a significant contributing factor in the pathogenesis of nasal polyposis. Its prevalence can vary but is observed frequently in patients with this condition. Understanding the role of fungi in nasal polyposis is vital for accurate diagnosis, effective treatment, and improved patient outcomes. Comprehensive diagnostic evaluation and tailored treatment approaches are crucial for managing fungal infection in nasal polyposis effectively. Continued research efforts hold

promise for advancing our knowledge and improving patient care in this area.

Future Directions

Further research is needed to enhance our understanding of the complex interplay between fungal infection and nasal polyposis and refine diagnostic strategies to better differentiate between colonization and infection.

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