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Study on incidence of fungal aetiology in cases of chronic rhinosinusitis: a teaching hospital based study

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ABSTRACT

Background: To study the presence of fungus and their types in nasal swabs taken from osteomeatal complex and in cases of nasal polyp from the nearest point of osteomeatal complex under endoscopic vision from the patients of chronic rhinosinusitis, using fungal culture and smear as the diagnostic method and to ascertain radiological, endoscopic and clinicopathological correlation.
Methods: 100 patients with CRS attending ENT OPD at tertiary care hospital to know the presence of fungus and their types and correlate clinico-pathological findings among patients of CRS with positive fungal culture and staining with those without positive fungal culture and staining.
Results: Positive fungal cultures and smear in all cases including those who underwent endoscopic sinus surgery tissue samples were submitted for fungal elements, eosinophilia and fungal culture. Evidence of fungal infection was obtained in 32% (n=32) cases. Amongst the total patients, in 68 (68%) patients fungal culture and smear were negative (Table 1). Correlation between CT score (Lund-Mackay) and endoscopic findings score (Lund- Mackay) among patients of CRS with positive fungal etiology and CRS without positive fungal etiology showed highly significant p value.
Conclusions: The fungal infection is frequent in patients with chronic rhinosinusitis (32%), though on the lower side when compared to various other studies which have shown much more incidence of fungus in cases of CRS using advanced diagnostic tools and better methods of sample collection. Based on our results, *Aspergillus* (71.875%) was the most frequent isolated fungus in CRS patients followed by *Mucormycosis* and *Candida*.

Keywords: Fungus, Chronic rhino sinusitis, Etiology, Polyps and nasal discharge

INTRODUCTION

Chronic rhinosinusitis (CRS) is a term that has been used to describe a number of entities characterized by chronic symptoms of nasal and sinus inflammation or infection. Chronic rhinosinusitis is one of the most common causes of visit to ENT OPD. This is one of the commonest causes of morbidity among all age groups. The group of CRS disorders annually accounts for as many as 22 million office visits and more than 500,000 emergency department visits in the USA according to some estimates.[1] There is no definite data regarding Indian scenario but we can estimate the burden of this disease on our society by the number of patients of CRS coming to our OPD. These patients present with sign and symptoms which are wide and varied and pose a great challenge to doctor in diagnosing and managing the situation. During the past 10 years, the prevalence of CRS has increased more than 50%. Chronic rhino sinusitis (CRS) is becoming more prevalent with industrialization and

prevailing pollution. Though there is no definite etiological factor for causation of CRS but industrialization and pollution are adding on to the probable causes of CRS.

Chronic rhinosinusitis is defined as a group of disorders characterized by inflammation of the mucosa of the nose and paranasal sinuses of at least 12 weeks duration. The diagnosis of CRS has been based largely on symptoms that have been categorized as either major or minor.[2] There are number of researchers and societies who has given various diagnostic criteria for diagnosing CRS, but the most commonly accepted and prevalent criteria is by rhinosinusitis task force of the American Academy of Otolaryngology-Head and Neck Surgery.[2]

Despite being widespread, little is known about the etiology and pathophysiology of CRS.[3] There are number of entities like allergic rhinitis, fungal sinusitis, nasal polyposis which share somewhat similar pathophysiology with CRS. Treatment has been symptomatic and focused on relieving symptoms. Improved diagnostic and radiological investigation have shown new lights on pathophysiology of CRS and have helped in correctly diagnosing this entity.

Recent investigations into causes of CRS have revealed that most CRS patients have an eosinophilic infiltration of their nasal tissue (mucosa), regardless of atopy and elevated immunoglobulin levels.[4] The diagnosis of CRS is based largely on symptomatic criteria, with anterior rhinoscopy or endoscopy, and, if there is any doubt about the diagnosis, computed tomography imaging is employed to confirm the presence of diseased sinus mucosa. Aim of this present study was to be the presence of fungus and their types in nasal swabs taken from osteomeatal complex and in cases of nasal polyp from the nearest point of osteomeatal complex under endoscopic vision from the patients of chronic rhinosinusitis, using fungal culture and smear as the diagnostic method and to ascertain radiological, endoscopic and clinic-pathological correlation.

METHODS

A prospective study was conducted among 100 consecutive patients with CRS attending ENT OPD at a tertiary care hospital between Jan 2012 to Dec 2012 to know the presence of fungus and their types and correlate clinico-pathological findings among patients of CRS with positive fungal culture and staining with those without positive fungal culture and staining. CRS was defined as per the major and minor criteria given by rhinosinusitis task force of the American Academy of Otolaryngology-Head and Neck surgery and infection of nasal and paranasal sinuses that persisted for more than 12 weeks.[2] Written informed consent was taken from all the patients. The study was placed before and approved by the ethics committee of the Institute.

Inclusion criteria were patients above 15 yrs of age, with signs and symptoms of rhinosinusitis of more than 12 weeks duration and satisfy TFR criteria.

Exclusion criteria were (a) patients below 15 years of age (b) patients of rhinosinusitis of less than 12 weeks duration (c) pregnant women.

Outcome to be measured was the presence or absence of fungus and their types in nasal swab culture and nasal smear in cases of chronic rhinosinusitis and its correlation with radiological, endoscopic and clinico-pathological findings.

Statistical analysis was done using Chi-square, Fischer exact test and unpaired‘t’ Test. Data are presented as means, standard deviations or when indicated as absolute number and percentage. P value of <0.05 was considered significant.

RESULTS

Positive fungal cultures and smear in all cases including those who underwent endoscopic sinus surgery tissue samples were submitted for fungal elements, eosinophilia and fungal culture. Evidence of fungal infection was obtained in 32% (n=32) cases. Amongst the total patients, in 68 (68%) patients fungal culture and smear were negative (Table 1). In this study, 44% (n=44) of the patients were males and 56% (n=56) were female (Table 2).

Table 1: Distribution of cases of CRS with and without fungal etiology (n=100).

Group	Total no cases	% of cases
CRS with fungal etiology	32	32
CRS without fungal etiology	68	68

Table 2: Epidemiological profile of the study group (n=100).

Parameters	CRS with fungal etiology	CRS without fungal etiology	% of cases with fungal etiology (%)
Age group (years)			
18-28	04	14	12.50
29-38	04	12	12.50
39-48	07	20	21.87
49-58	08	10	25.00
59-68	09	12	28.13
Total	32	68	100
Sex			
Male	20	36	62.50
Female	12	32	37.50
Total	32	68	100

Table 3: Incidence of fungus and their types in cases of chronic rhinosinusitis (n=32).

Type of fungal species	No of cases	% of cases (of fungal positive)	% of cases (of total)
Aspergillus niger	23	71.875	23
Mucormycoses	05	15.625	05
Epidermophyton	02	6.25	02
Candida albicans	02	6.25	02

Total of 15 (15%) patients underwent endoscopic sinus surgery and all of these showed fungal elements and eosinophillia in the tissue submitted. Fungal smear was positive in 07 (07% of total and 21.9% of total positive cases. Mycological culture exam showed *Aspergillus* as the most frequent species, followed by *Mucormycosis*, *Epidermophyton* and *Candida*. *Aspergillus niger* were present in 23 (71.875% of total positive and 23% of total cases) out of total 32 positive fungal patients. *Mucormycosis* was present in 05 patients (15.625% of total positive and 5% of total cases) whereas *Epidermophyton* and *Candida* were present in two each (6.25% of total positive and 2% of total cases) (Table 3). The most common clinical presentation was nasal obstruction and nasal discharge which was present in all cases (100% of cases) included in this study. Other common clinical presentation was with facial fullness, facial congestion and olfactory problems (Table 4). Correlation between signs and symptoms among CRS with positive fungal etiology and CRS without positive fungal etiology were done using Chi-Square test and Fischer exact test (Table 4). I No significant difference was observed between CRS with positive fungal etiology and CRS without positive fungal etiology patients for major nasal symptoms like nasal obstruction, nasal discharge, facial pain, facial fullness, pus in nasal cavity, acute fever and hyposmia. The p value was not significant for above mentioned major symptoms. But minor symptoms like headache, dental pain and halitosis showed significant difference between two groups. Correlation between signs and symptoms among CRS with positive fungal etiology and CRS without positive fungal etiology were done using Chi-Square test and Fischer exact test (Table 4).

Table 4: Correlation between the cases CRS with fungal etiology and without fungal etiology in relation to their varying signs and symptoms (as per Rhinosinusitis Task Force's definitions).

Sign/symptoms		Patient groups		
		CRS with fungal etiology	CRS without fungal etiology	P value
Nasal obstruction		32	68	-
Nasal discharge		32	68	-
Facial pain/ pressure	Present	18	34	0.55
	Absent	14	34	
Facial congestion/fullness	Present	12	24	0.83
	Absent	20	44	
Hyposmia/anosmia	Present	16	35	0.89
	Absent	16	33	
Pus in nasal cavity	Present	10	28	0.34
	Absent	22	40	
Acute fever	Present	06	12	0.893
	Absent	26	56	
Headache	Present	06	40	0.000
	Absent	26	28	
Halitosis	Present	03	25	0.004
	Absent	29	43	
Dental pain	Present	10	08	0.01
	Absent	22	60	
Cough	Present	02	10	0.224
	Absent	30	58	
Ear pain/pressure	Present	02	12	0.125
	Absent	30	56	

No significant difference was observed between CRS with positive fungal etiology and CRS without positive fungal etiology patients for major nasal symptoms like nasal obstruction, nasal discharge, facial pain, facial fullness, pus in nasal cavity, acute fever and hyposmia. The p value was not significant for above mentioned major symptoms. But minor symptoms like headache, dental pain and halitosis showed significant difference between two groups. The p value for above mentioned minor symptoms was significant.

Table 5: Correlation between the cases with fungal etiology and negative fungal etiology in relation to their varying signs and symptoms (as per Lund and Mackay staging system- scored between 1-10, 0- symptom not presents 10- greatest severity).

	Lund and Mackay scoring system (mean±SD)					
Group	**Facial pain/pressure**	**Headache**	**Nasal blockage/ congestion**	**Nasal discharge**	**Olfactory disturbances**	**Overall discomfort**
CRS with fungal etiology	6.2±2	6.4±1.8	8±1.2	7.2±2	5±1	6.4±2
CRS without fungal etiology	3.2± 2	4.2±1.6	6.2±2	5.2±1.2	3±1	4.25±1.6
P value	0.003	0.01	0.02	0.014	0.000	0.014

Table 6: Correlation between the cases with fungal etiology and without fungal etiology in relation to the NCCT PNS findings using Lund and Mackay score.

Group	CT score (Lund- Mackay)	P value
CRS with fungal etiology	17.5±4	0.0001
CRS without fungal etiology	12±2.3	

Table 7: Correlation between endoscopic findings and fungal smear and culture report.

Endoscopic findings	CRS with fungal etiology	CRS without fungal etiology	P value
Polyp present	24	28	0.001
Polyps absent	08	40	
Nasal mucosa polypoidal	22	48	0.851
Nasal mucosa not polypoidal	10	20	
Osteomeatal complex blocked	20	46	0.612
Osteomeatal complex not blocked	12	22	
Pus present in middle meatus	10	28	0.340
Absent	22	40	

Table 8: Correlation between endoscopic scoring as per Lund and Mackay scoring system and fungal smear and culture report.

Group	Lund and Mackay scoring (mean±SD)	P value
CRS with fungal etiology	10.2±2.1	0.022
CRS without fungal etiology	8.2±2	

Table 9: Correlation between CT Score (Lund- Mackay) and endoscopic findings score (Lund-Mackay).

Group	CT score (Lund-Mackay)	Endoscopic findings score (Lund-Mackay)	P value
CRS with fungal etiology	17.5±4	10.2±2.1	0.0001
CRS without fungal etiology	12±2.3	8.2±2	

Similar correlation was performed for clinical symptoms score using Lund and Mackay score[5] between patients of CRS with positive fungal etiology and CRS without positive fungal etiology using unpaired 't' test (Table 5). It showed a significant difference in score for all symptoms among two groups. The p value showed a highly statistically significant difference for facial pain/pressure and olfactory disturbances, whereas it was significant for headache, nasal blockage, nasal discharge and overall discomfort.

NCCT PNS of all patients were scored as per Lund and Mackay score and correlation done between patients of CRS with positive fungal etiology and CRS without positive fungal etiology using unpaired 't' test (Table 6).[5] It showed a highly significant p value for this variable.

Correlation between endoscopic findings among patients of CRS with positive fungal etiology and CRS without positive fungal etiology was done using Chi Square test and Fischer exact test (Table 7). It showed a significant p value for presence of nasal polyps only. Nasal polyps

were more common in patients of CRS with positive fungal etiology.

Correlation between endoscopic scoring as per Lund and Mackay scoring system[5] and fungal smear and culture report were done using unpaired 't' test (Table 8). It showed significant p value for CT findings among patients of CRS with positive fungal etiology and CRS without positive fungal etiology. Correlation between CT score (Lund-Mackay) and endoscopic findings score (Lund-Mackay) among patients of CRS with positive fungal etiology and CRS without positive fungal etiology was done using Chi square test and Fischer exact test (Table 9). It showed highly significant p value for endoscopic and CT findings among patients of CRS with positive fungal etiology and CRS without positive fungal etiology.

DISCUSSION

This study showed that fungal cultures and fungal smear of nasal/paranasal mucus and tissue submitted was positive in 32% of cases. This included positive fungal smear which was in 07% of total cases, fungal culture was positive in total 28% of cases. 04 cases in which fungal smear were positive did not grow fungus on culture. The most common species grown in this study was *Aspergillus* 71.875%) followed by *Mucormycosis* (15.625%), *Epidermophyton* (6.25%) and *Candida* (6.25%). This variation in species of fungus can be explained by the seasonal and geographical variation. This has been shown in various studies also.

Out of total 100 patients 52 (52%) had nasal polyps either unilateral or bilateral of which 15 underwent endoscopic sinus surgery and rest were being managed conservatively. Out of these 52, 15 who underwent surgery showed 100% positivity for eosinophilic infiltration in HPE of submitted tissue and 11 out of these grew fungus on culture. Remaining 37 patients with nasal polyp showed positive fungal culture in 9 cases. This variation in positivity for fungus among the group who underwent surgery and those who did not undergo surgery can be explained by the fact that there was difficulty in collection of nasal/paranasal mucus from the osteomeatal complex in the case with nasal polyps.

Positive fungal smear of nasal/paranasal sinuses mucus were seen in 07% of cases. These variable rates of fungi in CRS patients in different studies may be explained by epidemiological and geographic variations and study conditions such as the number of the patients and the methods used for detection of fungi. Various studies which have used advanced diagnostic techniques like PCR and tissue HPE have shown more prevalence of fungus in cases of CRS as well as in normal volunteer.[5]

In this study patients were also evaluated for endoscopic and CT scan findings. All cases underwent nasal endoscopy on first visit by an experienced ENT surgeon and NCCT PNS was advised to all cases. NCCT PNS findings and Endoscopic findings then were scored as per Lund and Mackay score for CT scan and Endoscopy respectively.[6] This score was then compared among patient of CRS with positive fungal etiology and without positive fungal etiology. This correlation showed significant variation in CT and endoscopy score among Patients with CRS with positive fungal etiology and Patients without positive fungal etiology. This shows that there are more radiological changes in patients with fungal infection. In the majority of cases of patients of chronic rhinosinusitis radiological evidence of the disease was present. In this study, the maxillary sinus was the commonest sinus involved either alone or with involvement of other sinuses. The narrowing or blockage of ostio-meatal complex (OMC) was a frequent finding. In this study, OMC involvement was commonly associated with mucosal thickening in the maxillary, ethmoid and the frontal sinuses. This could be explained by the fact that the OMC is a common draining channel most commonly involved in chronic rhinosinusitis. The presence of minor swelling may cause the opposition of the mucosal layer that will lead to stenosis or obstruction. Similar findings have been shown in various studies.[7-10]

Presence of nasal polyp was very common in both groups. The presence of polyps usually represents the manifestation of recurrent inflammation. Another study found that polyps are the commonest findings in patients with chronic rhinosinusitis followed by mucosal abnormalities.[11] In one patient, the endoscopic finding (mucopus and polyp) was positive while the CT score was negative. CT has the limitation to assess the presence of mucopus and diseased mucosa as their feature is non-specific. CT is known to be superior in terms of visualisation of deeper structures not visualised by endoscopy like maxillary ostia, infundibulum and the sinus contents. Endoscopy is limited to visualization of anterior nasal cavity and middle meatal cleft. It can however, provide the ability to accurately assess for evidence of localised diseases or for anatomic defects that compromise ventilation and mucocillary clearance.

Nasal obstruction and Nasal discharge were the two universal complaint with which patient presented in both the groups, whereas headache, halitosis and olfactory disturbances were more in the patients of CRS with positive fungal etiology and on statistical analysis showed significant p value. But when similar correlation was done by using Lund Mackay scoring symptoms for various major symptoms, all symptoms had significant p value. This shows that when scored objectively, patients of CRS with positive fungal etiology had significantly high score than patients of CRS without positive fungal etiology.

Similar findings were observed in regard of CT scan findings and endoscopic findings when they were compared using objective Lund and Mackay scoring system for both.[6]

CONCLUSION

Thsese findings suggest that the fungal infection is frequent in patients with chronic rhinosinusitis (32%). Based on our results, *Aspergillus* (71.875%) was the most frequent isolated fungus in CRS patients followed by *Mucormycosis* and *candida*.

The difference between major and minor symptoms among patients of CRS with positive fungal culture and without positive fungal culture was not significant when subjective assessment was done. But when this correlation was done using Lund and Mackay scoring system, there was significant difference between two groups. The p value was significant for all symptoms, radiological and endoscopic finding.

This study also showed that patients of CRS with fungal etiology are more symptomatic than patients of CRS without fungal etiology. Endoscopic changes and Radiological changes which were more in patients of CRS with positive fungal etiology strengthen the role of fungus in pathophysiology and clinical profile in the patients of CRS.

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