

# Fungal Rhinosinusitis in Delhi-National Capital Region

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## ABSTRACT

**Background and objective:** During past decades, fungal rhinosinusitis (FRS) has been diagnosed more frequently. Knowing the fungal flora and its prevalence in chronic rhinosinusitis (CRS) patients will allow a better understanding of this disease, diagnosis and treatment. We studied the prevalence of fungus in CRS patients in Delhi-NCR (National Capital Region) in a tertiary care hospital.

**Materials and methods:** In this prospective study, a total of 180 patients having CRS were enrolled in which functional endoscopic sinus surgery was done. In 173 (96.1%) patients, polyps/tissue/mass were collected during surgery. In seven (3.9%) cases, sinus secretions were obtained. All the collected samples were sent for microbiology and pathology examination. Diagnosis of FRS was confirmed by direct mycological (10% KOH) and/or culture and/or pathology analysis.

**Results:** Forty-eight cases were positive for fungus, out of these 180 patients of CRS. In patients of FRS, the most common presentation was nasal blockage followed by facial pain and facial fullness. The prevalence of FRS was found to be 26.6% in CRS and most common fungal pathogen isolated was *Aspergillus flavus*.

**Conclusion:** Delhi-NCR region falls under a moderate prevalence area for fungal infection in CRS patients as compared to other regions in India. Majority of cases were isolated in summer months, the dry and hot climate of the Delhi-NCR may be responsible for such prevalence.

**Keywords:** *Aspergillus*, FRS, Prevalence, *Rhizopus*.

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## INTRODUCTION

India is a vast country with more than a billion people, spread over an area of 3.3 thousand million square kilometers.<sup>1,2</sup> Geographical and environmental conditions in different parts of the country vary. Located in the tropics and receiving a heavy annual monsoon makes climatic conditions favorable for fungi to grow in major parts of the country.<sup>2</sup> Fungi are found in air, dust, soil, plants and decaying organic matter. They adhere to dust particles and are inhaled and deposited on the nasal and paranasal sinus mucosa. The warm, moist environment of the upper respiratory tract is an ideal environment for the proliferation of these organisms.<sup>3,4</sup> However, they are rarely pathogenic because host resistance is high except under favorable growth conditions in highly susceptible individuals.

Although once considered a rare disorder, fungal rhinosinusitis (FRS) has recently gained importance, as an increase in the incidence has been observed during the past decades. This increase in incidence may be due to technological advances in mycology, serology, histopathology and radiology.<sup>5,6</sup> Fungal overgrowth in the nose and sinus is enhanced due to the altered normal bacterial flora by increasing use of broad spectrum antibiotic and topical preparations.<sup>7</sup> Besides, in the past two decades there is an increase in the use of immunosuppressant drugs, more cases of diabetes mellitus and human immunodeficiency virus (HIV).<sup>6</sup> The knowledge of type of fungal flora, its prevalence, supplementary tests in patients with chronic rhinosinusitis (CRS) have enabled a better understanding of the disease and increased the awareness of the involved physicians for appropriate diagnosis and treatment of this disease entity.<sup>6</sup>

The fungal agents usually isolated from paranasal sinuses include *Aspergillus*, *Mucor*, *Histoplasma*, *Coccidioides*, *Candida*, *Fusarium* spp, *Curvularia* spp, *Pseudallescheria boydii* and *Alternaria* spp. *Aspergillus* is the most common fungal pathogen causing fungal sinusitis.<sup>8,9</sup> The highest mortality rate (33.3%) was reported among patients with zygomycotic infection.<sup>8</sup>

The pattern of organisms varies from place to place and depends upon age, habits of the inhabitants, their immune status and other clinical factors.<sup>9</sup> Treatment in cases of FRS depends on the local prevalence and antifungal sensitivities. The lack of sufficient data relating to actual prevalence of FRS among the clinically suspected patients of CRS in Delhi-NCR (National Capital Region) prompted us to undertake this study. All the cases involved in the study were nonmigrant population of Delhi-NCR.

## MATERIALS AND METHODS

A randomized prospective study was carried out in the Departments of Otorhinolaryngology, Microbiology and Pathology, Lady Hardinge Medical College, New Delhi, for a period of 3.5 years from November 2008 and April 2012. One hundred and eighty patients were randomly selected with CRS fulfilling diagnostic criteria<sup>10</sup> having age more than 14 years. After recording the complete history and physical examination, computed tomographic (CT) scan and other relevant investigations were carried out for each patient. All patients underwent functional endoscopic sinus surgery. Nine (5%) patients were diabetic in this study.

A total of 180 samples, 173 (96.1%) polyp/mass and 7 (3.9%) secretion, were collected from these patients.

One part of the sample was put in a sterile container containing sterile normal saline for mycological and bacteriological examination and the other part was put in 10% formalin for histopathology. A small amount of specimen was mixed with 10% potassium hydroxide (KOH) and was examined under magnification of 40× for the presence of fungal elements. The size, morphology and quantity of any fungal elements were noted. Specimen was inoculated on to Sabouraud's dextrose agar (SDA) with antibiotics for fungal culture. SDA was inoculated at 25°C and 37°C observed for fungal growth daily for 1 week and every week for 3 weeks. Growth, if any, was identified on the basis of rate of growth, color, texture, pigmentation of fungal colony and their morphological features in microscopy. Tissues brought in formalin were processed for histopathological examination (hematoxylin and eosin and periodic-acid Schiff) and the sinus secretions were processed for cytological examination. Diagnosis of FRS was confirmed by direct mycological (10% KOH) and/or culture and/or clinical pathology analysis.

## RESULTS

Out of 180 CRS patients, FRS was diagnosed in 28 males and 20 females. The mean age of patients with FRS was 34.3 years (range: 17-63 years). Maximum 15 cases of FRS were diagnosed in 31 to 40 years of age group. The clinical presentation of patients with FRS is summarized in Table 1. Seasonal variation (monthly isolations) among the FRS cases is shown in Table 2.

A total of 62 isolates were identified from 180 patients of CRS. Out of which 39 were fungal and 23 were bacterial (Table 3). Among the bacterial isolates, 12 *Staphylococcus epidermidis*, 5 *Escherichia coli* and 3 *Staphylococcus aureus*

**Table 1: Distribution of clinical presentation in patients with FRS**

Preoperative symptom	FRS; n = 48 (%)
Nasal blocking	41 (85.4)
Facial pain	38 (79.2)
Facial fullness	38 (79.2)
Rhinorrhea	35 (72.9)
Headache	35 (72.9)
Hyposmia-anosmia	28 (58.3)

**Table 2: Monthly isolation of FRS cases**

Months	FRS cases (%)
March-June (Summer)	24 (50)
July-October (Rainy)	7 (14.6)
November-February (Winter)	17 (35.4)
Total	48 (100)

**Table 3: Diagnosis of fungus**

Test	No. of cases
KOH, culture, histopathology positive	23
KOH and culture positive	16
KOH-positive only	9

and *Streptococcus pneumoniae* each were isolated. Among fungal isolates, 33 were *Aspergillus flavus* and six were *Rhizopus arrhizus*. All *Rhizopus arrhizus* were isolated from diabetic patients, in whom a history of sudden worsening of CRS existed. Six patients showed mixed infection with *Aspergillus flavus* and *Staphylococcus epidermidis*.

## DISCUSSION

Approximately 300 species of fungi have been documented as having caused diseases in human beings<sup>11</sup> and 90% of the infections are attributed to few dozens of species.<sup>12</sup> Most fungi are exogenous; they exist in the soil, water and organic debris. Most mycoses are caused by little fungi that are part of the normal flora, such as candidiasis, or are highly adapted to survive in the human body, such as dermatophytosis.<sup>12</sup>

FRS is a disease that produces significant morbidity or even more fatal outcomes. High morbidity and mortality is seen in patients who develop invasive form of this disease. Since, the incidence of invasive FRS is increasing due to the large number of chronic diseases resulting from aging of the population and/or from pathological situations that require use of immunosuppressant drugs. Early and correct diagnosis combined with proper treatment can reduce the fatality rate associated with this disease. Symptoms are easily overlapping with other diseases and it is difficult for the physician to recognize it. Assessment and management of these conditions may require the participation of many specialists, including the otorhinolaryngologist, microbiologist and pathologist, providing appropriate diagnosis and treatment. Besides this, the clinical suspicion may be based on the existing prevalence rate of this disease in local community and geographical area. The knowledge of these facts is important in the clinical suspicion and investigative approach of ENT patients with CRS in our daily practice. In our study, we tried to define the prevalence of fungal infection in CRS patients as well as type of clinical presentation of the disease in Delhi-NCR.

We diagnosed FRS on the basis of following criteria: Demonstration of fungal elements by direct microscopical examination (10% KOH) and/or with isolation of the fungus. This was based on the fact that because they are ubiquitous fungi, contamination of samples by culture can occur easily during the collection or laboratory processing. Considering the simple identification of fungi does not necessarily confirms the pathogenicity, the diagnosis of a mycotic

infection can only be performed when we analyze the set of data of the culture, surgical findings and results of pathological examination. In our study, out of all 48 cases of FRS, only 23 (48%) samples showed fungal element in histopathology. Similarly Eslamifar et al<sup>13</sup> found fungal culture positive in 49 (49%) cases and on histological examination fungal element was seen in 41 (41%) cases. Karsligil et al<sup>14</sup> also showed fungal growth in 55.9% (33 cases) from patients of CRS while on histopathological examination only 6% (three cases) showed fungal element.

From 180 patients of CRS, on culture 39 fungus and 23 bacteria were isolated. Among the culture positive results for fungus, *Aspergillus flavus* was the commonest causative fungi, isolated in 33 (84.61%) cases. This is in agreement with other studies in India and from outside India.<sup>8,14-16</sup> *Rhizopus arrhizus* was isolated in six patients, all of whom were diabetic. In these cases, bony erosion was also seen by CT scan finding suggesting invasive FRS. Panda et al also found, 10 out of 12 *Rhizopus arrhizus* in diabetic patients.<sup>17</sup>

During the 42 months of our study period, maximum number of FRS (50% patients) was observed during March to June (summer) months. According to Met Monograph No. Environment Meteorology-01/2010 climate profile of India, by India Meteorological Department, Ministry of Earth Sciences, Govt. of India, the temperatures start to increase all over the country in March and by April and maximum temperatures rise sharply exceeding 45°C by the end of May and early June resulting in harsh summers in the North and North-West regions of the country. The season is also characterized by cyclonic storms, which are intense low pressure systems over hundreds to thousands of kilometers associated with surface winds more than 33 knots over the Indian seas viz Bay of Bengal and the Arabian Sea. These systems generally move toward a northwesterly direction and some of them recurve to northerly or north-easterly path. Hot and dry winds accompanied with dust winds ('andhi') blow frequently over the plains of north-west India.<sup>17</sup> During summer, sandstorm disseminate the fungal spores leading to widespread colonization and prolonged exposure to large inocula of spores which probably initiates chronic sinonasal infection, as dry and warm climate appears to be important factor for higher incidence of FRS. Dusty and arid conditions possibly predispose to rhinitis and recurrent sinusitis that facilitates the growth of fungi. Possibly, the dust and frequent sand storms during the summer months contain large numbers of *Aspergillus conidia* that can easily settle on the injured mucosa of the sinuses.<sup>18</sup>

FRS was diagnosed in all age groups range from 17 to 63 years age. Maximum numbers of cases were found in 31 to 40 years of age group and the mean age was 34.3 years.

Chakrabarti et al<sup>19</sup> reported younger age groups are more susceptible for FRS. The mean age for fungal nasal polyposis shows that adults who expose to air pollutant and use more antibiotics through their life suffer from the disease. The extremes of age were contributed with underlying disease. However, no particular age group can be considered a risk factor for the development of FRS.

We found the prevalence of FRS in CRS patients in our region is 26.6%. The prevalence rate reported is less as compared to other studies from various parts of India. Chakrabarti et al<sup>3</sup> from Chandigarh and Venugopal et al<sup>20</sup> from Tamil Nadu reported 42% and 45% of prevalence rates respectively. This may be due to different climate conditions like temperature and air relative humidity<sup>4</sup> playing a role in the pathogenesis of FRS, as the presence of a specific fungus in the environment is related with environmental conditions. The significantly higher prevalence rate in some studies has been attributed to improved and novel technique for processing samples for detection of fungi. This varying prevalence in different geographical areas remains unexplained.

## CONCLUSION

In Delhi-NCR, the prevalence of FRS was found to be 26.6% and most frequently isolated fungus was *Aspergillus flavus*. Our region falls under a moderate prevalence area after comparing with data from other regions. As highest percentage of cases were isolated in summer months, dry and hot climate of the Delhi-NCR may be responsible for such prevalence. This led us to believe that during summer months high degree of suspicion should be given for FRS in CRS patients.

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