

RHINOLOGY

Prevalence of fungal infection among Iranian patients with chronic sinusitis

Prevalenza delle infezioni micotiche tra i pazienti iraniani affetti da sinusite cronica

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SUMMARY

Chronic sinusitis is a major cause of morbidity today. Regional variations in the incidence of this disease have been reported. The aim of this study was to evaluate the incidence of fungal infection as the causative agent of chronic sinusitis among Iranian patients. A cross sectional hospital based study was designed; the patients underwent paranasal sinus washing and maxillary sinus biopsy. All specimens were studied by light microscopy. Fungal culturing was employed to confirm diagnosis. The patients underwent Computed Tomography for sinus evaluation. Of 162 participants, 12 samples from patients showed fungal elements, 2 of them *Aspergillus fulvovus* (1.2%), 9 of them *Alternaria species* (5.56%) and 1 of them *Psilomyces* (0.6%). All patients presented radiologic evidence of sinusitis, ranging from mucosal thickening to total opacity. In conclusion, results obtained showed a low prevalence of fungal sinusitis among Iranian patients with chronic sinusitis. Findings also showed that *Alternaria* is the most causative agent.

KEY WORDS: Paranasal sinuses • Chronic sinusitis • Fungal infection

RIASSUNTO

*La sinusite cronica è attualmente una patologia molto frequente, la cui incidenza è variabile da paese a paese. Lo scopo di questo studio è stato quello di valutare l'incidenza di infezione micotica come agente causale delle sinusiti croniche in Iran. A questo proposito è stato realizzato uno studio cross sectional, in cui i pazienti arruolati sono stati sottoposti a lavaggio dei seni paranasali e biopsia del seno mascellare. La coltura specifica per i miceti è stata utilizzata per la conferma diagnostica. Inoltre i pazienti sono stati sottoposti a tomografia computerizzata dei seni paranasali. Dei 162 pazienti inclusi nello studio, in 12 pazienti sono stati messi in evidenza miceti, in particolare in 2 pazienti *Aspergillus fulvovus* (1,2%), in 9 *Alternaria species* (5,56%), e in un caso *Psilomyces* (0,6%). Tutti i pazienti presentavano segni radiologici di sinusite, variabili da un ispessimento mucoso al completo opacamento del seno mascellare. In conclusione, questo studio ha messo in evidenza globalmente una bassa incidenza di sinusiti micotiche nella popolazione iraniana; tra i miceti chiamati in causa nelle affezioni sinusali, il più frequente è rappresentato dall'*Alternaria*.*

PAROLE CHIAVE: *Seni paranasali • Sinusiti croniche • Infezioni micotiche*

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Introduction

Rhinosinusitis is the symptomatic inflammation of the paranasal sinuses and nasal cavity. It may be further classified as acute (less than 4 weeks), subacute (4-12 weeks) or chronic (more than 12 weeks, with or without acute exacerbations). Chronic rhinosinusitis is one of the most common chronic diseases, with a substantial negative health impact due to this disease¹. In contrast to acute sinusitis, for which bacterial and viral infection are the major causative agents, the pathogenesis of chronic sinusitis is not yet understood². Although there are controversies in the categorization of chronic rhinosinusitis³, the pathobiologic role of fungus, as the causative agent, is not yet known⁴.

Fungus spores are widely distributed in the environment, upon inhalation they can colonize, cause invasive or non-invasive forms, mainly depending on host immunity⁵. So the fungal rhinosinusitis is divided into two broad categories, invasive and non-invasive, depending on invasion to the mucosal layer. Three types of invasive fungal rhinosinusitis are described: acute invasive, chronic invasive, and granulomatous. The two non-invasive forms are fungal ball, and fungus related eosinophilic rhinosinusitis including allergic fungal rhinosinusitis (AFRS)⁴. Chronic invasive, granulomatous, fungal ball and fungus-related eosinophilic rhinosinusitis are chronic forms of fungal rhinosinusitis⁶.

Regional variations in the incidence of fungal infection have been reported^{7,8}. It has been shown that chronic fungal sinusitis is more prevalent in African Americans and lower income societies⁸. On the other hand, the incidence of fungal rhinosinusitis in the immune competent host is increasing⁹. We did not find any study demonstrating the prevalence of fungal infection among Iranian patients with chronic sinusitis. We aimed to provide a picture of fungal infection among Iranian patients with chronic sinusitis.

Material and methods

This was a cross sectional study conducted from February 2007 to September 2009. A total of 162 patients with documented chronic sinusitis who attended Vali Asr Hospital, affiliated to Tehran University of Medical Science, were included in the study. Demographic and anthropometric profiles as well as the history of previous treatment was collected upon admission. All patients underwent paranasal sinus washing with potassium hydrate solution 10%. Light microscopy was employed for examination of nasal secretions. Those in whom no pathogen was detected with light microscopy underwent bilateral functional endoscopic sinus surgery of the maxillary sinus for aspiration biopsy, local anaesthesia for 15 minutes by lidocain solution, then the middle wall of the maxillary sinus was punctured using needle number 16 or 18. The secretion was totally aspirated and the sinus was washed using 10 cc of normal saline to make available a specimen for diagnosis. Treatment consisted of functional endo-nasal sinus surgery and lavage in all the patients studied. We did not use antifungal agents for treatment, as some studies have suggested that these antifungal agents are not effective

in the management of chronic fungal sinusitis¹⁰. Fungal culture was performed for all participants in 2 plates which were kept at 30 and 37°C, respectively. The type of fungal infection was confirmed with morphologic characteristics of colonies. All patients underwent Computed Tomography (CT) scanning for further evaluation.

Results

There were 162 participants, 52 (32%) of whom women and 110 (68%) men with a mean age of 31.62 ± 12.56 years. Characteristics of participants are presented in Table I. Twelve samples from patients showed fungal elements (2 of them *Aspergillus fulvovous* (1.2%), 9 of them *Alternaria species* (5.56%) and 1 of them *Psilomyces* (0.6%)). All patients had radiologic findings ranging from mucosal thickening to total opacity (Table I). All species were evaluated by light microscopy and culturing. Light microscopy confirmed fungal infection in 5 of them, while 7 of them did not show any evidence of fungal infection upon light microscopy. The distribution of fungal infection, according to age group of the patients, is presented in Table I.

Discussion

Results showed that the prevalence of fungal infection is about 7.4% among patients with chronic sinusitis. We also demonstrated that *Alternaria* is the most causative agent, being more prevalent in patients in their 3rd or 4th decade of life; however, we did not find any sex difference among them.

Regional variations have been reported in the prevalence of chronic fungal sinusitis⁷. Wise et al. showed that Afri-

Table I. Characteristics of participants.

	Negative Culturing N = 150	Positive Culturing N = 12
Age (yrs)		31.62 ± 12.56
Male (n, %)	101 (92%)	9 (8%)
Female (n, %)	49 (94%)	3 (6%)
Positive on light microscopy (n, %)	150 (95.5%)	7 (4.5%)
Negative on light microscopy (n, %)	0 (0%)	5 (100%)
Right Maxillary Sinus Opacities (n, %)	30 (97%)	1 (3%)
Left Maxillary Sinus Opacities (n, %)	48 (96%)	2 (4%)
Bilateral Maxillary Sinus Opacities (n, %)	72 (88%)	9 (12%)
Age Groups (yrs)		
10-19 (n, %)	29 (100%)	0 (0%)
20-29 (n, %)	45 (94%)	3 (6%)
30-39 (n, %)	45 (86%)	7 (4%)
40-49 (n, %)	20 (95%)	1 (5%)
50-59 (n, %)	6 (86%)	1 (15%)
> 60 (n, %)	5 (100%)	0 (0%)

can Americans are more prone to allergic fungal sinusitis than whites⁸. Dall'Igna et al. reported a 6.7% prevalence of fungal sinusitis in Brazil¹¹. The prevalence of allergic fungal sinusitis is about 12.1% among patients with nasal polyps in Saudi Arabia¹², and about 13% among Turkish patients with chronic rhino-sinusitis¹³. To date, we are unaware of any study demonstrating the prevalence of fungal sinusitis among Iranian patients with chronic sinusitis. We found a 7.3% prevalence of fungal infection among Iranian patients with chronic fungal sinusitis. The highest prevalence of fungal infection was in the 3rd and 4th decade of our studied population (83%). Likewise, other studies have suggested that chronic fungal sinusitis is a disease of younger age groups, especially those in their twenties and thirties¹⁴⁻¹⁷. On the contrary, Ferreiro et al. showed a higher prevalence of fungus ball in elderly patients¹⁸. In addition, we did not find any sex difference in our study population. Consistent with our findings, Wise et al. did not report any sex difference in chronic fungal sinusitis¹⁹. Nicolai et al. showed a higher prevalence in women¹⁵. Tahimi et al. reported a male predominance in chronic fungal sinusitis. We suggest further prospective studies to answer these questions.

Aspergillus is reported as the most aetiological agent in many studies^{11 17 20 21}. In the study of Tahim et al., *Aspergillus* has a 60% prevalence¹⁷. A high prevalence of *Aspergillus* infection has also been reported in the French population⁹. We showed that *Alternaria species* are the most causative agents in the pathogenesis of chronic fungal sinusitis in Iran. It has been suggested that *Alternaria* increase IgG antibodies and inflammatory factors in patients with chronic sinusitis²². *Alternaria* is one of the most common fungi worldwide, found almost everywhere. It produces long chains of spores that are easily dispersed through the air. In addition, *Alternaria species* are diverse with numerous strains, unique to different environments world-

wide^{23 24}. We did not find any study reporting *Alternaria* as the most causative agent in the pathogenesis of allergic fungal sinusitis. Whether the difference in the culprit agent of fungal sinusitis, between Iran and other countries, is due to regional differences or socio-economic status remains to be studied in the near future.

Much controversy exists regarding the role of socioeconomic status and fungal sinusitis^{17 25}. While some Authors have reported a significant positive correlation between poor socio-economic status and fungal sinusitis¹⁷, some have not found any correlation²⁵. On the other hand, it is known that geographical variations, like climate and weather humidity, play some role in the incidence and prevalence of fungal sinusitis^{26 27}. Iran is a vast country with a great variability in climate and geographical regions as well as population. Patients who attend University Hospitals, in Iran, are usually of lower socio-economic status and are usually from all around Iran. However, we did not include the place of birth, residence, and income, in our study. These may be the major confounding factors which affect an estimation of the prevalence of chronic fungal sinusitis and its culprit pathogens in Iran.

In conclusion, we showed a low prevalence of fungal sinusitis among Iranian patients with chronic sinusitis. We also showed that *Alternaria* is the most causative agent. These findings are of great clinical importance due to a high rate of emigration from Iran to other countries especially Europe and North America. The principal limitation of the present study is the cross sectional nature which precludes the determination of causality, however we took advantage of a relatively large sample size.

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