Main Article

Allergic fungal rhinosinusitis with skull base and orbital erosion

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Abstract

Introduction: Allergic fungal rhinosinusitis is a benign, noninvasive sinus disease related to hypersensitivity to fungal infection having bony skull base and orbital erosion as common finding.

Patients and method: This descriptive study was conducted at the department of otorhinolaryngology, Dow University of Health Sciences, Karachi, Pakistan, from April 2003 to March 2006. In forty-seven proven cases of allergic fungal sinusitis the following information was recorded: demographic data, signs and symptoms, laboratory investigation results, imaging results, pre- and post-operative medical treatment, surgery performed, follow up, and residual or recurrent disease. The Statistical Package for the Social Sciences version 10.0 software was used for data analysis.

Results: Findings indicated that allergic fungal rhinosinusitis usually occurred in the second decade of life (51.06 per cent) in males (70.21 per cent), allergic rhinitis (100 per cent) and nasal polyposis (100 per cent). Nasal obstruction (100 per cent), nasal discharge (89.36 per cent), postnasal drip (89.36 per cent), and unilateral nasal and paranasal sinus involvement (59.57 per cent) were significant features. Aspergillus (59.57 per cent) was the most common aetiological agent. Combined orbital and skull base erosion was seen in 30.04 per cent of cases, with male preponderance 6.8 : 1. Endoscopic sinus surgery was performed in all cases, and recurrent or residual disease was observed in 19.14 per cent.

Conclusion: Allergic fungal rhinosinusitis is a disease of young, immunocompetent individual. Skull base and orbital erosion are seen in one-third of cases. Bone erosion is 6.8 times more common in males than females. Orbital erosion is 1.5 times more common than skull base erosion. Endoscopic surgical debridement and drainage combined with topical steroids leads to resolution of disease in the majority of cases, without resorting to systemic antifungal agents, craniotomy or dural resection.

Key words: Sinusitis; Fungus; Aspergillus; Endoscopy; Computed Tomography

Introduction

Allergic fungal rhinosinusitis is a form of paranasal mycosis that often causes bone destruction with extension into the orbit and anterior skull base.[1]

Five basic diagnostic categories of fungal rhinosinusitis disorder are currently recognised, differentiated by their characteristic clinical presentation and histopathological findings. Three types of fungal rhinosinusitis are true, tissue-invasive, infectious diseases: acute necrotising (acute invasive) fungal rhinosinusitis, chronic invasive fungal rhinosinusitis and granulomatous invasive (indolent) fungal rhinosinusitis. The two non-invasive fungal rhinosinusitis disorders are fungal ball (sinus mycetoma) and allergic fungal rhinosinusitis.[2] Allergic fungal rhinosinusitis usually follows a slow, nonaggressive course. However, extension of the disease process outside the confines of the sinuses can lead to massive bone destruction. Kinsella *et al.* have proposed a new diagnostic entity, 'skull base allergic fungal sinusitis', which incorporates the histological diagnostic criteria of allergic fungal sinusitis with the computed tomography (CT) criteria for bone erosion. Biopsy is necessary to exclude invasive fungus or tumour. Otolaryngologists, ophthalmologists and neurosurgeons should be familiar with skull base allergic fungal sinusitis so that systemic antifungal agents, craniotomy and dural resection (which may initially appear necessary) can be avoided.[3]

Allergic fungal rhinosinusitis is managed using pre-operative corticosteroids and antibiotics for 10 to 14 days, prior to surgery, to decrease intranasal inflammation and post-obstructive bacterial sinusitis.

Endoscopic sinus surgery (ESS) is accepted to be the most appropriate surgical procedure for allergic fungal rhinosinusitis. Weekly follow-up visits are

required in the first post-operative month to allow regular inspection of the operative site and cleaning of crusts and retained debris. To attain best results, systemic corticosteroids are continued for three to four weeks in the post-operative period, and are then gradually tapered. Topical steroids are also administered for six months post-operatively. Allergic fungal rhinosinusitis is more prevalent in temperate regions with high humidity, such as Karachi; thus the number of cases presenting to our department is ever-increasing.

The diagnosis and treatment of allergic fungal rhinosinusitis remains difficult and controversial, despite the increasing number of publications in the international literature. As very few local studies were available, we conducted this study in our department to evaluate the presentation and management of allergic fungal rhinosinusitis, with special reference to orbital and skull base erosion. This study serves not only to emphasise the seriousness of this condition, but also to propose a management strategy aiming to minimise complications, morbidity and recurrence.

Materials and methods

Forty-seven proven cases of allergic fungal sinusitis (using fungal culture and sensitivity, and/or fungal staining) were selected for this study, irrespective of age, sex, socioeconomic status and geographical area. This descriptive study was conducted from April 2003 to March 2006 in the department of otorhinolaryngology – head and neck surgery, Dow Medical College and Civil Hospital, Karachi, a 1837-bed, tertiary care hospital. A non-probability sampling technique was used.

We used a proforma to record: patient demographic data (including name, age, sex, address and socioeconomic status); signs and symptoms, laboratory investigation results (especially immunoglobulin (Ig) E and eosinophil count); and imaging results (CT and/or magnetic resonance imaging (MRI)).

The following criteria were used for case selection: (1) clinical picture of nasal polyposis, along with characteristic CT findings depicting marked polyposis involving the nose and paranasal sinuses means maxillary, frontal, ethmoidal & sphenoidal sinuses, with orbital and skull base erosion; (2) identification of allergic fungal mucin (grossly at surgery or on histopathological analysis); and (3) absence of invasive fungal disease.

We also recorded details of: surgical procedures performed; pre- and post-operative treatment; follow-up results (assessed weekly for the first month and then monthly for two years); detection of residual disease (within six months of surgery); recurrence of disease (more than six months after surgery); and revision surgery for residual or recurrent disease.

The Statistical Package for the Social Sciences version 10.0 software was used for statistical analysis. Data analysis used: the male to female ratio to indicate sex distribution; mean $\pm$ standard deviation (SD) for age distribution; and frequencies and percentages for all categorical variables (e.g. socioeconomic status, CT findings, clinical features and treatment).

Results

Forty-seven cases of proven allergic fungal sinusitis were evaluated. The majority of patients (78.71 per cent) were in their second or third decade (Table I). The mean age $\pm$ SD was 23.44 ± 10.34 years; the age range was 11 to 60 years.

Males comprised 70.21 per cent of the patients and females 29.78 per cent; the male to female ratio was 2.3 : 1 (Figure 1).

The majority of patients (63.83 per cent) were of lower socioeconomic status (Table II).

Histopathological analysis showed aspergillus to be the commonest type of fungus identified (59.57 per cent). In the remaining (40.42 per cent) cases, allergic mucin was seen but no fungal spores were identified.

Computed tomography scanning demonstrated double density signs on CT Scan is due to magnesium deposition, showing hyperdense areas on isodense back ground indicating fungal infestation in 37 cases (78.72 per cent), while orbital erosion (Figure 2) was noted in 29.78 per cent of cases and skull base erosion (Figure 3) in 19.14 per cent (Table III).

Due to financial constraints, MRI was performed only in 14 cases (29.78 per cent) suspected of having intracranial and/or orbital involvement.

Nasal obstruction was the most common clinical feature, being observed in all cases (100 per cent), while nasal discharge (89.36 per cent) and postnasal drip (89.36 per cent) were the next commonest findings (Table IV).

Of the extranasal and paranasal sinus symptoms, headache (29.78 per cent), telecanthus (29.78 per cent) and facial disfigurement (29.78 per cent) were the most common, while proptosis (19.14 per cent) and facial pain (10.63 per cent) were also encountered. The most common positive laboratory findings were raised eosinophil counts (80 per cent) and increased IgE levels (80 per cent). Unilateral involvement of the nose and paranasal sinuses was seen in 59.57 per cent of cases, while nasal polyps and allergic rhinitis were present in all cases (100 per cent).

Orbital and skull base erosion was observed in 30.04 per cent of cases, orbital erosion alone in 29.78 per cent and skull base erosion alone in 19.14 per cent (Table III). Interestingly, orbital and/or

TABLE I

AGE DISTRIBUTION

Age (yrs)	Patients	
	n^*	%
11–20	24	51.06
21–30	13	27.65
31–40	6	12.76
>40	4	8.51

$^*n = 47$. Age mean $\pm$ standard deviation $= 23.44 \pm 10.34$ years (yrs); age range $= 11–60$ yrs.
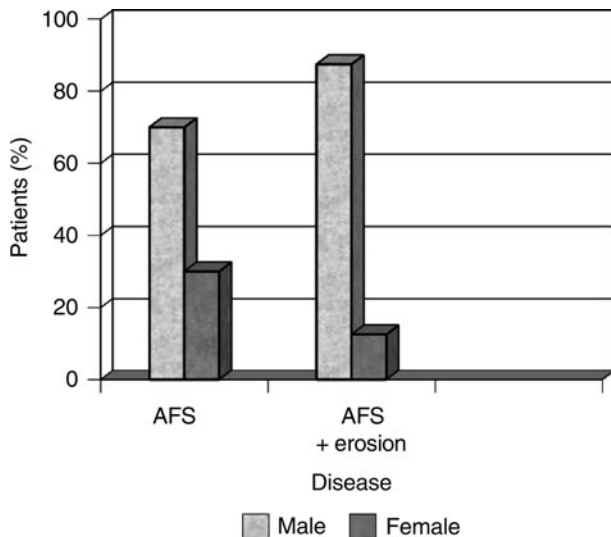
FIG. 1

Sex distribution for patients with allergic fungal rhinosinusitis (AFS) and with allergic fungal rhinosinusitis plus erosion. Total patients $n = 47$. Male to female sex ratios: AFS = 2.3 : 1; AFS + erosion = 6.8 : 1

skull base erosion was notably more common in males than in females (with a ratio of 6.8 : 1) (Figure 1).

All patients were managed surgically using ESS.

Residual or recurrent disease was seen in only nine patients (in two years); revision ESS was performed for these cases.

Discussion

Allergic fungal rhinosinusitis is probably the end-point in a spectrum of sinonasal diseases caused by fungi, eosinophils and other inflammatory mediators. The affected nasal mucosa ceases to function properly, resulting in a cycle of chronic oedema, stasis and bacterial super-infection.[4] Allergic fungal rhinosinusitis usually accounts for the majority of fungal sinusitis cases, although a study in Taiwan found fungal ball to be the commonest form.[5-7]

Allergic fungal rhinosinusitis usually follows a slow, nonaggressive course. However, if the disease process extends outside the confines of the sinuses, massive bone destruction can occur.[3] Bony erosion with intracranial and intra-orbital extension is more common in allergic fungal rhinosinusitis than in all

TABLE II

SOCIOECONOMIC STATUS

Status	Patients	
	n	%
Higher*	8	17.02
Middle†	9	19.14
Lower‡	30	63.83

*Income ≥ Rs 10 001 per person/month; †income = Rs 5001 to 10 000 per person/month; ‡income = ≤Rs 5000 per person/month; where Rs = Pakistani rupees
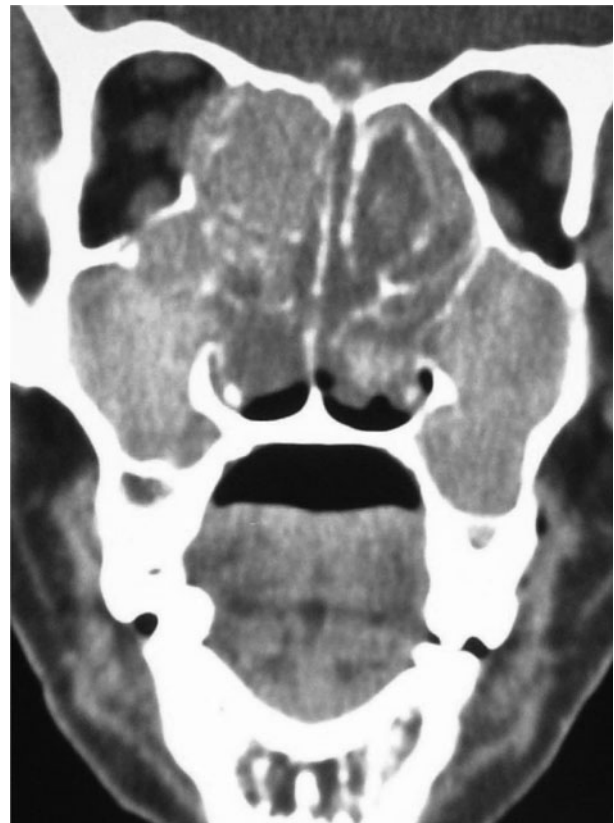

FIG. 2

Coronal computed tomography scan of patient with allergic fungal rhinosinusitis, showing orbital erosion.

other types of inflammatory sinusitis combined.[8] Recognition of this possibility is important, because bone erosion can be interpreted as an indication of invasive disease.[9] This unique form of fungal disease may mimic anterior skull base and paranasal sinus tumours.[1]

Most cases of allergic fungal rhinosinusitis can be successfully managed with transnasal and/or trans-maxillary endoscopic techniques. A craniotomy is very rarely indicated, unless there is a suspicion of dural invasion or extensive intracranial and/or orbital involvement inaccessible from below.[1]

The current study findings suggest that allergic fungal rhinosinusitis is a disease of young, immuno-competent individuals. The majority of our patients (78.71 per cent) were in their second or third decade; this is comparable with previous reports.[2,10-15] Our patients' mean age was 23.44 years (SD 10.34 years), and their ages ranged from 11 to 60 years. These findings are similar to those of Mian et al. and Liu et al. In contrast, Ghegan et al. and Iqbal et al. reported a mean age of 28.6 years.[1,8,13,14]

The male to female ratio of our patients was 2.3 : 1; this was comparable to the findings of Liu et al. (3.75 : 1), Ghegan et al. (4 : 1) and other local studies.[1,8,13-15] In contrast, Rashid et al. reported a female preponderance.[16]

On histopathological analysis, aspergillus was found in 59.57 per cent of our cases; this is similar to McCann and colleagues' and Panda and colleagues' findings.[17,18] However, this percentage is
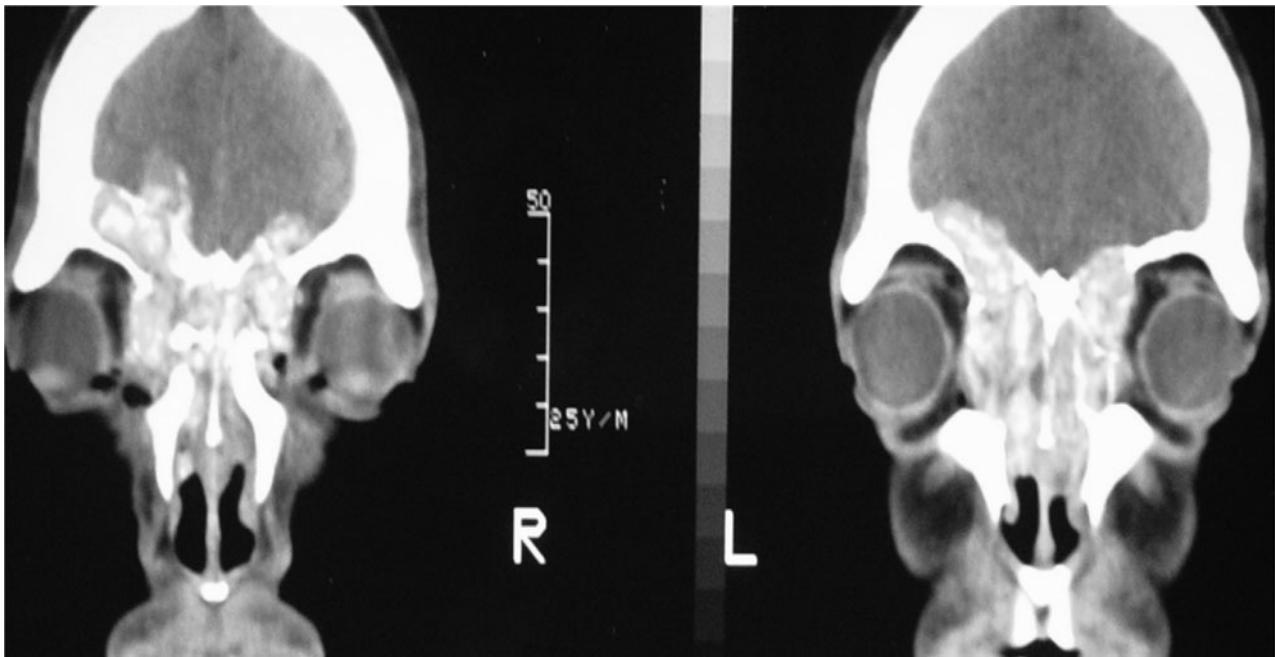
FIG. 3

Coronal computed tomography scan of patient with allergic fungal rhinosinusitis, showing skull base erosion. 25Y/N = Years old male; R = right; L = left

much higher than most findings from the western world.[19,20] In our remaining 40.42 per cent of allergic fungal rhinosinusitis cases, allergic mucin was seen but no fungal spores were identified; this emphasises the importance, in this condition, of surgical sinus fungal culture, and the difficulty of accurately identifying the fungal genus or species from allergic mucin histopathology alone. This was also reported in a study conducted in the southern US.[17]

Computed tomography scanning is a primary imaging modality, and is probably more accurate

TABLE III
PREVALENCE OF ORBITAL & SKULL BASE EROSION

Finding	Patients	
	n	%
Orbital & skull base erosion	16	34.04
Total Orbital erosion	14	29.78
Total Skull base erosion	9	19.14
Only orbital erosion	7	14.89
Only skull base erosion	2	4.25

TABLE IV
PREVALENCE OF NASAL SIGNS AND SYMPTOMS

Sign or symptom	Patients	
	n	%
Nasal obstruction	47	100.00
Nasal discharge	42	89.36
Postnasal drip	42	89.36
Semisolid nasal crust	14	29.78
Hyposmia or anosmia	19	40.42

than MRI in terms of diagnostic specificity and determination of the extent of bone erosion. Magnetic resonance imaging should be used to supplement CT when intracranial or intra-orbital extension is suspected.[21] In our study, CT scanning was performed in all cases (100 per cent), and MRI in 14 cases (29.78 per cent) suspected of intracranial and/or orbital involvement. Orbital and skull base erosion was detected in 34.04 per cent of cases. This is comparable to the results of Liu *et al.*, who observed bony erosion in 38.09 per cent of cases.[1] In contrast, Ghegan *et al.* reported bony skull base or orbital erosion in 56 per cent of cases, Nussenbaum *et al.* noted bony erosion in 20 per cent, and Kinsella *et al.* reported skull base erosion in 21.42 per cent.[3,8,9] Orbital erosion alone was detected in 29.78 per cent of our patients; this result is similar to that of Liu *et al.* (28.57 per cent) but higher than that of Kinsella *et al.* (21.42 per cent).[1,3] Skull base erosion alone was detected in 19.14% of our patients, whereas Liu *et al.* observed intracranial extension in 38.09 per cent of their patients.[1]

In the current study, prominent clinical features comprised nasal obstruction, nasal discharge, postnasal drip, hyposmia or anosmia, facial pain, headache, and proptosis. Corresponding results in the local and international literature differed little.[2,13–16] However, we observed raised IgE levels in 80 per cent of our patients, a higher proportion than that reported in other studies.[19,22,23]

Another important finding of our study was a male to female ratio of 6.8 : 1 in patients with orbital and skull base erosion. This represents a significant male predominance, and further research is required, with more patients and longer follow-up times,

in order to confirm this finding and to investigate its cause.

- **The paper explains allergic fungal rhinosinusitis and its classification**
- **Diagnosis of this condition requires: positive computed tomography findings; a clinical picture of nasal obstruction, discharge and postnasal drip; and identification of allergic fungal mucin**
- **Skull base and orbital erosion are not uncommon in cases of allergic fungal rhinosinusitis, and such cases show a significant male predominance**
- **The preferred treatment comprises corticosteroids plus endoscopic sinus surgery for complete removal of allergic fungal mucin and debris, together with regular follow up**

Prednisolone (0.5–1 mg/kg/day) plus clarithromycin (250–500 mg twice daily) and topical steroids were given to all our patients for 10 to 14 days in the pre-operative period. This was intended to reduce inflammation by controlling infection and allergy, resulting in reduced bleeding and better surgical clearance of disease. Oral steroids were continued for three to four weeks and topical steroids for six months after surgery to prevent recurrence. No steroid toxicity was noted over two years of follow up.

Endoscopic sinus surgery was performed in all our patients to achieve complete surgical removal of allergic mucin and debris, in order to greatly decrease the antigenic load, to ensure permanent drainage with ventilation of sinuses, and to access previously diseased sinuses, as previously reported.[1,3,9]

Conclusion

Skull base and orbital erosion is not uncommon in cases of allergic fungal rhinosinusitis, and such cases have a significant male dominance; however, orbital erosion is more common than skull base erosion. The use of ESS plus pre- and post-operative steroid treatment facilitates good results. The use of pre-operative steroids decreases inflammation and helps clear disease, while post-operative steroids prevent recurrence. Regular follow up is the key to success. Endoscopic assessment of the operative site and clearance of crusts and retained debris should be conducted at every follow-up visit.

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