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Original Research Article

EVALUATION OF BONY EROSION IN PATIENTS WITH ALLERGIC FUNGAL RHINOSINUSITIS

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Abstract: *The retrospective study was conducted in Nishtar Medical Hospital & Bakhtawar Amin Hospital from January 2021 to January 2022 to evaluate CT findings of bone erosion and the implication of surgical treatment in patients with AFRS. The study was conducted on a total of 140 patients. All patients underwent sinus CT examination before the start of treatment. Experienced neuroradiologist examined CT characteristics of bone erosion. Data were recorded, including disease and bone erosion location, sinus expansion, and disease extension into neighboring anatomical spaces. Of 140 patients, 26 (18.5%) had radiographic evidence of bone erosion. 1 of the 26 patients had undergone previous endoscopic surgery. The ethmoid sinus was the most common site of bone erosion. The adjacent anatomic site which was affected most due to disease extension was the orbit. There was a significant association between bone expansion and expansion of frontal, sphenoid, ethmoid, and maxillary sinuses (P=.027). Bone erosion creates a route for disease progression in the intracranial cavity and orbit. It is not associated with fungal invasion and should be accurately differentiated from Sino nasal malignancy or invasive fungal sinusitis to avoid unnecessary invasive procedures.*

Keywords: Bone Erosion, Allergic Fungal Rhinosinusitis, Radiographic Findings

Introduction

Allergic fungal rhinosinusitis (AFRS) results from fungal colonization in hypersensitive immune-competent individuals (Cameron and Luong, 2023). Its diagnostic criteria include the presence of type I hypersensitivity, nasal polyps, eosinophilic mucus in the absence of fungal invasion of sinus tissues, positive fungal staining of content from sinus, and characteristic computed tomography (CT) features (Chua et al., 2023). Other findings may include positive fungal culture results, unilateral predominance, Charcot-Leyden crystals, and history of bronchial asthma, peripheral eosinophilia, and radiographic signs of bone erosion. These findings help diagnose but are not always present (Tyler and Luong, 2020).

AFRS has slow progression and shows non-specific chronic rhinosinusitis (CRS) symptoms which are non-responsive to medical treatment. In some patients, it may present as late intracranial or orbital extension resembling a malignant tumor. Such a presentation is due to bone expansion of erosion as fungi do not invade intracranial or orbital tissues (Alarifi et al., 2019; Dryden et al., 2021). Bone erosion in AFRS results from fungal debris, secondary impacts of inflammatory mediators, and expansion of walls of paranasal sinuses, all of which cause pressure atrophy (Tsetsos et al., 2021).

Numerous studies have reported bone erosion to radiographic and clinical findings in some patients of AFRS (Alajmi et al., 2019; Alharbi et al., 2023). However, limited literature on CT features of AFRS associated bone erosion exists. Thus, in this study, we will evaluate CT findings of bone erosion and the implication of surgical treatment in patients with AFRS.

Methodology

The retrospective stud was conducted in Nishtar Medical Hospital & Bakhtawar Amin Hospital from January 2021 to January 2022. Patients diagnosed with AFRS were included in the study. Patients with systemic diseases were excluded. The study was conducted on a total of 140 patients. Informed consent of the participants was taken. The ethical board of the hospital approved the study.

The data of patients treated for AFRS during 2021-2022 was taken from the hospital. All patients underwent sinus CT examination before the start of treatment. Experienced neuroradiologist examined CT characteristics of bone erosion. Data included

disease and bone erosion location, sinus expansion, and disease extension into neighboring anatomical spaces.

All patients underwent endoscopic sinus surgery and were post-operatively managed by immunotherapy or/and immunomodulation with topical or systemic corticosteroids. The results of culture and treatment were reviewed.

Data were analyzed using SPSS version 23.0. The absence or presence of bone erosion and bone erosion in the absence or presence of sinus changes was analyzed. Binomial logistic regression was used to find the association between bone erosion and sinus expansion. P value < 0.05 was considered statistically significant.

Results

Of 140 patients, 26 (18.5%) had radiographic evidence of bone erosion. 1 of the 26 patients had undergone previous endoscopic surgery. Sites of bone erosion are summarized in Table I. Ethmoid sinus was the most common site of bone erosion, and lamina papyracea was the most common subsite. Areas of disease extension are summarized in Table II. The adjacent anatomic site which was affected most due to disease extension was the orbit. The route of disease extension was through lamina papyracea, the maxillary sinus, and the frontal sinus. The second most common extension was an intracranial extension. The route of disease was through the ethmoid roof, frontal sinus, planum sphenoidal, and sphenoid sinus.

The most commonly found fungus was Bipolaris. Bone erosion was not associated with any specific fungi. Concomitant sinus expansion was uniform, except in the sphenoid sinus. There was a significant association between bone erosion and expansion of frontal, sphenoid, ethmoid, and maxillary sinuses (P=.027). Expansion without erosion was observed in 2 frontal sinuses, 3 sphenoid sinuses, 8 ethmoid sinuses, and 5 maxillary sinuses.

Surgery was performed through endoscopic technique in all patients. No complication was reported, and allergic mucin was extirpated completely. There were reports of fungal invasion into sino nasal mucosa.

Table I Site of bone erosion

Site	Frequency (%)
Ethmoid sinus	25 (17.8%)
• **Roof of ethmoid**	2
• **Lamina papyracea**	23
Maxillary sinus	3(2.1%)
• **Superior wall**	2
• **Posterior wall**	1
Frontal sinus	9(6.4%)
• **Anterior table**	2
• **Posterior table**	6
• **Floor**	1
Sphenoid sinus	21 (15%)
• **Planum sphenoidal**	7
• **Posterior wall**	2
• **Lateral wall**	5
• **Clivus**	5
• **Pterygoid plate**	2

Table II Site of disease expansion

Site	Frequency (%)
Intracranial	21 (15%)
• **Anterior cranial fossa**	11
• **Middle cranial fossa**	4
• **Posterior cranial fossa**	5
Orbit	22 (16%)
Pterygopalatine fossa	2 (1.4%)
Nasopharynx	2 (1.4%)

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Discussion

The present study aimed to investigate the prevalence AFRS-related bone erosion is well documented. In the current study, 26 (18.5%) had radiographic evidence of bone erosion. Previous studies on AFRS-related bone erosion have reported its incidence to range from 20%-90% (Chakrabarti, 2019; Jabri and Qotb, 2019). The most common site of bone erosion was the ethmoid sinus, and the most common site of extension was orbit. The anterior cranial fossa was mostly affected; in some cases, diseases extended to the middle and posterior cranial fossa. This data implies that extension occurs naturally as the disease progresses due to bone erosion. In the past, radiographic evidence of bone erosion was thought to suggest invasive pathologies, such as invasive fungal sinusitis or malignancy. However, current literature confirms that bone erosion does not result from fungal invasion (Meng et al., 2019; Oretti et al., 2019). The findings of our study are in line with this concept. The current study showed no histological evidence of fungal invasion of the mucosa. Pressure atrophy due to the expansion of mucoceles and polyps is the causative factor in AFRS-related bone erosion (Alenzi et al., 2020). Allergic mucin produces inflammatory mediators, which contribute to bone erosion.

A previous study conducted by Al-Dousary et al. reported that fragments from AFRS-related bone erosion demonstrate changes associated with the active remolding of bone (Al-Dousary et al., 2019). Our study had a significant association between bone erosion in paranasal sinuses and CT evidence of expansion. Sinus expansion generally leads to bone erosion. A previous study reported the association between Bipolaris and erosion of the cranial base (Jabri and Qotb, 2019). The current study did not find a significant association between bone erosion and any specific organism. Though Bipolaris was most frequently cultured, its association with bone erosion was insignificant (P=0.051), as reported by a previous study (Choudhary et al., 2022). In the current study, we used endoscopic techniques for disease management. A previous study used an extirpative approach to manage disease extension and bone erosion (Eissa et al., 2022). A study reported the efficacy of the endoscopic technique for AFRS-related cranial bone erosion (Rowan et al., 2019). In our study, endoscopic surgery did not cause any complications. Thus avoiding open surgery is recommended. However, individual case and the surgeon's experience is paramount in deciding the operative approach. The limitation of our study is the small sample size; a larger study is recommended for detailed analysis.

Conclusion

AFRS-related bone erosion occurred in 18.5% of patients. Bone erosion creates a route for disease progression in the intracranial cavity and orbit. It is not associated with fungal invasion and should be accurately differentiated from sinonasal malignancy or invasive fungal sinusitis to avoid unnecessary invasive procedures. The endoscopic technique is a safe and effective procedure for its treatment.

Conflict of interest

The authors declared absence of conflict of interest.

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