

# Fungus Balls of the Paranasal Sinuses

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## Abstract

Fungal balls are extramucosal collections of fungal elements, usually localized to a single sinus cavity, commonly the maxillary sinus. They are usually of the noninvasive variety, and commonly seen in immunocompetent hosts. Occasionally a waning of the immunity can cause them to turn invasive. Much controversy exists regarding its management – medical as well as surgical. Endonasal evacuation of the involved sinus is usually all that is required to manage this condition.

**Keywords:** Aspergilloma, fungus ball, paranasal sinuses.

## INTRODUCTION

Fungus ball of the paranasal sinuses is the terminology used to describe a dense mass of noninvasive matted fungal hyphae within a paranasal sinus. It has replaced the erstwhile misnomer 'mycetoma' which was used to describe this condition. A true 'mycetoma' is a suppurative and granulomatous subcutaneous infection with draining sinus tracts.<sup>1</sup> In the past, the term 'aspergilloma' or 'sinus aspergillosis' was used for fungus balls.<sup>2</sup> Fungus balls are found in just one paranasal sinus, most frequently in the maxillary sinus and occasionally in the sphenoid sinus. The host is immunocompetent, but if during the infection the host is immunocompromised, then this noninvasive fungal infection may become invasive and life-threatening.<sup>3</sup>

## EPIDEMIOLOGY

Fungus balls are known to occur in normal immunocompetent individuals and are usually found unexpectedly during the treatment of chronic bacterial rhinosinusitis. They are seen to occur in older individuals (60-70 years), usually triggering nonspecific symptoms of chronic rhinosinusitis such as nasal obstruction, postnasal discharge and facial pain.<sup>4</sup> The average age reported in an American retrospective series was 64 years, ranging from 28-86 years.<sup>5</sup> A similar age range was reported in a series by both deShazo (1997) and Klossek (1997), the youngest reported age being 18

years. There have been no pediatric cases reported in literature. There is a considerable female preponderance with almost all series reporting a female incidence of approximately 64%.<sup>4-6</sup>

## PATHOPHYSIOLOGY

Fungus balls follow a slow, benign course. Patients may have symptoms for months or years before a diagnosis is confirmed.<sup>2</sup> For a fungus ball to form, fungal hyphae and spores must get trapped in a paranasal sinus and conditions must support their growth. These conditions develop when some pathology disrupts the normal mucociliary clearance and/or obstructs the sinus ostium as is seen in acute or chronic rhinosinusitis.<sup>7,8</sup> When this occurs, the fungal spores germinate within the sinus cavity and the growth of hyphae further impairs clearance of the fungi and growth proceeds within the sinus cavity.

## CLINICAL PRESENTATION

Patients with fungus balls exhibit neither evidence of immunocompromise nor an increased incidence of atopy to explain the development of this condition.<sup>2</sup> They occur most commonly in the maxillary or sphenoid sinuses (Fig. 1) however, they are also reported to occur in the frontal or ethmoid sinuses in literature. They usually affect a solitary sinus but, may occasionally involve two contiguous sinuses.



**FIGURE 1:** Endoscopic photograph showing a fungus ball in the left sphenoid sinus

Symptoms are similar to those seen in chronic rhinosinusitis secondary to inflammation or bacterial infection. These include nasal obstruction, nasal discharge, anosmia, facial pain with a history of these symptoms being refractory to medication. Symptoms are usually of long duration (months to years). Occasionally the patient may present with unusual symptoms such as epistaxis, visual disturbances, convulsions, fever, cough, and proptosis.<sup>4-6</sup> Sometimes, the patient may be asymptomatic and the fungus ball may be an incidental finding. 10% of patients have associated nasal polyps<sup>4</sup> which are infact, a nonspecific response to a variety of inflammatory conditions. Approximately 50% of individuals give a history of some endodontic treatment being done prior to maxillary sinus fungus ball indicating it could be a predisposing factor.<sup>4</sup> Fungus balls are rarely known to cause bone remodeling with widening of the affected sinus and distortion of anatomy. They may also cause bone erosion. Rarely, if during the infection, the immunity of the host declines, a fungus ball may become invasive. Characteristic imaging findings and histopathologic examination confirms the diagnosis. At surgery, thick inspissated debris forms a mass which fills the sinus cavity.<sup>5</sup> On histopathological examination, the debris found in a fungus ball consists of dense tangles of hyphae with calcifications and oxalate crystals.<sup>5</sup> However, fungal cultures are usually negative. It usually does not invade tissue; however acute or chronic inflammatory infiltrate may be present in adjacent mucosa but, granulomas are absent.<sup>5,9</sup>

## HISTOPATHOLOGY AND FUNGAL CULTURE

Fungus balls are essentially noninvasive and extramucosal fungal infestations without any granulomatous reaction. Routine hematoxylin and eosin stains can demonstrate the presence of fungus but, special stains such as the gomori methenamine silver (GMS) are helpful in diagnosing the *Aspergillus* species.

Intraoperatively, the gross appearance of the fungus is gritty or cheesy and clay-like, breaking up into fragments, the color of which ranges from brown to black to green or yellow.

The causative fungi include *Aspergillus fumigatus*, *Aspergillus flavus*, *Alternaria* Sp and *P. Boydii*. Only 23-50% cultures result in fungal growth.

## RADIOLOGIC FEATURES

Fungus balls have typical characteristics on CT scan. In over 90% of patients, a single sinus is involved.<sup>4</sup> The maxillary sinus is most commonly involved (Fig. 2) followed by the sphenoid (Fig. 3). Involvement of the ethmoids is contiguous with the maxillary sinus. The frontal sinus is rarely involved. On CT scan, fungus balls show partial or complete heterogeneous opacification of the sinus.<sup>5</sup> Central areas of hyperattenuation within the fungus ball correspond to fungal debris/hyphae and calcifications. Sclerosis or bony thickening of the sinus wall is commonly seen and bony erosion of the sinus wall may occur. However, there is minimal or no sinus expansion.

## MANAGEMENT

The goal of treatment for a fungus ball is surgical removal of the hyphal mass with re-establishing the drainage from the affected sinus. A symptomatic patient with opacification of the sinus and bone erosion merits surgical evacuation, however the same line of management in a patient who is asymptomatic is controversial. Presence of coexisting asthma in a patient with a fungus ball merits surgery to prevent exacerbation of asthmatic attacks due to the fungal antigen.

Endoscopic sinus surgery to remove the fungus ball is the treatment of choice today and the erstwhile external approaches are obsolete. Irrigation of the sinus is performed to clear the sinus of all the fungal debris.

The maxillary sinus is cleared by widening the natural ostium (middle meatus antrostomy) and a canine puncture will help in visualizing the entire sinus cavity as well as serve the purpose of irrigation.



**FIGURE 2:** Axial CT – PNS showing an isolated right maxillary sinus opacification, with reactive sclerosis of the bony margins. The patient was found to have fungal mass within the right maxillary sinus on surgery, making the final diagnosis of a right fungal ball



**FIGURE 3:** Coronal CT – PNS showing right sphenoid sinus opacification, with disease in the lateral recess of the right sphenoid sinus, in close proximity to the foramen rotundum and vidian canal. The patient presented with a right sided headache, which was relieved after an endoscopic evacuation of the right sphenoid sinus, with the KOH mount of the evacuated material showing fungal mycelia

Sphenoid sinus fungus balls are also approached endoscopically by widening the natural ostium. The sinus is irrigated to remove all debris thus preventing damage to important structures. Patients with sphenoid sinus fungus

balls are at a risk of life-threatening complications if there is a bony dehiscence of the lateral sphenoid wall (as seen in 8% individuals) or if seeding occurs during aggressive endoscopic removal since, the sphenoid sinus is surrounded by important intracranial structures (cavernous sinus, carotid artery, etc). In patients who demonstrate bony lateral sphenoid dehiscence radiologically preoperatively, we start systemic antifungal agents such as oral Itraconazole 200 mg twice daily prior to surgery and continue it for 4 weeks postoperatively till healing is complete.

Frontal sinus fungus balls are rare. Endoscopic removal combined with irrigation through the anterior table was advocated by Klossek (1997).

As described earlier in this section, the treatment of fungus balls is surgical removal endoscopically. Recurrence is rare but, has been reported to occur even as late as two years following surgery. In Klossek's (1997) series, the recurrence rate was 4%, whereas, Ferriero (1997) reported a slightly higher recurrence rate of 7%. A regular follow-up is important as many of these recurrences can be addressed with simple irrigation or suctioning in the outpatient department or conservative endoscopic surgery.<sup>4</sup>

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