CLINICAL, SUB-CLINICAL FEATURES AND TREATMENT FOR SINONASAL FUNGUS BALL

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Background: Sinonasal fungus ball (FB) is the most common non-invasive fungal rhinosinusitis. ***Objective***: To study clinical, sub-clinical presentations and evaluate the results of treatment for FB by functional endoscopic sinus surgery (FESS). ***Methods***: We prospectively examined with clinical intervention in 42 patients diagnosed with sinonasal FB and treated by FESS (January 2015 to December 2017). ***Results***: The mean age was 50,9 years and the gender ratio was 1,6 (female): 1 (male). Maxillary was the most involved (85,7%) followed by sphenoidal and ethmoidal with 11,9% and 2,4% respectively. While the most common presenting symptoms of maxillary sinus FB were nasal symptoms, such as post nasal drip (80,6%) and nasal obstruction (77,9%), sphenoid FB patients had headache mostly (4/5 patients). On computed tomography (CT) scans, the most common finding was intralesional hyperdensity (77,3%) and complete opacities (70,5%). There were no significant correlation between the presence of FB and structural malformations (septal deviation, concha bullosa, Haller cell). Recurrence and residual disease occurred in only 5 (11,9%) patients after 2 months follow-up. ***Conclusion***: FB should be suspected in patients who with unilateral nasal symptoms and unexplained headaches. A preoperative CT scan is essential to making diagnosis easier and faster. FESS is the noticeable choice of treatment with a low morbidity and recurrence rate.

Keywords: *fungus ball, FESS, chronic rhinosinusitis, fungal sinusitis*

1. INTRODUCTION

In 2009, the International Society for Human and Animal Mycology classified fungal rhinosinusitis (FRS) into 2 categories based on anapathological findings: invasive and non-invasive forms [1]. The invasive diseases usually appear in immunocompromised patients and can be life-threatening. They include acute invasive FRS, chronic invasive FRS, and granulomatous invasive FRS. Noninvasive FRS usually occurs in immunocompetent patients and include saprophytic fungal infestation, fungus ball (FB), and fungus-related eosinophilic FRS, including allergic fungal rhinosinusitis (AFRS) [1].

FB is described as the presence of noninvasive accumulation of dense conglomeration of fungal hyphae in one sinus cavity, usually the maxillary sinus, although the disease may affect other sinuses or rarely multiple sinuses [1]. Furthermore, FB is the most common noninvasive FRS [2]. FB used to be considered a relatively uncommon disease but its incidence has increased dramatically over the last 2 decades [2], [3], [4], [6]. The pathogenesis of paranasal sinus FB is still unclear, although endodontic treatment with intracanal or dental filling and ostial closure with the development of an anaerobic environment have been suggested to be possible contributing factors [2].

The treatment is surgical removal with lavage through functional endoscopic sinus surgery (FESS) having the good outcome and very low recurrence rate [5], [7].

Although numerous studies have reported on clinical and subclinical findings of FB but in Vietnam we have been lacking these studies. Therefore, we conducted this study with two main goals:

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i. To study clinical and subclinical features of sinonasal fungus ball.

ii. To evaluate the results of treatment for sinonasal fungus ball through FESS.

2. MATERIALS AND METHODS

2.1. Materials: Patients were diagnosed with FB by anapathological result after treated by FESS with preoperative diagnosis of FRS in Department of Otorhinolaryngology of Hue Medical University Hospital from January 2015 to December 2017. The inclusion criteria were as follow: (i) anapathologically confirm FB and (ii) fungal ball found in sinonasal sinuses. Patient were excluded if anapathologic diagnosis was invasive FRS [5].

2.2. Methods: Propective study with clinical intervention.

Because of the clinical symptom that may vary depending on the location of the FB, we studied the symptoms of maxillary and sphenoid FB separately.

All patient underwent computerized tomography (CT) preoperatively. Thus, we analyzed the CT findings of 44 lesions in 42 patients (including 2 patients with bilateral disease) for the presence of complete or partial opacity, partial opacity with irregular surface, intralesional hyperdensity, bony sclerosis, and erosion of the sinus wall [8], [9].

To assess the etiological correlations between anatomical malformations and the occurrence of FB, we evaluated the appearance of nasal septal deviation, concha bullosa, and Haller cells. Correlations of the appearance of these structural malformations with the localization of FB were analyzed using Pearson's χ^2 and χ^2 goodness-of-fit test. The angle of the maximal deflection off the vertical midline was measured to quantify the degree of septal deviation, an angel of deviation > 10^0 at the most deflected point was set as the positive for the presence of septal deviation [8], [9]. The direction of nasal deviation was define as the side of the nasal cavity that was compromised by the deviation and nasal septum [8], [9].

FESS was performed in all patients, abundant irrigation with normal saline was performed during the surgery to make sure not to leave any fungal debris. Nasal packing was applied for 2 or 3 days. Oral antibiotics were prescribed for 1 week to prevent postoperative infections. Systemic or topical antifungal agents were not prescribed. Nasal saline irrigation and topical steroid spray were recommended for 1 month. All patient were followed with endoscopic control [10]. The follow-up times after surgery were set at 1 month and 2 months after operation.

3. RESULTS

3.1. Demographic data

Table 3.1. Age and sex distribution of fungal ball patients

Age	Number of patients		
	Male	Female	Total
- 39	2	6	8 (19,1%)
40 - 49	6	9	15 (35,7%)
50 - 59	4	8	12 (28,6%)
60 - 69	4	3	7 (16,6%)
Total (%)	16 (38,1%)	26 (61,9%)	42 (100%)

The average age of patients was 50,9 years, ranging from 25 to 67 years and the number of patients in their 40s and 50s were 15 (35,7%) và 12 (28,6%). Có 16 nam (38,1%) và 26 nữ (61,9%).There were 16 males (38,1%) and 26 females (61,9%) showing a ratio 1,6:1 female predominance.

3.2. Site of fungus balls

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Site	Number of cases	Involved sinus	Number of cases
Right	21 (50%)	Maxillary sinus	36 (85,7%)
Left	19 (45,2%)	Sphenoid sinus	5 (11,9%)
Bilateral	2 (4,8%)	Ethmoid sinus	1 (2,4%)

In our study, unilateral FBs were seen in 40 cases (19 left, 21 right) while there were only 2 bilateral cases. Among 40 unilateral cases, the maxillary sinus (85%) was the most involved sinus, followed by the sphenoid (12,5%) and ethmoid (2,5%). Of 2 bilateral cases, bilateral maxillary sinus occurred in both cases. Briefly, there were 36 (85,7%) patients with maxillary sinus involvement and sphenoid sinus involvement was found in 5 (11,9%).

3.3. Presenting symptoms for each sites of fungus ball

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Symptoms	Maxillary sinus FB (n=36)	Sphenoid sinus FB (n=5)	p
Rhinologic symptoms			
Postnasal drip	29 (80,6%)	1 (20%)	0,013
Nasal obstruction	28 (77,9%)	1 (20%)	0,020
Rhinorrhea	27 (75%)	2 (40%)	0,139
Foul odor	8 (22,2%)	0 (0%)	0,562
Hyposmia	15 (41,7%)	1 (20%)	0,631
Pain			
Headache	10 (27,8%)	4 (80%)	0,038
Cheek or facial pain	19 (52,8%)	0 (0%)	0,051
Toothache	11 (30,6%)	0 (0%)	0,299
Orbital or preorbital pain	5 (13,9%)	1 (20%)	0,566
Eye symptoms	2 (5,6%)	1 (20%)	0,330
No symptoms	3 (8,3%)	1 (20%)	0,418

In patients with maxillary sinus FB, the symptoms were usually nonspecific and similar to the symptoms of patients with chronic rhinosinusitis (CRS): postnasal drip, nasal obstruction and rhinorrhea. When comparing the symptoms of maxillary sinus FB with symptoms of sphenoid sinus FB, postnasal drip and nasal obstruction occurred more frequently in maxillary sinus FB ($p < 0,05$). The most frequently symptom occurred in patients with sphenoid sinus FB is headache (4/5 cases).

Overall, there were 3 (8,3%) patients with maxillary sinus FB and 1 (20%) patients with sphenoid sinus FB had no symptoms, then FB were discovered on head and neck imaging during an examination for other headache diseases.

On the preoperative imaging, mucopurulent were seen in 37 (88,1%) patients and polyp or polypoid mucosa were appeared in 25 (59,5%) patients. There were 3 (7,1%) patients having negative findings.

3.4. Radiological findings

Table 3.4. Findings of CT for each sites of lesion

Findings	Sites of lesion			Total
	Maxillary sinus (n = 38)	Sphenoid sinus (n = 5)	Ethmoid sinus (n = 1)	
Complete opacities	27 (71,1%)	3 (60%)	1 (100%)	31 (70,5%)
Partial opacities	11 (28,9%)	2 (40%)	0 (0%)	13 (29,5%)
With irregular surface	11 (28,9%)	1 (20%)	0 (0%)	12 (27,3%)
Intralesional hyperdensity	29 (76,3%)	4 (80%)	1 (100%)	34 (77,3%)
Sclerosis of sinus wall	19 (50%)	4 (80%)	0 (0%)	23 (52,3%)
Bony erosion of sinus wall	6 (15,8%)	2 (40%)	1 (100%)	9 (20,5%)

On CT, complete opacities was seen in 31 (70,5%) involved sinuses while there were 13 (29,5%) cases showed a partial opacities. In those cases with partial opacities, 92,3% of cavities seen irregular surfaces. Intralesional hyperdensity were identified in 34 (77,3%) patients. Sclerosis of sinus wall was found in 52,3% of lesions and bony erosion of sinus wall was seen in 20,5% of lesions.

Nasal septal deviation was seen in 40,5% 917/42 patient with FB. There were 8 patients with maxillary sinus FB found with ipsilateral side of nasal septal deviation, whereas 6 patients with maxillary sinus FB identified with contralateral site of nasal septal deviation. There was no significant difference in the location of maxillary sinus FB between the ipsilateral and contralateral sides of the septal deviation ($p = 0,732 > 0,05$). The location of sphenoid sinus FB also showed no correlation with the direction of septal deviation ($p = 1.000 > 0,05$). Concha bullosa was seen in 9 (21,4%) patients, however there was no significant correlation between the appearance of concha bullosa and the location of maxillary sinus FB or sphenoid sinus ($p = 0,913$ and $p = 1,000 > 0,05$). The appearance of Haller cells also did not correlate with the location of maxillary sinus FB ($p = 1,000$).

3.5. Treatment and outcomes

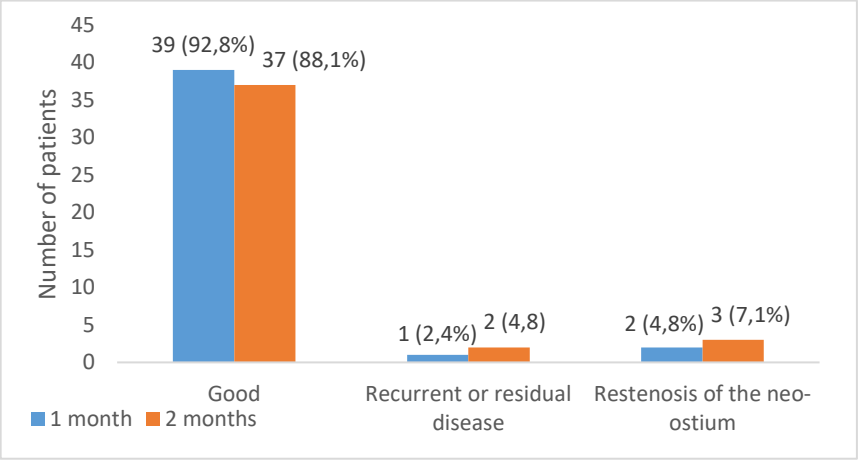

Figure 3.1. Outcomes of the treatment

All the patients was performed FESS under general anesthesia. In all cases, patients were removed clay materials from sinus cavities which were suggested of FB and confirmed by anapathological examination. Recurrent or residual disease was found in 2 (4,8%) patients after 2 months follow-up. Furthermore, there were 3 (7,1%) patients having restenosis-ostium. These patients were performed revision FESS under general anesthesia.

4. DISCUSSION

The incidence of FB in the general population is unknown. However, recent studies have shown that this incidence is increasing steadily [6], [10], [11]. There are no obvious reasons for this apparent increase, it is thought to be result of increasing awareness of this disease, improved diagnostic technologies including nasal endoscopy and imaging facilities, abuse of broad-spectrum antibiotics and decreasing human body‘s resistance, greenhouse effect and living environment change, and aging of population [2], [6]. Among these, we thought that the widespread use of imaging tools may be an important cause. In Vietnam in general and in Hue Medical University Hospital in particular, CT is currently not too expensive and is an easy-to-use diagnostic tool for many different diseases.

Following Table 3.1 noticed a female predominance which have been noted in most FB studies [5], [8], [10], [11], [12]. There is no obvious explanation for this female predominance, several studies have suggested that environmental and hormones may affect in the pathogenesis. Moreover, Yoon, Nomura and Ferguson et al suggested that the longer life expectancy of women may be a cause for the female predominance [10], [11], [13]. Nomura et al reported that the number of male and female patients under 60 years of age were the same, although the overall number of patients showed a female predominance [11]. However, our study does not support that hypothesis since the number of female patients under 60s was approximately 2 times higher (23/12) than the number of male patients. The numbers of female and male patients aged older than 60 were 3 and 4, respectively. This can be explained by the fact that our sample was small and not clearly defined epidemic of the disease.

This can be inferred from the fact that FB mostly involved in maxillary sinus with 36 (85,7%) patients and sphenoid sinus (11,9%), which are highly affected by gravity (Table 3.2) [2]. Kim and Yoon et al had the same results with 89% and 10%; 88,7% and 9,9%, respectively [6], [10].

The symptoms of FB patients maybe nonspecific and indistinguishable from those of CRS patients [2], [5], [10], [12]. However, unlike patients with CRS, FB patients usually complain of unilateral symptoms [5], [14]. Moreover, pain, including facial pain, toothache and headache, is often compared with CRS [2], [14], [15]. The pain is thought to be caused by the pressure inside the sinuses due to cavities filled up by fluids and concretions or by irritation of sensory nerve that supplies the sinus [15]. Symptoms of complaints usually vary by locations of FB. Following Table 3.3, in maxillary sinus FB, nasal symptoms were more frequent. On the contrary, the most seen symptom of sphenoid sinus FB was headache (4/5 patients), similar to other studies [10], [15].

Patients with FB sometimes have no symptoms and may be discovered accidentally . However, all patients who was diagnosed with FB were recommended surgery even they had no symptoms[10].

Etiology of FB still remains a topic to be discussed [2], [5]. One hypothesis is that functional obstruction of the sinus ostium, leading to an anaerobic and low pH environment, may be a fungal growth factor [16]. Thus, predisposing anatomical malformations that block sinonasal airflow have been considered to be inducing factors of FB formation. However, we found no significant correlations between the direction of nasal septal deviation, concha bullosa, or Haller cell and location of FB ($p>0,05$). This is consistent with the results of Tsai and Yoon et al [9], [10]. In Table 3.4, we can easily notice that intralesional hyperdensity suggested fungal appearance was the most frequent finding with 77,3% of all cases, similar to Yoon ‘s result with 73,7% [10].

The chosen treatment is FESS. The purpose of surgery is to remove all factors causing obstruction in sinus ostiums and cavities, including FB. As shown in Figure 3.1, the percentages of recurrent or residual disease and restenosis of neo-ostium was 11,9% (5/42 patients) after 2 months follow-up. This proportion is higher than surgical outcomes of Yoon‘s study with 1,1% and Kim‘s study with 1% [6],[10]. Previously, the Caldwell-Luc procedure had been the traditional approach. Later, the recurrence rates reported in many other studies are low, in range 1,6-6,8%, suggesting that FESS is very effective for FB treatment [7]. Today, external approaches seem to be unnecessary in the most cases [2].

5. CONCLUSION

In recent years, the rate of patients with FB having FESS have been increasing steadily. FB should be suspected in patients with unilateral nasal symptoms and unexplained pain , including facial pain, toothache, and headache. Preoperative nasal endoscopic examination and CT are important facilities to suggest and set up the diagnosis. FESS is safe and very effective for FB treatment with low morbidity and recurrence rate.

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