

Allergic Fungal Rhinosinusitis Involving Frontal Sinus: A Prospective Study comparing Surgical Modalities

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ABSTRACT

Allergic fungal rhinosinusitis (AFRS) represents a hypersensitivity response to extramucosal fungi within the sinus cavity without evidence of tissue invasion. AFRS is characterized by fungal element with allergic mucin, Charcot-Leyden crystals, type I hypersensitivity, bony erosion with sinus infection on computed tomographic (CT) scan. Surgery remains the treatment of choice for AFRS followed by prolonged steroid therapy. Surgical approaches for frontal sinus disease can be either endonasal endoscopic or external. This is a nonrandomized prospective study, where the postoperative results of endoscopic frontal sinusotomy were compared with external frontoethmoidectomy approach. This is a nonrandomized prospective study, where the postoperative results of endoscopic frontal sinusotomy were compared with external frontoethmoidectomy approach. The comparison between external frontoethmoidectomy and endoscopic approach was done by using Chi-square test. There was no statistical significant difference found, when postoperatively clinical symptoms, radiology and investigations in patients of both the groups were compared. The success rate was 95.5% in group I and 91.1% after 6 months of follow-up. The world literature lacks prospective studies where attempts are made to compare the long-term results of both the surgical modalities for AFRS patients. Endoscopic endonasal approach has a distinct advantage over the external frontoethmoidectomy approach as it minimizes external scars over the face with almost equal or better long-term results.

Keywords: Allergic fungal rhinosinusitis, Surgical approach, Frontal sinusotomy, Endonasal endoscopic or external.

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INTRODUCTION

Allergic fungal rhinosinusitis (AFRS) represents a hypersensitivity response to extramucosal fungi within the sinus cavity without evidence of tissue invasion.¹ AFRS is characterized by fungal element with allergic mucin, Charcot-Leyden crystals, type I hypersensitivity, bony erosion with sinus infection on computed tomographic (CT) scan.^{2,3} Involvement of maxillary, sphenoid, ethmoid sinuses by the disease is 84.4, 7 and 4% respectively however, frontal sinus involvement is seen only in 1 to 2% of cases.³ Surgery remains the treatment of choice for AFRS followed by prolonged steroid therapy. Surgical approaches for frontal sinus disease can be either endonasal endoscopic or external.³ Success rate with external approach varies from

85 to 97%⁴ and for endonasal endoscopic approach from 79 to 97.8%.⁵

The world literature lacks prospective studies where attempts are made to compare the long-term results of both surgical modalities. This is a nonrandomized prospective study where the postoperative results of endoscopic frontal sinusotomy were compared with external frontoethmoidectomy approach.

MATERIALS AND METHODS

The proposed work included cases of AFRS having involvement of frontal sinuses with or without nasal polyposis, who had presented to outpatient services of Otolaryngology and Head and Neck Surgery Department at Postgraduate Institute of Medical Education and Research, Chandigarh, from January 2007 to July 2010, with any sex and age ranging from 10 to 65 years. All the cases were diagnosed as AFRS on the basis of mycological and radiological investigations. Patients who were unfit for general anesthesia because of medical problems or those not willing for surgery were excluded from study.

STUDY DESIGN

It is a prospective nonrandomized study comprising two groups. Group I included 16 cases (21 frontal sinuses) in which an external frontoethmoidectomy approach with or without extension was used for the clearance of disease and group II included 24 cases (37 frontal sinuses) in which an endoscopic endonasal frontoethmoidectomy approach was used for the clearance of disease.

All the patients underwent a detailed history and clinical examination including nasal endoscopy at the time of presentation and were subsequently subjected for CT scan of the nose and paranasal sinuses (axial and coronal cuts). Other investigations included aspergillin antigen skin sensitivity test, absolute eosinophilic count, preoperative nasal discharge for fungal smear and routine investigations like hemogram, serum electrolytes and X-ray chest.

Cases of group I underwent an external approach. Patient was positioned with 30° head end elevation. Nose was decongested with 4% xylocaine with adrenaline. Incision was made extending from below the medial one-third of eyebrow in a curvilinear manner through the point midway between medial canthus of eye and midline of nasal dorsum.

Periosteum over the nasal process of the frontal bone and frontal process of maxilla was incised. Medial canthus tendon and Horner's muscle was dissected to expose the posterior lacrimal crest. Periorbital was retracted to expose the frontal sinus floor. Agger nasi cells, thickened mucosa, fungal muck and polypoidal material were removed and sent for histopathology and fungal smear. In cases with bilateral disease in frontal sinuses similar procedure was done on the opposite side.

In group II, patients were positioned with 30° head end elevation. Nasal packing was done with 4% xylocaine with adrenaline. 0, 30, 45 and 70° nasal endoscopes were used. Uncinectomy was done. The anterior ethmoid roof, skull base were identified and agger nasi cells were uncapped to enlarge the frontal recess area. Fungal muck and allergic mucin was removed from the frontal sinus and from other sinuses as well. In cases with bilateral disease, both sides of frontal sinuses were approached endoscopically.

All patients were given postoperative antibiotics for 7 days, saline douches, systemic steroids for 3 to 6 weeks and topical steroids for 2 to 12 months.

All patients had follow-up for 6 months. Postoperatively, all the patients were followed up every week for 2 weeks and subsequently after 4, 8, 12 weeks and 6 months interval to see for nasal crusting, synechia, status of frontal recess and frontal sinus. A repeat CT scan was done at 1, 3 and 6 months after the surgery to look for the residual and recurrent disease in frontal recess and sinus.

Patients were evaluated under three categories after each follow-up.

1. Visual analog scale (VAS)–clinical symptoms mainly nasal obstruction, rhinorrhea, facial pain, sneezing, proptosis, swelling over medial side of eye was evaluated with a VAS ranging from 0 (no symptoms) to 10 (maximum symptoms) at the time of inclusion and during follow-up visit.
2. Objective CT score was based on Lund-Mackay staging system.⁶
3. Nasal endoscopic physical evaluation for any polypoidal changes, edema, crusting, fungal debris, synechia and status of frontal sinus.

RESULTS

On analyzing data of 40 cases of both the groups, male predominance was seen with male to female ratio of 1.5:1 (24 males and 16 females). The age ranged from 10 to 65 years (mean: 27.18 ± 13.19 years). The predominant symptoms were nasal discharge (80%) and nasal obstruction (77.5%). Telecanthus was seen in 17 patients (42.5%) and proptosis was observed in 14 cases. History of allergy was

present in 30 cases (75%), aspirin sensitivity and family history of allergy was present in two patients of each group. There was history of previous surgery in 4 patients of group I (25%) and 8 patients of group II (33.33%). Anterior rhinoscopy showed polyposis in 28 cases (70%) out of 40 cases and preoperative fungal smear was positive in 22 cases (55%).

Immunologic Testing

Type I reaction was positive in 11 cases (55%) of both the groups. Type III reaction was seen in two cases of group I and six cases of group II (20%). Postoperative fungal smear was positive in 28 cases (70%) and culture (*Aspergillus flavus*) was positive in 72.5%.

Histopathology

Allergic mucin and fungus was seen in 14 cases of group I (87.5%) and 19 cases of group II (79.16%). Preoperative nasal endoscopy showed polypoidal changes in mucosa of frontoethmoidal recess in two cases (12.50%) of group I and two cases (6.33%) of group II. The disease was bilateral and involving frontal sinuses in three cases of group I (18.70%) and 13 cases of group II (54.16%).

Radiological Finding

Soft tissue density was confined to frontal sinus only in two cases of group I (12.5%) and two cases of group II (6.33%). Bilateral disease was present in three cases (18.7%) of group I and 13 cases (54.16%) of group II. Unilateral disease was present in 24 cases out of 40 cases (60%) (Fig. 1).

A homogenous nondense pattern was seen in 11 cases of group I (68.7%) and 14 cases of group II (58.3%). Concretion pattern was seen in one case of group I (6.25%) and three cases of group II (12.5%). Cotton wool pattern was seen in one case of group II (4.15%).

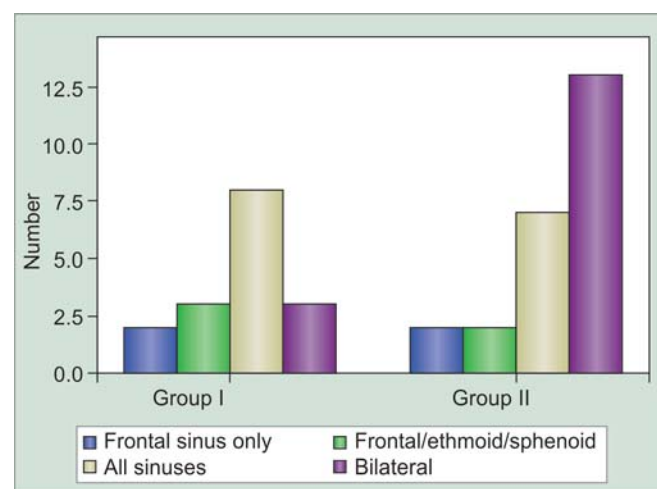


Fig. 1: CT scan finding

Posterior table of frontal sinus was found to be eroded in three cases of group I (18.7%) and seven cases of group II (29.1%), bilateral posterior table erosion was seen in one case of group II (4.16%) and floor of frontal sinus was found eroded in one case of group I (6.25%) and one case of group II (4.16%).

The patients were followed up ranging from 6 months to 2.5 years with mean follow-up of 11 months.

Clinically, recurrent nasal obstruction and discharge was present in three patients (18.7%) of group I out of 16 cases and five patients (20.8%) in group II out of 24 cases.

Endoscopic evaluation of 21 frontal sinuses of group I after 1 month, showed edema and retained secretions in all sinuses (100%). In group II, 30 frontal sinuses (81.8%) showed edema and hypertrophic mucosa and 31 frontal sinuses (86.4%) were showing retained secretions. Residual disease was seen in one frontal sinus (4.7%) out of 21 frontal sinuses in the form of fungal muck and allergic mucin in group I and three sinuses (8.2%) out of 37 sinuses in group II (Table 1).

On following up the patients after 6 months, edema was seen in three frontal sinuses in group I (14.3%) and five frontal sinuses of group II (13.5%). Retained secretions and hypertrophic mucosa were seen in three frontal sinuses in group I (14.3%) and six frontal sinuses in group II (16.2%).

Residual disease was present in one out of 21 sinuses in group I (4.76%) and three out of 37 sinuses in group II (8.18%) (Table 2).

Figure 2 is showing endoscopic picture of frontal sinus postoperatively after 6 months.

CT scan showed residual disease and retained secretions in one sinus in group I (4.76%) and three sinuses in group II (8.18%). Hypertrophic mucosa was seen in 21 sinuses in group I (100%) and 31 sinuses of group II (81.8%) after 1 month follow-up. At 6 months follow-up, one sinus in group I and three sinuses of group II showed residual disease (Table 3). Figure 3 shows preoperative and postoperative status of frontal sinus, axial cuts of CT scan at 6 months. The comparison between external frontoethmoidectomy and endoscopic approach was done by using Chi-square test. There was no statistical significant difference found when postoperatively clinical symptoms, radiology and investigations in patients of both the groups were compared. The success rate was 95.5% in group I and 91.1% after 6 months of follow-up.

DISCUSSION

In the present study, we studied the clinical, mycological, histopathological and radiological features of allergic fungal sinusitis of frontal sinus were studied comparing the surgical

Table 1: Endoscopic finding at first month

	Endoscopic finding				Total
	Edema	Residual	Retained secretion	Hypertrophic mucosa	
Group I	21 (21) 100.0%	1 (21) 4.76%	21 (21) 100%	21 (21) 100.0%	64
Group II	30 (37) 81.8%	3 (37) 8.18%	31 (37) 84.4%	30 (37) 81.8%	94
	51 (58) 87.9%	4 (58) 6.89%	52 (58) 89.6%	51 (58) 87.9%	158

Table 2: Endoscopic finding at 6 months

	Edema	Residual	Retained secretion	Hypertrophic mucosa	Total
Group I	3 (21) 14.28%	1 (21) 4.76%	3 (21) 14.28%	3 (21) 14.28%	10
Group II	5 (37) 13.51%	3 (37) 8.18%	6 (37) 16.21%	6 (37) 16.21%	20
	8 (58) 13.7%	4 (58) 6.89%	9 (58) 15.5%	9 (58) 15.5%	30

Table 3: CT scan FU 6 months

	Follow-up CT scan			Total
	Residual	Retained secretion	Hypertrophic mucosa	
Group I	1 (21) 4.76%	3 (21) 14.28%	3 (21) 14.28%	7
Group II	3 (37) 8.18%	6 (37) 16.21%	6 (37) 16.21%	15
	4 (58) 6.89%	9 (58) 15.5%	9 (58) 15.5%	22

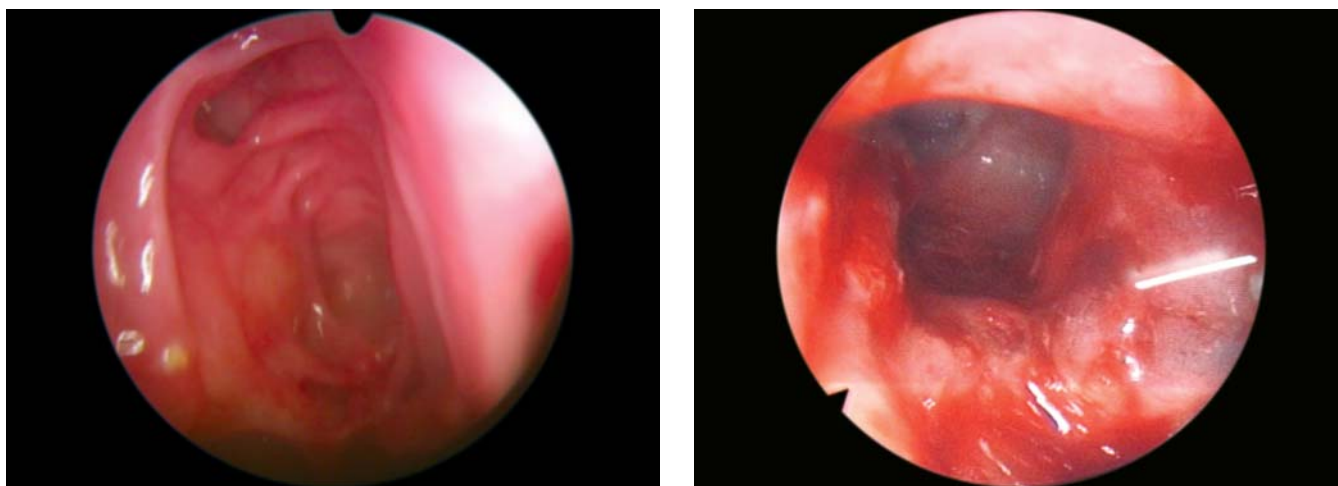


Fig. 2: Postoperative endoscopic pictures of frontal sinus and recess at 6th month

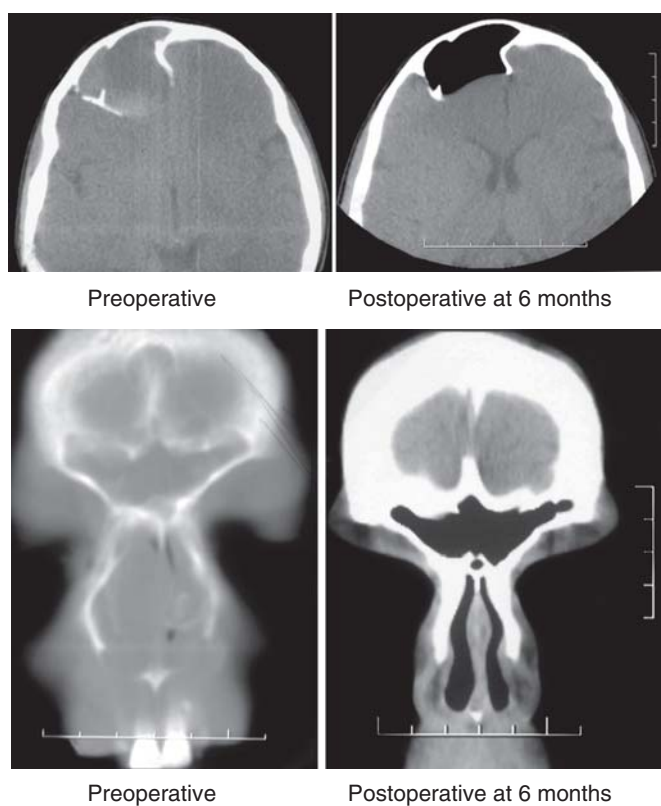


Fig. 3: Radiology

outcome between endoscopic frontal sinusotomy and external frontoethmoidectomy.

The rationale of management of fungal lesion of nose and paranasal sinuses is debridement and aeration of sinuses with oral and topical steroids postoperatively. Involvement of the lateral most part of frontal sinus and destruction of posterior table are limitations for an endoscopic approach. With the availability of angled endoscopes and expertise in endoscopic surgery, it has become possible to approach these areas endoscopically, but it needs good surgical skills to clear the disease from the skull base.

AFRS is more common in younger age group; mean age of larger series varies from 23 to 42.4 years of age.⁷ On the contrary, in our study 40% patients were in age group of 10 to 20 years, followed by 30% patients in the age group of 21 to 30 years. Manning and Holman⁷ reported a male predominance of 1.6:1 (males per females). Whereas this study out of 40 patients, 24 (66.67%) were males and 16 (33.33%) were females with the male and female ratio 1.5:1. The presence of nasal polyposis in 70% of the patients in our study is a bit different from those reported in the literature. Fergusson et al⁸ have reported polyposis in 100% of their cases of AFRS.

Bent et al⁹ reported positive type 1 reaction in 100% of cases of allergic fungal rhinosinusitis. Cody et al¹⁰ reported 58% positive type 1 reaction. Similarly we found, 55% patient with type 1 reaction and 20% with both type 1 and 3 hypersensitivity reactions.

In our study, nine (22.5%) patients had erosion of posterior table of frontal sinus and 18 (45%) patients had erosion of lamina papyracea. These findings are in agreement with reports showing bone erosion in 19 to 64% cases.¹¹ The bony erosion is usually due to pressure necrosis and destructive effect of multiple mediators of inflammation released by eosinophils in allergic mucin.

The patients with unilateral disease were more common with bilateral disease (62.5% vs 37.5%). The English literature also reports such observations.¹² Sewall Boyden⁴ and Neel et al¹³ have advocated the use of external frontoethmoidectomy approach for cases with chronic frontal sinusitis with a success rate of 86.2 to 97%. In our study success rate of 95.3% was seen in cases using frontal sinusotomy by external approach. Rubber tubing as a stent to maintain the patency of nasofrontal duct has been reported by Neel and Dedo, whereas in none of our cases any stent was used. The success rate in our cases undergoing

endoscopic frontal sinusotomy was 92% as compared to 89.8% by Friedman in cases with frontal sinusitis.¹⁴

Aspergillus flavus was isolated in 75% cases in our study (75%). However, dematiaceous fungus, like bipolaris has been reported in the western population. Ponikau et al¹⁵ has reported allergic mucin in 96% and fungal hyphae in 81% of their cases. In our study, allergic mucin was seen in 95% and fungal hyphae in 92.5% cases on histopathologic examination.

We found disease to be more aggressive among younger patient. Similar findings have been reported by Lee and Lee¹⁶ and Gupta et al.¹⁷

Residual disease was 8.13% in group I and 8.57% in group II and collectively it was 11.11%. There was no residual disease seen in isolated frontal sinus disease, hence showing high incidence of residual disease in cases of patients with pansinusitis but this data was not statistically significant (p-value: 0.838).

Residual disease was more common in patients with deviated nasal septum 14.28% in group I and 33.3% in group II (p-value: 0.683). The probable cause of more chance of having disease on the side of deviated nasal septum is the close proximity of two mucosal surfaces in the nasal cavity hampering the mucociliary mechanism and poor aeration of frontal sinuses.

On correlating the size of sinus with of residual disease, we found that patients having smaller frontal sinus had lesser chances of residual disease as compared to patients having well-developed frontal sinus (p-value: 0.511), which was not significant.

The residual disease with destruction of posterior table of frontal sinus, were found to be 33.33% in group I, 28.57% in group II, probably because of extensive disease through a smaller bony destruction in the posterior table of frontal sinus. This observation was contrary to the observation made by Ikram et al¹⁸ where the large series of chronic sinusitis patients were not found to have residual disease.

The difference in term of residual disease between endoscopic and external frontoethmoidectomy approaches seen during third follow-up was not found to be statistically significant (p-value: 0.942). This depends upon the expertise of the surgeon to choose the surgical approach. In cases where proper aeration of frontal sinus is due to anatomical variations, additional surgical procedure in the form of drilling the agger nasi cells or correction of deviated nasal septum should be undertaken.

A regular postoperative care is essential in cases undergoing endoscopic sinusotomy to improve long-term results.

The world literature lacks prospective studies where attempts are made to compare the long-term results of both the surgical modalities for AFRS patients. A major disadvantage of open surgery, however, is that it typically involves removal of large amounts of bone and healthy sinus tissue. The newer intranasal sinus procedures, such as functional endoscopic sinus surgery, are usually far less damaging. 'The purpose of functional endoscopic sinus surgery is to remove the obstruction at the outflow tract of the sinuses while preserving all possible mucous membranes and all possible normal structures'.⁹ Endoscopic endonasal approach has a distinct advantage over the external frontoethmoidectomy approach as it minimizes external scars over the face with almost equal or better long-term results.

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