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Case Series

Clinical and radiological evaluation of isolated frontal sinus disease: a case series

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ABSTRACT

Isolated frontal disease is a rare entity, although it has been widely discussed in literature. The frontal sinus features a wide variation in pneumatisation and drainage pattern and also has close proximity to the orbit and skull base. A retrospective study conducted at a tertiary care centre in South Kerala, between 2019 and 2021, identified five cases of isolated frontal diseases. Patients were diagnosed on the basis of clinical examination, radiological investigations and histology. Management decisions were based on size of the tumour, suspicion of malignancy and extend of disease.

Keywords: Isolated frontal disease, Fungal sinusitis, Mucocele, Inverted papilloma, Draf procedures, Osteoplastic flap

INTRODUCTION

Isolated frontal disease is a rare entity, although it has been widely discussed in literature. The frontal sinus features a wide variation in pneumatisation and drainage pattern and also has close proximity to the orbit and skull base.[1] Isolated involvement of the frontal sinus is, inflammatory in most patients. Neoplastic diseases are rare. The incidence of frontal sinus disease has reduced drastically following the advent of antibiotics. The presentations include headache, facial pain, nasal obstruction, nasal discharge, hyposmia/anosmia and proptosis. For evaluation of these symptoms we use diagnostic nasal endoscopy, X ray paranasal sinuses, computed tomography (CT) of paranasal sinuses and magnetic resonance imaging (MRI) in certain cases. If there is poor response or worsening of symptoms despite adequate medical therapy, or if there are intra cranial or orbital complications, surgery is indicated. Frontal sinus can be addressed surgically via open as well as endoscopic approaches. Complications of frontal sinusitis are classified into orbital, intra cranial and osseous. Some of the grave complications include orbital cellulitis, cavernous sinus thrombosis, meningitis and osteomyelitis of the frontal bone. Appropriate medical therapy, prompt diagnosis, adequate surgical intervention and a high index of suspicion of impending complications will pave way for a positive outcome in patients with frontal sinus disease.[2]

A retrospective study conducted at a tertiary care centre in South Kerala, between 2019 and 2021 identified five cases of isolated frontal diseases. The study population includes four males and one female. All the patients were considered for surgical resection after radiological evaluation.

CASE SERIES

During the two-year period from 2019 to 2021, five patients with isolated frontal diseases were treated. Out of them, four were males (80%) and one female (20%). The

mean age was 45.8 with the range from 22 to 59. The age and gender distribution are described in Table 1.

Table 1: Age and gender distribution.

Cases	Age (years)	Gender
Case 1	59	Female
Case 2	46	Male
Case 3	22	Male
Case 4	44	Male
Case 5	58	Male

The clinical presentations were, headache, nasal obstruction, foul smelling nasal discharge, diplopia, epistaxis and nasal mass. Frequency of clinical presentations are described in Figure 1.

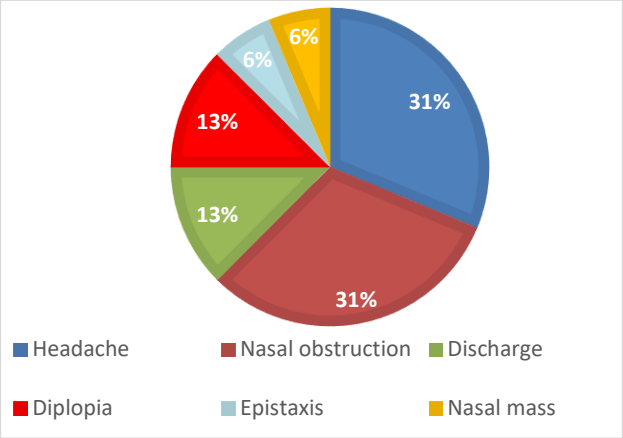

Figure 1: Frequency of clinical presentations.

Radiological modalities used were computed tomography (CT) of the paranasal sinus with and without contrast and magnetic resonance imaging (MRI). The findings in these patients are depicted in Figures 2-4.

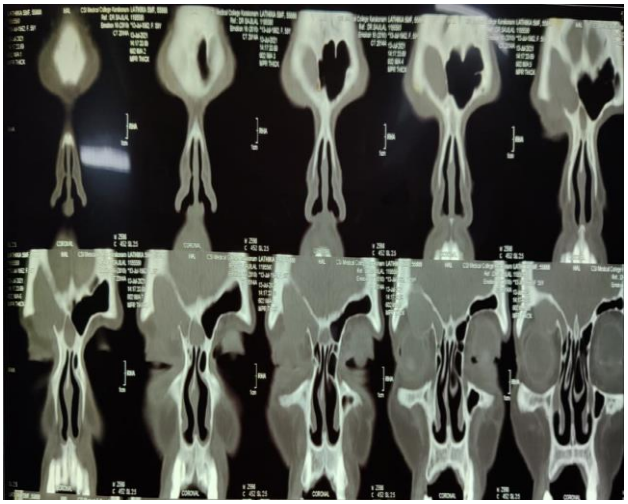

Figure 2: CT PNS showing homogenous opacification of right frontal sinus and thinning and sclerosis of the walls.

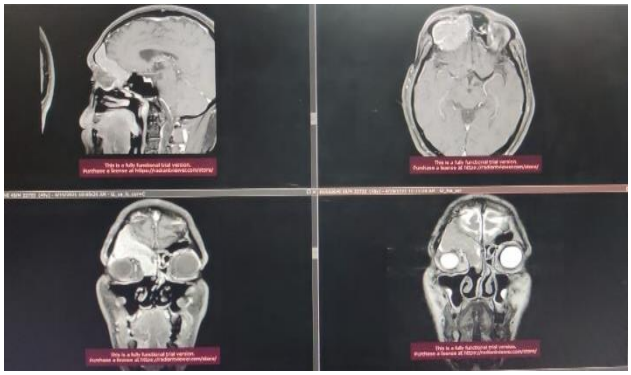

Figure 3: MRI brain showing convoluted cerebriform pattern on right side.

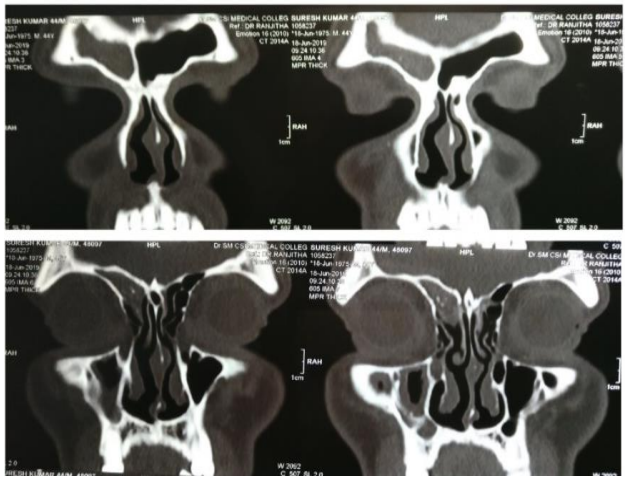

Figure 4: CT PNS showing homogenous opacification of right frontal sinus with hyper densities.

Findings obtained from radiological evaluation are depicted in Table 2.

Table 2: Radiological evaluation findings.

Cases	CT findings	MRI findings
Case 1	Homogenous opacification of right frontal sinus. Thinning and sclerosis of the walls.	Not done
Case 2	Intra lesional calcifications on right frontal sinus [previously operated case of inverted papilloma]	Convoluted cerebriform pattern on right side
Case 3	Homogenous opacification of the left frontal sinus. Narrowing of the frontal recess. Obstruction of ostium by type III air cell.	Not done
Case 4	Homogenous opacification of right frontal sinus with hyperdensities.	Not done
Case 5	Homogenous opacification of left frontal sinus. Thinning and sclerosis of the walls.	Not done

All the patients were operated based on radiological evaluation and the specimens sent for histopathological examination and the diagnosis were confirmed.

Diagnosis of the study population are shown in Table 3.

Table 3: Diagnosis of study population.

Study population	Diagnosis
Case 1	Right frontal sinus mucocele
Case 2	Right inverted papilloma [recurrence]
Case 3	Type III frontal cell with coexisting frontal sinusitis on left side
Case 4	Right frontal fungal sinusitis
Case 5	Left frontal sinus mucocele

No intraoperative or postoperative complications were encountered.

The frequency of diagnosis of isolated frontal sinus disease are shown in Figure 5.

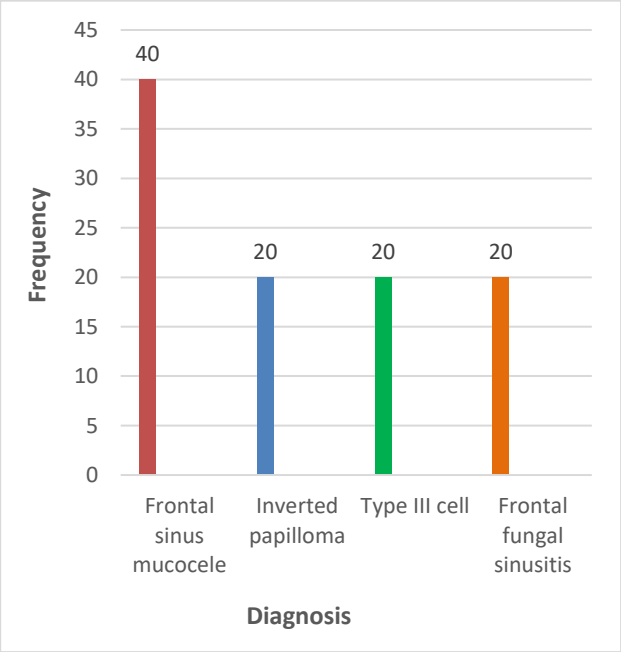

Figure 5: Frequency of diagnosis.

DISCUSSION

Isolated frontal sinus involvement is very rare and majority of them are histopathologically benign. In literature incidence of frontal sinus disease due to type III cell is 22.14%.[3] 70-90% of mucoceles are involving frontal sinus.[4] Benign tumours like inverted papilloma are rare in frontal sinus which accounts for 1.8-2.0%.[5] Fungal sinusitis is usually unilateral and involves multiple para nasal sinuses among which frontal sinus are very rarely affected.[6]

In our study, type III frontal cell with coexisting frontal sinusitis was observed in 20%. 40% of the cases were diagnosed with frontal sinus mucoceles, whereas it was 20% for frontal sinus inverted papilloma. Isolated frontal fungal sinusitis diagnosed in 20% of the cases.

Frontal sinus is the most anteriorly placed sinus in the frontal bone which shares its boundaries with orbit inferiorly and brain posteriorly. The location of frontal sinus, its narrow ostium and variability in drainage pattern contributes to its complexity. The frontal recess and frontal cells determine the disease pattern. Faulty surgical methods and incomplete removal of disease increase the chances of catastrophic complications.[7]

Frontal recess is an hour glass shaped space between the frontal sinus and the hiatus semilunaris. The boundaries are anteriorly agger nasi, posteriorly bulla ethmoidalis, laterally lamina papyracea and medially middle turbinate.[8]

Frontal cells are anterior ethmoidal cells that encroach into the frontal recess. Bent and Kuhn classified these cells into four types.[9] Type I single cell above the agger nasi, type II a row of cells above agger nasi, type III a single cell extending into the frontal sinus but less than 50% of frontal sinus and type IV an isolated or loner cell within the frontal sinus

In our study population, the frontal mucocele and type III cell causing frontal sinusitis were addressed by Draf procedures. The frontal recess and infundibulum are cleared in Draf 1 by removal of uncinate process, agar nasi and anterior ethmoidal cells and Kuhn cells obstructing the frontal recess if present. Hence for our patient with type III cell we advocated a Draf 1 procedure.

The frontal beak and floor up to the anterior attachment of middle turbinate are cleared in Draf 2a in addition to the structures in Draf 1. Apart from Draf 2a, the Draf 2b involves the removal of floor of frontal sinus with the medial extent being the nasal septum and inter sinus septum. Hence the patients with frontal mucocele were addressed with Draf 2b. In case of Draf 3, a single common drainage pathway is created for both frontal sinuses.[10]

Fungal disease of frontal sinus was addressed by Draf 2a, which includes thorough removal of fungal debris along with widening of ostium hence establishing the mucocilliary clearance.

One of our patients had a history of inverted papilloma involving the nasal cavity and maxillary sinus which was addressed surgically via endonasal approach 10 years back. Again, the patient presented with a diagnosis of inverted papilloma confined to the frontal sinus, hence addressed via a combination of endoscopic and osteoplastic flap procedures.

CONCLUSION

Isolated frontal sinus disease is a rare entity with wide variation in management due to its complex anatomy. Each and every case should be looked upon with utmost care. The frontal sinus disease can produce significant mortality and morbidity due to its proximity to important structures and capacity to produce grave complications. So, proper surgical planning and execution is essential to re-establish the functional integrity of the frontal sinus.

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