

## The incidence of frontal cells in patients with frontal sinusitis and their association with mucosal disease by radiological studies in the indian population

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### Abstract

The access and complete removal of disease from the frontal sinus by the Functional Endoscopic Sinus Surgery (FESS) poses a great challenge to the otolaryngologists worldwide. So it is of utmost importance to be well versed with the basic anatomy as well as the anatomical anomalies of the frontal sinus and FSDP (Frontal Sinus Drainage Pathway). The following study was conducted in the department of Otorhinolaryngology, GMC Azamgarh among 55 patients (30 males and 25 females) who underwent CT scanning of the paranasal sinuses for their complaints regarding frontal sinusitis during the period from August 2018 to July 2020. CT scans 110 sinuses were studied for occurrence of various types of frontal cells and the incidence of Agger nasi cells. Agger nasi cells were encountered in 80% of the sinuses studied. Type I frontal cells were seen in 31.81% sinuses, type II frontal cells were seen in 30.90% of sinuses, type III frontal cells were seen 29.09% of sinuses and type IV frontal cells were seen 8.18% of the sinuses.

**Keywords:** Urinary Tract Infection, Microscopic Urine Analysis, Febrile Children.

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### Introduction

Since the introduction of concept of endoscopic sinus surgery in late 80s of last century, it has become clear that "frontal recess" or outflow tract of the frontal sinus is the key area in pathogenesis of frontal sinus disease[1]. The idiosyncrasies of the frontal sinus drainage pathway (FSDP) anatomy and its intimate proximity to the orbit and skull base may lead the surgeon to its inadequate dissection and consequently expose the patient to major complications. Meticulous anatomical knowledge of this region and pre-surgical planning that starts before the patient enters the operating room is mandatory for any otolaryngologist to perform a safe and successful surgery[2]. Resembling an hourglass shape, the FSDP is formed by the frontal ostium superiorly and the frontal recess inferiorly[3,4]. Described as a connection between the frontal sinus and the anterior ethmoid cells, the frontal recess is an inverted, cone-shaped space with the superior narrow end at the internal frontal ostium. The lower limit is wider than the superior one and blends into the anterior ethmoid cells.<sup>5</sup> The anterior wall is formed by the frontal process of the maxilla and the frontal bone, which thickens antero-superiorly to form the frontal beak. In the posteromedial and superior region of the frontal recess lies the lateral wall of the olfactory fossa, which is the thinnest part of the anterior skull base[6]. The first detailed description of the various cells in this area was in 1941 by Van Alyea, who used the term "frontal recess" rather than "nasofrontal duct." Van Alyea used the name "frontal cells" in its broader meaning to refer to the different types of ethmoidal cells pneumatizing in this area[7,8]. The term frontal cells (frontoethmoidal cells) is currently used to describe a group of anterior ethmoidal cells that have been classified by Kuhn et al. into 4 types[9].

• **Type I:** a single cell located above the Agger nasi cell;

- **Type II:** a tier of two or more cells located superior to the Agger nasi cell;
- **Type III:** a single massive cell that has pneumatized superiorly into the frontal sinus; and
- **Type IV:** a cell contained entirely within the frontal sinus that may appear as a cell within a cell on coronal computed tomography (CT). The Agger nasi is generally considered to be the most constant cell in the frontal recess and was found by Bolger et al. to exist in 98.5% of patient[10].

Recently, Wormald et al described an anatomical classification (international frontal sinus anatomy classification [IFAC]) based on three cell types: the anterior cells (Agger nasi cell, supra agger cell, supra agger frontal cell) that push the FSDP medial, posterior or posteromedially; the posterior cells (supra bulla cell, supra bulla frontal cell, supraorbital ethmoid cell) that push the drainage pathway anteriorly; and medial cells (frontal septal cell) that push the drainage pathway laterally[11].

### Material and Methods

The following study was conducted in the department of Otorhinolaryngology, GMC Azamgarh among 55 patients (30 males and 25 females) who underwent CT scanning of the paranasal sinuses for their complaints regarding frontal sinusitis during the period from August 2018 to July 2020. Diagnosis was made on the basis of history, clinical examination and CT scans of the paranasal sinuses, both in the coronal and axial views. Patients below 18 years of age and above 60 years of age, with history of maxillofacial trauma and with history of previous sino-nasal surgeries were not included in the study. The CT scan slides were studied for the occurrence of the various types of frontal cells based on the classification done by Kuhn et al[9] and the Agger nasi cells, on left and right side frontal sinuses separately. The grading of the mucosal disease in the frontal sinuses was also done using the Lund and Mackay staging system[12]. All the other types of cells i.e. the supra-bulla cell, supraorbital cells, supra bulla frontal cells, and inter-septal frontal sinus cells were not included in the study.

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Results

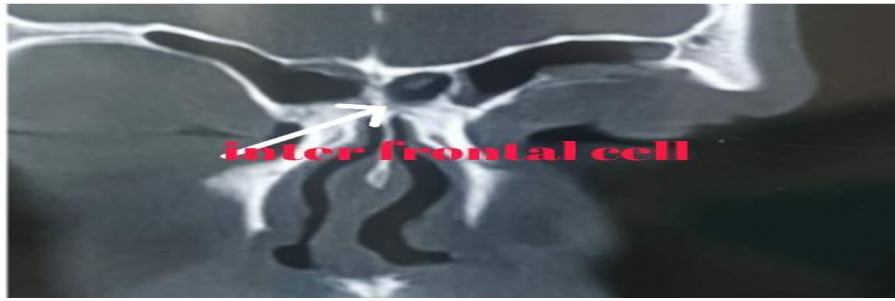


Fig 1:Inter frontal cell

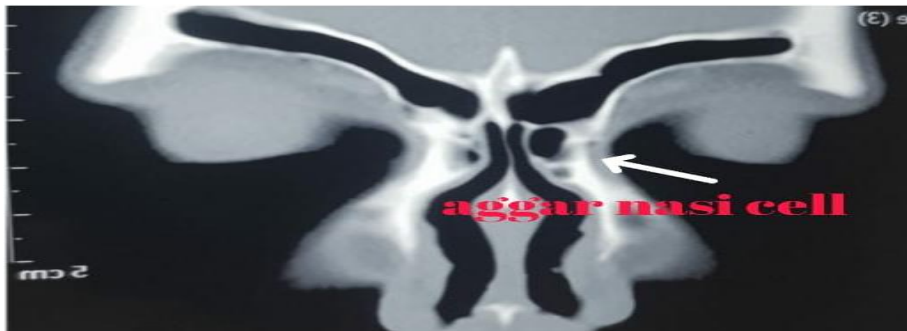


Fig 2:Aggar nasi cell



Fig 3:Sagittal view

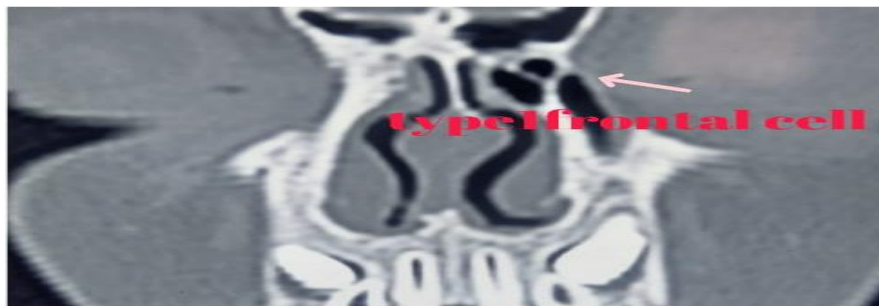


Fig 4:Type 1 Frontal cell



Fig 5:Type 2 frontal cell



Fig 6:Type 3 frontal cell

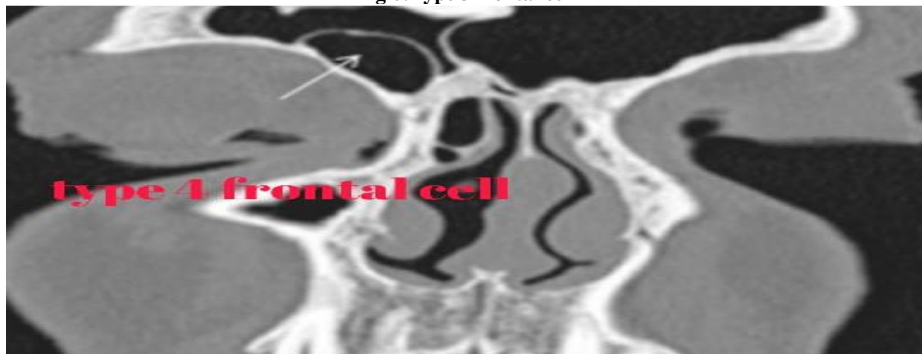


Fig 7:Type 4 frontal cell

CT scans of 55 patients (30 males and 25 females) were studied. A total of 110 frontal sinuses were studied, in both coronal and axial cuts. All the patients were between the age group of 18 to 60 years. The age-wise distribution of the occurrence of frontal cells was as follows:

Between age group 18- 30 years: 10 (0.91%)

Between age group 31-40 years: 21 (19.1%)

Between age group 41-50 years: 29 (26.36%)

Between age group 51-60 years: 24 (21.81%)

Agger nasi cells were encountered in 88 (80%) of the total number of sinuses studied.

Based on the Kuhn et al[9] classification of frontal cells:

Type I frontal cells were seen in 35 sinuses (31.81%).

Type II frontal cells were seen in 34 sinuses (30.90%).

Type III frontal cells were seen in 32 sinuses (29.09%).

Type IV frontal cells were seen in 9 sinuses (8.18%).

Frontal Cells were encountered in 82 (73.63%) sinuses out of the CT scans of 110 sinuses studied.

According to the Lund and Mackay staging system[12] for mucosal disease:

No opacity was seen in 28 (25.45%) sinuses (disease free mucosa), i.e. stage 0

Partial opacity was seen in 33 (30%) sinuses, i.e. stage 1

Complete opacity was seen in 44 (40%) sinuses, i.e. stage 2

Severe hypoplasia was encountered in 5 sinuses (4.54%).

#### Discussion

The access and complete removal of disease from the frontal sinus by the Functional Endoscopic Sinus Surgery (FESS) poses a great challenge to the otolaryngologists worldwide. So it is of utmost importance to be well versed with the basic anatomy as well as the anatomical anomalies of the frontal sinus and FSDP. In 1905 Turner<sup>13</sup> stated that “the existence in many instances of incomplete bony septa and partitions within the interior of the frontal sinus gives rise to one or more diverticula or recess” and claimed that failures in operation have been caused by non-recognition of such recess.

According to Wormold[6], Aggernasi cells are the key to understanding the anatomy of frontal recess. In the literature distribution of Aggernasi cells are between 78 and 98.5 % of the patients. According to Landsberg and Friedman[14] Agger nasi cells were found in 78 % of scans. Bolger et al[9] has found the prevalence in 98.5 % of their cases. According to a study conducted by Makihara et al[15] on the Japanese population the prevalence of Aggernasi cells was found to be 85.3%. In our study Aggernasi cells were visualised in 80% of the scans. This is in accordance with the existing literature. The presence of Aggernasi cell actually works as a landmark and guide for access to the frontal sinus ostia.

Krzeski et al[16] identified frontal cells in 23.56% sinuses studied in the CT scans. Meyer et al[17] detected a prevalence of frontal cells in 20.4% of CT scans done in patients with chronic rhinosinusitis. Their results showed a significantly higher incidence of frontal sinus disease in presence of types III and IV frontal cells. Han et al[18] detected frontal cells in 39.6% of the paranasal sinuses while studying CT scans in a Chinese population without frontal sinusitis symptoms. In our study frontal cells were encountered in almost 73.63% of the sinuses out of all the CT scans studied. The occurrence of more percentage of frontal cells in our study was probably because all the patients were confirmed cases of frontal sinusitis. So, the prevalence of frontal cells in this study cannot be taken as a reflection of the occurrence of frontal cells in the general population. In our study no correlation was seen between the presence or absence of frontal cells with the occurrence of mucosal disease in the frontal sinuses which goes in accordance with the study conducted by Delgaudio et al[19] So, the occurrence of frontal sinusitis cannot be attributed to the presence of frontal cells, which was also seen in various studies conducted before.

#### Conclusion

According to our study it can be said that although the frontal cells are frequently encountered on CT scans of patients with frontal sinusitis, they cannot be associated with the occurrence of mucosal disease in the frontal sinus. Also, apart from clinical examination radiological study of the frontal sinuses plays a significant part in access and complete removal of the disease from the frontal sinuses.

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