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CORRELATION BETWEEN PREVALENCE OF HALLER CELLS AND POSTOPERATIVE OUTCOME OF FUNCTIONAL ENDOSCOPIC SINUS SURGERY (FESS) – A LONGITUDINAL OBSERVATIONAL STUDY IN A TERTIARY CARE HOSPITAL

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ABSTRACT **Introduction:** Haller cells, or infraorbital ethmoid cells, represent anatomical variations of the paranasal sinuses, with reported prevalence rates ranging from 2% to over 45%. Given their close relationship to the ostiomeatal complex (OMC), the size and shape of Haller cells may influence the outcome of middle meatal antrostomy (MMA) during Functional Endoscopic Sinus Surgery (FESS), affecting both symptom relief and postoperative success.**Methods:** A longitudinal observational case series was conducted on 48 patients presenting with sinonasal symptoms at a tertiary care hospital in Mandya. Preoperative assessment included symptom evaluation, nasal endoscopy, and CT imaging to identify the presence, size, and shape of Haller cells. Intraoperative findings were recorded, and postoperative outcomes were assessed. Correlation between radiological and intraoperative findings, as well as postoperative symptom persistence, was analyzed.**Results:** Among the 48 patients, 33 (68.8%) were males. The most common presenting symptoms were headache (60.4%), nasal obstruction (56.3%), and nasal discharge (54.2%). Haller cells were predominantly unilocular (89.6%), oval (62.5%), and unilateral (66.7%). Following Functional Endoscopic Sinus Surgery (FESS), 37 (77.1%) patients showed symptomatic improvement. No significant association was found between Haller cell size or shape and postoperative maxillary sinusitis or persistent symptoms ($p > 0.05$).**Conclusion:** Large and round Haller cells appear to contribute significantly to sinus obstruction and postoperative symptom persistence following FESS. Preoperative identification of these variations through CT imaging aids in surgical planning and minimizes complications. The findings highlight the importance of detailed anatomical evaluation for improved FESS outcomes.

KEYWORDS : Haller cells, Infraorbital ethmoid cells, Functional Endoscopic Sinus Surgery, Paranasal sinuses, Anatomical variation

INTRODUCTION

Haller cells, also known as infraorbital ethmoid cells, are anatomical variations of the paranasal sinuses. They are small air cells that form along the floor of the orbit and lateral to the ethmoid sinus, sometimes extending into the maxillary sinus roof [1]. First described by Albrecht von Haller, these cells can vary significantly in size, shape, and number.

Studies have shown that Haller cells are relatively common, with prevalence rates varying from 2% to over 45% depending on the population and imaging techniques [2]. Haller cells are often identified on imaging, particularly on CT scans. Anatomical variations in Haller cells are notable; they may be uni or multilocular and vary in size and shape. They are more frequently found bilaterally, and their presence does not always lead to clinical symptoms.

Haller cells have been associated with sinus-related issues such as recurrent maxillary sinusitis and chronic rhinosinusitis. They may contribute to sinus drainage obstruction by narrowing the infundibulum or ostiomeatal complex (OMC), leading to mucus retention and inflammation. In some cases, large Haller cells may even impinge on the infraorbital nerve, potentially causing facial pain or orbital complications[4].

Haller cells, given their location near the ostiomeatal complex (OMC), can influence the outcomes of middle meatal antrostomy (MMA), a surgical procedure typically performed to enhance drainage of the maxillary sinus, particularly in cases of chronic sinusitis. The presence of Haller cells can alter the anatomy of this region, impacting both surgical access and postoperative drainage, potentially affecting symptom relief and overall surgical outcomes [5].

Studies indicate that the presence of Haller cells can make access to the OMC more challenging, as these cells can narrow the middle meatus and restrict access to the natural maxillary ostium. Haller cells may lead to partial or complete obstruction of the infundibulum or ostium, which are critical pathways for maxillary sinus drainage. Even if MMA is performed successfully, residual obstruction from Haller cells can reduce the effectiveness of the antrostomy.

Studies have demonstrated that patients with prominent Haller cells have higher rates of residual symptoms, such as facial pain, congestion, and drainage issues, after MMA compared to those without these cells [5]. A notable factor is that Haller cells can affect adjacent sinus areas, leading to continued sinus inflammation and recurrence of symptoms even after surgical intervention. A limited published literature is present for the above study.

OBJECTIVE

To correlate the presence of haller cell and its anatomical variations on Computed Tomography (CT) and how it helps in the outcome of Functional Endoscopic Sinus Surgery (FESS).

MATERIALS AND METHODS

Study Design: Observational Longitudinal Study**.**

Study Period: Three months (June 2025 to August 2025).

Study Population: Outpatient Department, Department of Otorhinolaryngology, MIMS, Mandya. Written informed consent was obtained from all participants prior to enrollment.

Sample Size:

The Sample size was calculated by using the formula,
based on one of the previous studies the prevalence of participants (p),

$N = Z^2 \times pq / d^2$
Z = standard normal variate (1.96)
p = 88.89% [6]
q = 100-p; 100-88.89 = 11.11
d= 10% of p = 8.89
$N = 1.96 \times 1.96 \times 88.89 \times 11.11 / (8.89)^2$
N = 48.01
Rounding off to 48.

A total of 48 consecutive eligible patients were included. The sample size was considered adequate with a confidence level of 95% and statistical power of 80%.

Sampling Method: Consecutive enrollment till the sample size was met.

Inclusion Criteria:

1. Patients who come to the ENT outpatient department with complaints related to sinonasal disease followed by clinical examination & radiological investigation and who are willing for operative procedure (FESS).
2. Such patients who are willing for follow up.
3. Such patients who are willing to give informed consent.

Exclusion Criteria:

1. With prior surgery of nose and PNS, with sinonasal tumours and head and neck injuries.
2. Those not willing for diagnostic or operative procedures.

Method of Data Collection (study tools):

Study was initiated after obtaining approval from the institutional ethics committee of Mandya Institute of Medical Sciences, Mandya.

All patients who came to the ENT department OPD with symptoms like headache, nasal obstruction, nasal mass, nasal discharge, facial pain, decrease sense of smell of long duration were thoroughly examined and their clinical signs were noted by performing a Diagnostic Nasal Endoscopy (DNE) test. After which, the patients were subjected to CT Nose & PNS scan (5mm slices thickness reconstructed to 1mm with axial, coronal and sagittal cuts).

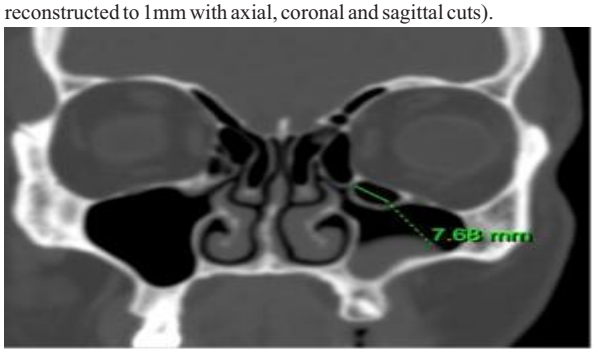

Figure 1: Coronal section of CT-PNS demonstrating patent left haller cell not obliterating OMC.

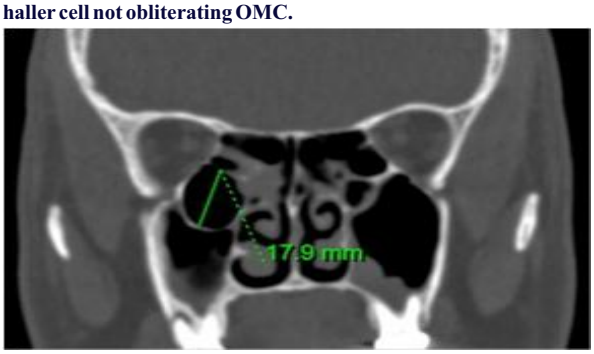

Figure 2: Coronal section of CT-PNS demonstrating large right haller cell obliterating right OMC.

All relevant findings on the CT scan were noted and patients were then categorised into Chronic Rhinosinusitis (CRS) with nasal polyposis (CRSwNP) or without nasal polyposis (CRSsNP).

Findings related to presence of haller cells along with its anatomical and pathological variations were noted. Patients were then prescribed maximal medical therapy (MMT) for 3 weeks from the diagnosis. Patients who gave consent for surgery thereafter were subjected to the Functional Endoscopic Sinus Surgery (FESS), performed by the senior rhinologist under general anaesthesia of the institute. FESS was performed by standard Stammberger Messerklinger technique.

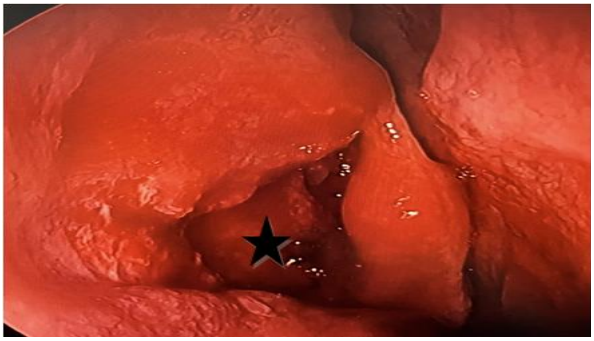

Figure 3: Intra-operative appearance of Haller cell (starred) in Right nasal cavity.

Intraoperatively, CT scan findings were correlated with respect to presence of haller cells, unilateral or bilateral, extent, drainage impact on disease clearance, along with other anatomical variations.

Analysis:

Data were entered into Microsoft Excel and analyzed using the Statistical Package for Social Sciences (SPSS), version 29.0.

Descriptive statistical tests like frequency, proportion, of categorical data, mean, standard deviation for quantitative data like age, sex, presence of unilateral or bilateral haller cell and inferential statistical tests like chi square test, paired t-test to know the association of intraoperative finding with CT nose & PNS readings. Significance level was set at 5 % ($p<0.05$).

RESULTS:

A total of 48 participants were included in the study. The mean age was 35.7 ± 14.4 years (median: 35 years), with ages ranging from 16 to 67 years. Of the 48 participants, 33 (68.8%) were males and 15 (31.2%) were females, with a male-to-female ratio of 2.2:1. Among the 48 participants, the majority belonged to the Upper Lower socioeconomic class (Class IV) 31 (64.6%), followed by the Lower Middle class 9 (18.8%), while 8.3% each belonged to the 4 Upper and 4 Upper Middle socioeconomic classes.

Among the 48 participants, headache in 29 (60.4%) was the most common presenting symptom, followed by nasal obstruction in 27 (56.3%) and nasal discharge in 26 (54.2%). Facial pain in 12 (25.0%) and decreased sense of smell in 10 (20.8%) patients were less frequently reported.

Among the study population (n = 48), Haller cells demonstrated variations in size (large, medium, and small), shape (oval, round, and teardrop), and laterality (unilateral and bilateral).

The majority of Haller cells were unilocular (43/48, 89.6%), oval in shape (30/48, 62.5%), and unilateral (32/48, 66.7%).

Statistical analysis revealed no significant association between the size of Haller cells and postoperative maxillary sinusitis outcomes ($p > 0.05$). Although a trend toward an association between Haller cell shape and the resolution of postoperative sinusitis was observed, it did not reach statistical significance.

Table 1. Baseline characteristics, clinical presentation, Haller cell morphology, and surgical outcomes of the study population (N = 48)

Variable	Category	n	%
Age (years)	Mean ± SD	35.7 ± 14.4	–
	Median (Range)	35 (16–67)	–
Gender	Male	33	68.8
	Female	15	31.2
Modified Kuppuswamy Socioeconomic Class	Class I (Upper)	4	8.3
	Class II (Upper Middle)	4	8.3
	Class III (Lower Middle)	9	18.8
	Class IV (Upper Lower)	31	64.6
Presenting Symptoms	Headache	29	60.4
	Nasal obstruction	27	56.3
	Nasal discharge	26	54.2
	Nasal mass	21	43.8
	Facial pain	12	25
	Decreased sense of smell	10	20.8
Haller Cell	Unilocular	43	89.6
	Multilocular	5	10.4
	Oval shape	30	62.5
	Other shapes (round/teardrop)	18	37.5
	Unilateral	32	66.7
	Bilateral	16	33.3
Surgical Outcome	Symptomatic improvement after FESS	37	77.1
	Persistent symptoms	11	22.9

With respect to surgical outcomes, 37 of 48 patients (77.1%) experienced symptomatic improvement following Functional Endoscopic Sinus Surgery (FESS), whereas 11 of 48 patients (22.9%) reported persistent symptoms during the follow-up period.

Although the presence of Haller cells altered the anatomy of the

ostiomeatal complex and could potentially increase the technical complexity of surgery, it was not identified as a significant predictor of persistent postoperative symptoms in our study.

CONCLUSION:

CT evaluation of Haller cells plays an important role in preoperative assessment and surgical planning for Functional Endoscopic Sinus Surgery (FESS).

Although Large and round Haller cells appear to contribute significantly to sinus obstruction and postoperative symptom persistence following FESS, the morphology of Haller cells did not show a statistically significant correlation with postoperative outcomes.

Haller cell identification helps in anticipating anatomical variations, thereby reducing intraoperative complications and enhancing surgical safety and precision.

DECLARATIONS:

Ethics & Consent to Participate: Institutional Ethics Committee approval obtained; written informed consent from all participants was obtained.

- **Consent for Publication:** Not applicable.
- **Funding:** No external funding was received.
- **Conflict of Interest:** The authors declare no competing interests.

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