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Prevalence of Haller's Cells using Computed Tomography in Namakkal District - A Retrospective Study

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Abstract

Aim: Haller's cells are developmental variants of anterior ethmoidal sinus which are also known as infraorbital ethmoidal cells or orbito ethmoidal cells or maxilla ethmoidal cells. These anatomic variants of sinonasal regions pneumatize inferiorly and medial to the orbital floor and towards the inferior of maxillary sinus. Hence, the present study was to determine the prevalence of Haller's cells using CT PNS images. **Objectives:** The purpose of the study is to determine the prevalence of Haller's cells according to age and gender, to evaluate the relationship between Haller's cells and maxillary sinusitis and to correlate between Haller's cells and ipsilateral orbital floor dehiscence. **Methods:** CT PNS images of 60 patients within the age group of 16-75 years were retrieved, screened by a radiologist and analyzed. The data collected were subjected to statistical analysis analyzed with statistical software package, SPSS version 16.0. and p value < 0.05 was considered to be statistically significant. **Results:** The prevalence of Haller's cells in the present study was found to be 48%. There was no statistically significant association between the presence of Haller cells with respect to age and gender. There was a significant association between Haller cells with maxillary sinusitis and orbital floor dehiscence. **Conclusion:** This study has attempted to find the prevalence of Haller's cells which will be helpful for dentists in specifying the differential diagnosis for Oro facial pain and maxillary sinusitis.

Keywords: Dehiscence, Computed Tomography, Haller's Cells, Maxillary Sinus, Orbital Floor, Orofacial Pain

1. Introduction

Haller's cells are developmental variants of anterior ethmoidal sinus which are also known as infraorbital ethmoidal cells or orbito ethmoidal cells or maxilla ethmoidal cells[1]. These anatomic variants of sinonasal regions pneumatize inferiorly and medial to the orbital floor and towards the inferior of maxillary sinus (Figure 1). It was Albrecht Von Haller, a Swedish anatomist in 1765 who described about this sinonasal variant in his book and hence the name given as 'Haller's cells'[2]. Haller's cells can predispose to various conditions like recurrent and acute sinusitis, Nasal obstruction, impaired nasal breathing, oro facial pain related to paranasal region, chronic cough



Figure 1. Coronal CT image showing right side Haller's cells with well corticated border.

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Figure 2. Axial image showing Haller's cells.

and mucoceles. These patient symptoms associated with Haller's cells emphasize its clinical significance[3–6].

Various imaging modalities like Orthopantomogram, computed tomography, Sinonasal endoscopy, cone beam computed tomography can be utilized to identify Haller's cells. Only two dimensional view of the paranasal regions are obtained using OPG which explains its drawback. According to Bolger et al., sinonasal endoscopy alone cannot identify Haller's cells as they are seen lateral to the uncinate process. Though CBCT has more advantages when compared to CT, it is considered as the gold standard for viewing the paranasal sinus region[6,7].

With this background, the main aim of our study was to find out the prevalence of Haller's cells using Computed Tomographic images amongst the study population. The objectives were to determine the prevalence of Haller's cells according to age and gender, to evaluate the relationship between Haller's cells and maxillary sinusitis and to correlate between Haller's cells and ipsilateral orbital floor dehiscence.

2. Materials and Methods

A retrospective study was done in 100 CT Para Nasal Sinus (PNS) images of patients who reported to the Otorhinolaryngology department from January 2017 to November 2017 were considered in the study. The images were retrieved from GE High speed CT/e software from the department of general radiology and the images were screened by an experienced radiologist. Images of patients within age group 16-75 years were included in this study. The images below 16 years were not included as complete development of paranasal sinuses will not occur before adolescence according to Gray's anatomy[8]. Patients who reported with idiopathic orofacial pain related to Paranasal sinus region and symptoms of sinusitis were included in our study. Images of patients with congenital deformities of maxillofacial region, any history of maxillofacial surgery, trauma to the maxillofacial region and tumors of the nose, paranasal sinus or maxillofacial region were excluded from the study. Out of the 100 CT PNS images, 60 images which fulfilled the inclusion as well as exclusion criteria was assessed for our study. The CT images were evaluated using DICOM software in both axial and coronal planes with a slice thickness of about 3mm (Figure 2). The approval of the study was obtained from the institutional ethical committee.

According to Mathew et al. criteria Haller's cells were identified in our study using where they were considered as air filled cavities located medial on orbital floor and/or lamina papyracea, inferior to the bulla ethmoidalis. According to Sebrechts et al. criteria, the orbital floor dehiscence was assessed as the loss of orbital bone in the areas where Haller's cells were present. The thickening of sinus mucosa or fluid accumulation at any level was viewed as maxillary sinusitis[9–11].

3. Statistical Analysis

The data were reported as the mean +/- SD depending on their distribution and frequencies were expressed in percentages and all data were analyzed with statistical software package, SPSS version 16.0. The differences in quantitative variables between groups were assessed using unpaired T test and comparisons between the groups were made by Mann-Whitney test. Chi-square test was used to assess the differences in categorical variables between the groups and Pearson correlation co-efficient was used to evaluate the relationship between the variables.

4. Results

Out of the total 60 samples, 36 (60%) were females and 24 (40%) were males with ages ranging from 16–75 years. The total prevalence of Haller's cells was found to be 48% and absent in 52%, among which they were present 36% unilaterally and 12% bilaterally (Table 1). The presence of Haller's cells were seen in males 38% unilaterally and 4% bilaterally and in females they were present 36% unilaterally and 17% bilaterally (Table 2 and 3).

Table 1. Pie diagram showing prevalence of Haller's cells

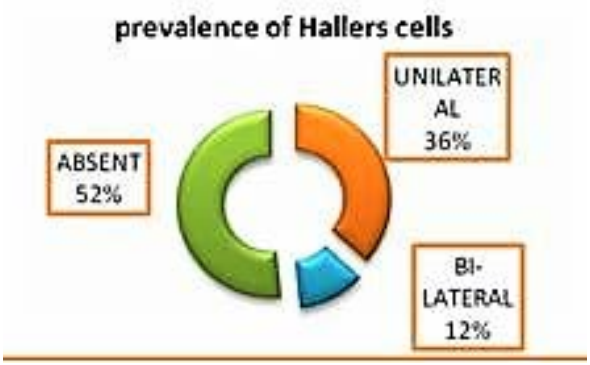


Table 2. Prevalence of Haller's cells according to age

AGE	MALES	(%)	FEMALES	(%)	TOTAL	(%)
16-25	5	8%	6	10%	11	18%
26-35	6	10%	10	17%	16	27%
36-45	4	7%	7	12%	11	18%
46-55	2	3%	9	15%	11	18%
56-65	5	8%	4	7%	9	15%
66-75	2	3%		0%	2	3%
TOTAL	24		36		60	

Table 3. Prevalence of Haller's cells according to gender

THE HALLER'S CELL PATTERN IN GENDER							
GENDER	UNILATERAL	(%)	BILATERAL	(%)	ABSENT	(%)	p-value
MALE	9	38 %	1	4%	14	58%	>0.05
FEMALE	13	36 %	6	17 %	17	47%	

Table 4. Association of Haller's cells with maxillary sinusitis

HALLERS CELLS	MAXILLARY SINUSITIS ABSENT	(%)	MAXILLARY SINUSITIS PRESENT	(%)	p-value
ABSENT	18	58%	13	42%	<0.05
PRESENT	8	28%	21	72%	

There was no significant association of Haller's cells with age and gender respectively in our study with p>0.05. Among the 60 samples, the presence of maxillary sinusitis was seen 39% unilaterally, 18% bilaterally and was absent in 43% (Table 4). In the present study, out of the 21 patients with Haller's cells, 8 were evaluated with orbital floor dehiscence.

Table 5. Association of Haller's cells with orbital floor dehiscence

	ORBITAL FLOOR DEHISCENCE				
HALLERS CELLS	ABSENT	(%)	PRESENT	(%)	p-value
ABSENT	31	100%	0	0%	<0.01
PRESENT	21	72%	8	28%	

5. Discussion

An extensive range of discrepancy was seen in previous literatures regarding the prevalence of Haller's cells from 2.5% to 45.1%[6,10,12]. This wide range of discrepancy in the prevalence may be due to patient's age, race, sample size, difference in the imaging technique used and improper definition of Haller's cells. Ahmad et al. in 2006 proposed a criterion for identifying Haller's cells using OPG[13]. Using this criterion Solanki et al. and Ramaswamy et al. did a study in 2014 and 2015 respectively in Indian population using OPG where the prevalence rate was 19.2% and 20.75%[14,15]. Using the same criterion Pekiner et al. in 2014 did a study using CBCT which had a prevalence rate of 43.3%[16]. Bolger et al. in 1991 reported Haller's cells as any cell located between the ethmoid bulla, the orbital lamina of the ethmoid bone and the orbital bone and the orbital floor and did a study using CT with prevalence rate of 45.1%. Mathew et al. in 2013 did a study using CBCT which had a high prevalence rate of 60%. Hence in our study we used Mathew et al. criteria for identification of Haller's cells and the prevalence was found to be 48%. This shows that advanced imaging modalities like CT, CBCT are more reliable in identifying these anatomic variant than two dimensional imaging modalities like OPG.

The presence of Haller's cells with respect to age and gender was not statistically significant in our study. This was in accordance with CBCT imaging study done by Pekiner et al. but was contradictory to studies done by Mathew et al. and Kamdi et al.[7,10,16] The presence of unilateral pattern was found to be 38% and 4% bilateral in males. In females, they were present 36% unilaterally and 17% bilaterally.

Dale et al. in 2004 described that large sized Haller's cells can block the mucociliary flow by compressing the maxillary infundibulum which can lead to maxillary sinusitis by creating an environment for the growth of microorganisms[9,11,17]. Only few studies have been done to find the association of Haller's cells with maxillary sinusitis. In our study, out of the 34 symptomatic patients 21 samples had Haller's cells and 13 samples with maxillary sinusitis were assessed with the absence of Haller's cells (Table 4). Thus there was a significant association of Haller's cells with maxillary sinusitis in this study. This was similar to study done by Kamdi et al.[7] but was contradictory to results by Mathew et al.[10].

Sebrechts et al. in 2000 reported that Haller's cells can cause loss of bone density of the orbital bone leading to the spread of inflammation from the maxillary sinus into the orbit which finally results in proptosis or orbital cellulitis[11, 18]. In the present study, 8 cases (28%) with the presence of Haller's cells had orbital dehiscence and none of them without Haller's cells had orbital dehiscence (Table 5). Thus there existed a significant association of Haller's cells with orbital dehiscence which was similar to Kamdi et al. and Mathew et al. Also, Shetty et al.[7,10] in 2015 reported that reachability to maxillary sinus while doing endonasal surgical procedures like FESS can be restricted due to the presence of Haller's that can ultimately lead to orbital floor perforation[19]. Hence, presurgical identification of Haller's cells help in preventing such intra-operative complications.

6. Conclusion

Thus the results of the present study illustrated the association of Haller's cells with maxillary sinusitis and orbital floor dehiscence which help in specifying the differential diagnosis for orofacial pain related to paranasal sinus region. Thus CBCT is a better imaging modality to view paranasal sinuses with respect to radiation dosage and cost effectiveness when compared to CT which was one of the limitations of this study. And also some Haller's cells may be missed in CT interslice intervals. In future, size specific CT analysis of Haller's cells and association of various signs and symptoms of maxillary sinusitis with Haller's cells is strongly recommended. Hence as an

oral and maxillofacial radiologist, we should be able to identify this minute entity to guide the patient through proper treatment regime and to many more research frontiers as well.

7. Conflicts of Interests

Authors declare that they have no conflicts of interest.

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