The Infraorbital Ethmoid (Haller's) Cells in a Group of Thai Patients: Panoramic Radiographic Study

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Abstract

The aim was to determine the prevalence of infraorbital ethmoid (Haller's) cells on panoramic radiograph in a group of Thai patients. This study was performed on 500 digital panoramic radiographs from the patients who were referred to radiographic examination for various reasons between January 2018 and February 2020. All radiographs were observed by an oral radiologist for the presence of Haller's cells. The collected data were analyzed statistically; frequencies/percentages, descriptive statistics, and Chi-square test to obtain the results. From 500 patients, 362 (72.4%) had Haller's cells. The maximum number of the sample with Haller's cells were found in the age group of 14-23 years. Among 362 cases with Haller's cells, 26.4% (132) were ovoid shape. The relationship between pattern of Haller's cells and side was found to be significant ($p = 0.002$). In addition, a significant relationship was also observed when the shape and side of the Haller's cells were correlated, $p < 0.001$. The results of our study can be used in differential diagnosis of unexplained orofacial pain. The diagnosis of Haller's cells can provide preoperative information for the surgeon to prevent complications caused by entering these areas. Panoramic radiograph may be an appropriate imaging modality for evaluation of the presence of Haller's cells.

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Introduction

Infraorbital ethmoid (Haller's) cells are the extensions of anterior ethmoid sinus into floor of the orbit and superior aspect of maxillary sinus.[1] Haller's cells were first described by Albert von Haller, a Swiss anatomist. They are also known as maxilloethmoidal or orbitoethmoidal cells.[2] Although Haller's cells are anatomical variations of the nose and paranasal sinuses, they have been held responsible for patient's symptoms and are clinically significant.[1,3] These symptoms include orofacial pain and sinusitis, nasal obstruction, impaired nasal breathing, headache, chronic cough and mucoceles.[1,4,5] The Haller's cells can be seen by various imaging modalities. Infraorbital ethmoid cells appeared on panoramic radiograph as well-defined, round, oval or teardrop-shaped radiolucencies (single or multiple), unilocular or multilocular with a smooth border which may or may not appear corticated, and are located medial to the infraorbital foramen.[1] There have been reports about the prevalence of Haller's cells on panoramic and cone-beam computed tomography in different population.[1,2,6,7] The results of these studies indicated the various shape and pattern of Haller's cells on panoramic radiograph in different race or population. To our knowledges, there have not been report of the prevalence of Haller's cells in Thai population. Thus, the objectives of the present study were to determine the prevalence of infraorbital ethmoid (Haller's) cells on panoramic radiograph in a group of Thai patients.

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Materials and methods

The present study was approved by institutional review board (IRB No. 0542/62). The

study group comprised of 500 digital panoramic radiographs from the patients who were referred to radiographic examination for various reasons between January 2018 and February 2020. All radiographs were taken with digital panoramic machine (Veraview X800, J Morita MFG. Corp, Kyoto, Japan) at 75 kV, 6-8 mA and interpreted on computer monitor (Dell P2317H, Dell Corp, Malaysia). The radiographs obtained were serially interpreted under ideal viewing conditions. One oral radiologist with more than 10 years experiences examined the radiographs. The examiner viewed radiograph twice for the presence of Haller's cells in a time interval of 15 days. Intra-examiner analysis revealed κ = 0.83, which represents almost perfect agreement. The interpretation and the criteria for choosing the Haller's cells in a panoramic radiograph was confirmed by Ahmad et al.[1] These selection criteria are listed below;

1. well-defined round, oval, or tear-drop shaped radiolucency, single or multiple, unilocular or multilocular, with a smooth border, which may or may not appear corticated,
2. located medial to infraorbital foramen,
3. all or most of the border of the entity in the panoramic section is visible,
4. the inferior border of the orbit lacks cortication or remains indistinguishable in areas superimposed by this entity.

Patients with a history of trauma and/or surgery involving the maxillofacial region, systemic diseases affecting growth and development, or clinical and/or radiographic evidence of developmental anomalies/pathologies affecting the maxillofacial region were excluded from the study. The data were analyzed for frequencies/percentages, descriptive statistics, Chi-square test and cross-tabulation using SPSS for Windows (SPSS Inc., Chicago, IL) to obtain the results. Significance was set at 0.05 levels.

Results

The total sample size of the study was 500, consisting of 141 males and 359 females. The mean age of the participants was 25.80 years; 26.09 in males and 25.69 years in females (Table 1).

Gender	n	Mean	SD
Male	141	26.09	18.08
Female	359	25.69	14.25
Total	500	25.80	15.41

Table 1. Number of the patients with the mean age and standard deviation.
SD = standard deviation, $p = 0.384$

The patients were divided into various groups according to the age as 5-13 years (group 1), 14-23 years (group 2), 24-33 years (group 3), 34-43 years (group 4), 44-53 years (group 5), 54-63 years (group 6), and greater than or equal to 64 years (group 7). Of the 500 patients, Haller's cells were found in 362 (72.4%). Out of 362 with Haller's cells, 106 were found in males and 256 were found in females, with the ratio of 1:2.42. According to age group, the Haller's cells was most found in group 2 (Table 2).

Age groups	Presence of Haller's cells	Total
5-13 years (group 1)	32	44
14-23 years (group 2)	238	320
24-33 years (group 3)	38	50
34-43 years (group 4)	11	15
44-53 years (group 5)	8	14
54-63 years (group 6)	19	32
≥ 64 years (group 7)	16	25
Total	362	500

Table 2. Frequency of Haller's cells according to age. $P = 0.402$

Shape	n (%)
Round	52 (10.4)
Ovoid	132 (26.4)
Teardrop	41 (8.2)
Irregular	33 (6.6)
Multiple (more than one shape)	104 (20.8)

Table 3. Frequency of Haller's cells according to shape.

Among the 362 with Haller's cells, 132 (26.4%) were ovoid shape (Table 3, Figure 1), which also most found in the age group 2 (Table 4).

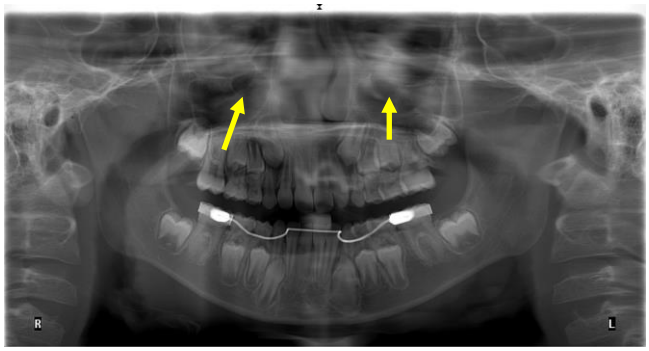

Figure 1. Panoramic radiograph showing bilateral unilocular ovoid shape Haller's cells (arrows).

Age groups	Shape of Haller's cells					
	Round	Ovoid	Teardrop	Irregular	Multiple	Total
5-13 years (group 1)	5	11	3	3	10	32
14-23 years (group 2)	29	85	24	22	78	238
24-33 years (group 3)	10	11	7	2	8	38
34-43 years (group 4)	2	6	2	0	1	11
44-53 years (group 5)	1	5	0	0	2	8
54-63 years (group 6)	1	9	4	2	3	19
≥ 64 years (group 7)	4	5	1	4	2	16
Total	52	132	41	33	104	362

Multiple = more than one shape

Table 4. Correlation between age and shape of Haller's cells.

Gender	Pattern of Haller's cells		Total
	Unilocular	Multilocular	
Male	89	17	106
Female	211	45	256
Total	300	62	362

Table 5. Correlation between gender and pattern of Haller's cells. $p = 0.675$

Pattern of Haller's cells	Side			
	Right	Left	Bilateral	Total
Unilocular	49	42	209	300
Multilocular	4	5	53	62
Total	53	47	262	362

Table 6. Correlation between pattern of Haller's cells and side. $P = 0.002$

Shape of Haller's cells	Side			
	Right	Left	Bilateral	Total
Round	13	15	24	52
Ovoid	24	24	84	132
Teardrop	10	4	27	41
Irregular	7	4	22	33
Multiple (more than one shape)	0	0	104	104
Total	54	47	261	362

Table 7. Correlation between shape of Haller's cells and side. $P < 0.001$

Regarding the pattern of Haller's cells, unilocular pattern was found in 300 (82.87%), multilocular pattern was found in 62 (17.13%). There was no correlation between gender and pattern of Haller's cells ($p = 0.675$, Table 5). The relationship between pattern of Haller's cells and side was found to be significant ($p = 0.002$, Table 6). Among 362 patients with Haller's cells, 262 (72.38%) were found bilaterally in which 209 were unilocular pattern and 53 were multilocular pattern.

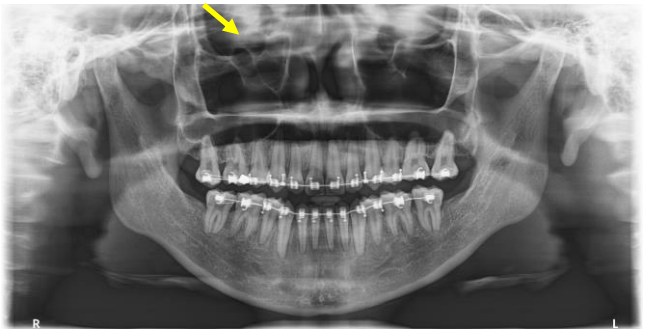

Figure 2. Panoramic radiograph showing multilocular pattern of Haller's cells on right side (arrow).

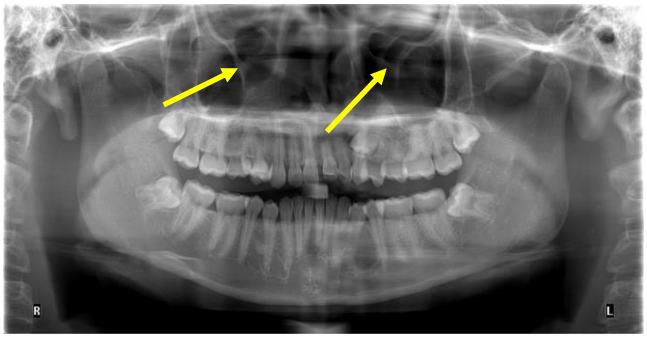

Figure 3. Panoramic radiograph showing irregular shape of Haller's cells on left side and round shape on right side (arrows).

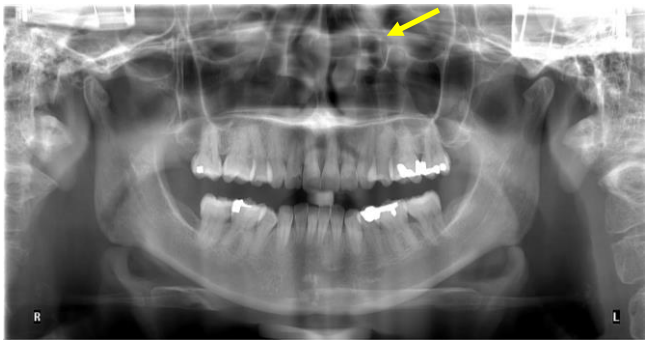

Figure 4. Panoramic radiograph showing multiple (more than one shape) Haller's cells on left side (arrow).

In addition, a significant relationship was also observed when the shape and side of the Haller's cells were correlated, $p < 0.001$ (Table 7). Figures 2-4 showed the examples of the Haller's cells on panoramic radiographs.

Discussion

The present study was performed to evaluate the prevalence of infraorbital ethmoid (Haller's) cells on panoramic radiograph in a group of Thai patients. The prevalence of Haller's cells was reported to be 10-38.2%.[1, 8-11] In our study, panoramic radiographs showed the prevalence of Haller's cells as high as 72.4% (362 out of 500 cases), which was higher than the previous ones. The possible reasons for this difference may be variation in population, sample size and observation bias. We found higher prevalence of Haller's cells in females (male: female ratio = 1: 2.55), which was similar to the previous reports.[1,8,10,11] However, Raina et al.[2] reported more prevalence Haller's cells in male. The maximum number of the sample with Haller's cells were found in the age group of 14-23 years (group 2), followed by those from 24-33 years (group 3). The frequency of Haller's cells seems to be decreased further with increasing age. Our findings were in accordance with Chaudhri et al.[8], Solanki et al.[10], and Prem Kumar et al.[11], who reported the highest prevalence of the cells in the age group of 19-28 years, 18-28 years, and 20-30 years, respectively. In addition, these authors also found that the cells decreased further with increasing age group. In the present study, we analyzed the variations of Haller's cells with respect to shape, pattern, and side. It was seen that among 362 cases with Haller's cells, 26.4% (132) were ovoid, followed by multiple shape (more than one shape, 20.8%). Our study results were in agreement with the study performed by Raina et al.[2], Chaudhri et al.[8], and Solanki et al.[10]. However, Prem Kumar et al.[11] found that the most common found shape of the cells in their study was tear shape.

Nedunchezhian et al.[12], who study the prevalence and characteristics of Haller's cells on digital panoramic radiographs, reported that the majority of cells were circular. The differences in the prevalence may be due to factors such as the definition of the cells shape, the methods of imaging, and the experience of the observers.

The Chi-square test was used to analyze the correlation between age group and shape of Haller's cells. There was no relationship between these two parameters. Out of 362 cases, 300 (82.87%) had unilocular pattern, and similar finding was found in the study conducted by Solanki et al.[10], Ghaffari et al.[13], and Khan et al.[14] Most of the cells in our study were bilateral (262 out of 362). Similar finding was seen in study performed by Chaudhri et al.[8]. However, Solanki et al.[10] and Prem Kumar et al.[11] reported the higher prevalence of unilateral side of Haller's cells We correlated the pattern of Haller's cells and side. There was significant relationship between the pattern and side of Haller's cells ($p = 0.002$), which was not in accordance with the previous studies.[6,8] Additionally, significant relationship was observed when the shape and side of the cells were correlated ($p < 0.001$), which was consistent with the findings from Chaudhri et al.[8] and Solanki et al.[10]

To our knowledges, this is the first study of the prevalence of Haller's cells in Thai population. We carefully examined the prevalence of Haller's cells with respect to age, gender, shape, pattern, and side. It has been noted that Haller's cells can be detected on panoramic radiograph. The results of our study can be used in differential diagnosis of unexplained orofacial pain, which could be affected by many of related maxillofacial structures.[15-17] Diagnosis of Haller's cells can provide preoperative information for the surgeon to prevent complications caused by entering these areas.

Conclusions

It may be concluded that panoramic radiograph can be an appropriate imaging modality for evaluation of the presence of Haller's cells. The genetic and racial factors, radiographic techniques, and the age range of patients are some of the reasons for the differences in the results. Further studies with higher number of cases, the various condition such as in edentulous patients, or with more advanced imaging modalities needed to be performed to confirm our findings and provide more precise description of Haller's cells.

Declaration of Interest

The authors have no conflicts of interest regarding the present study.

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