RESEARCH

Infraorbital ethmoid (Haller's) cells: a panoramic radiographic study

A Raina, MV Guledud* and K Patil

Department of Oral Medicine and Radiology, JSS Dental College and Hospital, SS Nagar, Mysore, Karnataka, India

Objective: Haller's cells or infraorbital ethmoid cells refer to the ethmoidal pneumatization of the superior aspect of the maxillary sinus and floor of the orbit. The clinical importance of these entities initiated this study with an aim to determine the prevalence and characteristics of Haller's cells on panoramic radiographs.

Methods: The study group comprised 600 healthy adults of both genders with an age range of 18–60 years. One panoramic radiograph for each of the patients was made and interpreted for the presence of Haller's cells. The data collected were subjected to statistical analysis: frequencies/percentages, descriptive statistics, χ^2 test and cross-tabulation (contingency table analysis) to obtain the results.

Results: Haller's cells were noted in 96 patients, accounting for a prevalence of 16%. Of these patients, 77.1% were unilateral while 22.9% were bilateral. Among 96 cases, a total of 204 cells were found. The majority of the cells were round or ovoid in shape. The unilocular type of Haller's cells occurring unilaterally was statistically significant.

Conclusion: This study has attempted to explore the characteristics of Haller's cells on panoramic radiographs. A description of Haller's cells on these radiographs may prove vital in enumerating the differential diagnosis for patients afflicted with intractable orofacial pain and reduce the risk of untoward intraoperative complications during endonasal procedures. *Dentomaxillofacial Radiology* (2012) **41**, 305–308. doi: 10.1259/dmfr/22999207

Keywords: Haller's cells; infraorbital ethmoid air cells; orofacial pain; panoramic radiographs

Introduction

Haller's cells are defined as air cells situated beneath the ethmoid bulla along the roof of the maxillary sinus and the most inferior portion of the lamina papyracea, including air cells located within the ethmoid infundibulum.¹ Haller's cells, first described by the Swiss anatomist Albert von Haller in 1765, are also known as maxillo-ethmoidal or orbito-ethmoidal cells.^{2,3} Haller's cells are thought to arise in individuals with pneumatization of the lateral crus.⁴

Although Haller's cells are anatomical variations in the development of the nose and paranasal sinuses, they have been held responsible for patient's symptoms and are thus clinically significant.^{1,2} In addition to distressing orofacial pain and sinusitis, numerous pathologies

and symptoms associated with this entity include nasal obstruction, impaired nasal breathing, headache, chronic cough and mucocoeles.^{2,3,5–8} Haller's cells can also restrict access to the maxillary sinus or the anterior ethmoidal cells during endonasal procedures, making it imperative for the surgeon to be aware of such variations that may incline the patient to increased risk of intraoperative complications.^{4,5}

Infraorbital ethmoid cells have been described 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 infra-orbital foramen according to a solitary panoramic radiographic study.² The clinical significance of these entities and the lack of noteworthy research initiated this study with an aim to determine the prevalence and scrutinize the characteristics of Haller's cells on panoramic radiographs.

*Correspondence to: Dr Mahima Veeranna Guledud, Department of Oral Medicine and Radiology, JSS Dental College and Hospital, SS Nagar, Mysore, 570 015 Karnataka, India. E-mail: mahimamds@rediffmail.com
Received 12 November 2010; revised 10 March 2011; accepted 22 March 2011

Table 1 Prevalence of Haller's cells

Absent	504	84.0%
Present	96	16.0%
Total	600	100%

$\chi^2 = 277.4$, degree of freedom = 2, $p = 0.00$ (< 0.05).

Materials and methods

The study group comprised 600 healthy adults of both genders with an age range of 18–60 years who were selected by simple random sampling. 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 institutional ethical clearance was obtained prior to the conduct of the study. Following clinical examination, one panoramic radiograph (Rotograph 230 eur, FIAD SpA—20094, Trezzano S/Naviglio, Villa, Italy) for each of the patients was made. Films (Eastman Kodak, Rochester, NY) were processed in an automatic processor (Promax 5 Speed No. 04431030, Chayagraphics, Bangalore, India) that was preset to the manufacturer's specifications regarding the processing cycle. The radiographs obtained were serially interpreted for the presence of Haller's cells under ideal viewing conditions. The recognition of Haller's cells was made if an anatomical variation fulfilled the criteria suggested by Ahmad *et al.*² The observations pertaining to the Haller's cells were entered in the subjects' proformas. The data collected were tabulated and subjected to statistical analysis, namely frequencies/percentages, descriptive statistics, χ^2 test and cross-tabulation (contingency table analysis) using SPSS for Windows (SPSS Inc., Chicago, IL) to obtain the results.

Results

The total sample size of the study was 600, consisting of 383 males and 217 females.

Of the 600 patients, Haller's cells were found in 96. The overall prevalence of Haller's cells was 16%

Table 2 Distribution of Haller's cells with respect to age (number of patients)

18–30 years (347)	17.9%
31–45 years (197)	14.7%
46–60 years (56)	8.9%

Contingency coefficient value 0.073, $p = 0.200$ (> 0.05).

Table 3 Distribution of Haller's cells with respect to gender (number of patients)

Male (383)	14.9%
Female (217)	18.0%

Contingency coefficient value 0.040, $p = 0.320$ (> 0.05).

Figure 1 Cropped panoramic radiograph showing unilateral (right) unilocular Haller's cell

(Table 1). The overall mean age of subjects with Haller's cells was 29.12 years. The overall mean age of male and female patients with Haller's cells was 27.92 years and 30.87 years, respectively. Of the 96 patients with Haller's cells, 62 (17.9%) were patients aged 18–30 years, 29 (14.7%) were patients aged 31–45 years and 5 (8.9%) were patients aged 46–60 years (Table 2). Among the 96 patients with Haller's cells, 57 (14.9%) were male and 39 (18%) were female (Table 3).

Among the 96 patients with Haller's cells, the cells occurred unilaterally in 74 (77.1%) (Figure 1) and bilaterally in 22 (22.9%) (Figure 2). Among the 74 patients with unilateral Haller's cells, the cells in 32 (43.2%) were

Figure 2 Cropped panoramic radiograph showing bilateral unilocular (one right, one left) Haller's cells

Figure 3 Cropped panoramic radiograph showing unilateral (left) unilocular Haller's cell

localized on the right side and the cells in 42 (56.7%) were localized on the left side.

Among the 96 patients with Haller's cells, in 74 the cells were unilateral unilocular (77%) (Figure 3), in 18 (18.8%) they were bilateral unilocular (Figure 4) and in 4 (4.2%) they were of a bilateral mixed pattern, *i.e.* both unilocular and multilocular patterns were noted on the right and left side (Table 4, Figure 5).

Figure 4 Cropped panoramic radiograph showing bilateral unilocular (one right, three left) Haller's cells

Table 4 Distribution of Haller's cells with respect to type

Unilocular (unilateral)	74 (77%)
Unilocular (bilateral)	18 (18.8 %)
Unilocular and multilocular (mixed pattern: bilateral)	4 (4.2 %)

Among the 96 patients with Haller's cells, a total of 204 cells were found. Of these, 200 were unilocular while 4 were multilocular.

94 of the Haller's cells (97.91%) were round or ovoid in shape with only 2 cases depicting a teardrop shape.

The inter-relationships among age, gender and side were not found to be significant. Unilocular Haller's cells occurring unilaterally were statistically significant.

Discussion

A wide range of prevalence (4.7–45.1%) of infra-orbital ethmoid cells using CT images has been reported in the literature.^{1,2,5,7,9–13} Although this study examined panoramic radiographs, the prevalence (16%) falls within the range of these previous studies. A much higher prevalence of 38.2% has been cited according to the sole panoramic radiographic study on Haller's cells conducted by Ahmad *et al* in 2006.² This disparity could have resulted from variations in the populations studied, sample sizes and the subjective judgment pertaining to the presence or absence of Haller's cells.

Figure 5 Cropped panoramic radiograph showing mixed pattern of Haller's cells (right: multilocular, left: unilocular)

Among the 96 cases of Haller's cells, 62 (64.6%) were found in patients aged 18–30 years. Results indicated a male-to-female ratio of 1.46:1 for the presence of Haller's cells. The distribution of Haller's cells with respect to gender was not statistically significant. This is consistent with the results of a CT imaging study on Haller's cells by Basic et al,¹ who reported no difference in prevalence of Haller's cells between males and females.

Unilateral occurrence of Haller's cells was found to be statistically significant. This is in harmony with the previous studies where Haller's cells were seen in a larger number of cases unilaterally than bilaterally.^{2,5,9,11} The presence of bilateral Haller's cells varies from 26% to 50%.⁹ According to our study, 22.9% of the cells were present bilaterally. Study population, cell definition and scanning technique probably account for this variation.

No statistically significant differences were noted in the occurrence of Haller's cells on the right and left side. In the study by Ahmad et al,² an almost equal distribution of Haller's cells was found on the right (48) and left sides (50). In the panoramic study conducted by Ahmad et al, both unilateral and bilateral Haller's cells were combined while estimating side distribution; therefore, a comparison with our study cannot be made.

References

1. Basic N, Basic V, Jukic T, Basic M, Jelic M, Hat J. Computed tomographic imaging to determine the frequency of anatomical variations in pneumatization of the ethmoid bone. *Eur Arch Otorhinolaryngol* 1999; **256**: 69–71.
2. Ahmad M, Khurana N, Jaber J, Sampair C, Kuba RK. Prevalence of infraorbital ethmoid (Haller's cells) on panoramic radiographs. *Oral Surg Oral Med Oral Pathol Oral Radiol Oral Endod* 2006; **101**: 658–661.
3. Yanagisawa E, Marotta JC, Yanagisawa K. Endoscopic view of a mucocoele in an infraorbital ethmoid cell (Haller cell). *Ear Nose Throat J* 2001; **80**: 364–368.
4. Lang J. *Clinical anatomy of nose, nasal cavity and paranasal sinuses: a basis for diagnosis and surgery*. New York, NY: Thieme; 1989.
5. Kantarci M, Karasen RM, Alper F, Onbas O, Okur A, Karaman A. Remarkable anatomic variations in paranasal sinus region and their clinical importance. *Eur J Radiol* 2004; **50**: 296–302.
6. Braun H, Stammberger H. Pneumatization of turbinates. *Laryngoscope* 2003; **113**: 668–672.
7. Tatli MM, San I, Karaoglanoglu M. Paranasal sinus computed tomographic findings of children with chronic cough. *Int J Pediatr Otorhinolaryngol* 2001; **60**: 213–217.
8. Holinger LD, Sanders AD. Chronic cough in infants and children: an update. *Laryngoscope* 1991; **101**: 596–605.
9. Wanamaker HH. Role of Haller's cell in headache and sinus disease: a case report. *Otolaryngol Head Neck Surg* 1996; **114**: 324–327.
10. Bolger WE, Butzin CA, Parsons DS. Paranasal sinus bony anatomic variations and mucosal abnormalities: CT analysis for endoscopic sinus surgery. *Laryngoscope* 1991; **101**: 56–64.
11. Milczuk HA, Dalley RW, Wessbacher FW, Richardson MA. Nasal and paranasal sinus anomalies in children with chronic sinusitis. *Laryngoscope* 1993; **103**: 247–252.
12. Nouraei SA, Elisay AR, Dimarco A, Abdi R, Majidi H, Madani SA, et al. Variations in paranasal sinus anatomy: implications for the pathophysiology of chronic rhinosinusitis and safety of endoscopic sinus surgery. *J Otolaryngol Head Neck Surg* 2009; **38**: 32–37.
13. Mazza D, Bontempi E, Guerrisi A, Del Monte S, Cipolla G, Perrone A, et al. Paranasal sinuses anatomic variants: 64-slice CT evaluation. *Minerva Stomatol* 2007; **56**: 311–318.