Original Article

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Morphometric Evaluation of Haller Cells on Cone Beam Computed Tomography: An Anthropometric Study

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Abstract

Objective: The aim of present study was to assess the age and sex related changes in Haller cells height and width.This study also help in prediction of age of an individual if Haller cell height / width is known. *Material and Methods:* The study population consists of 152 study subjects with age range from 7 to 74 years. The CBCT images of 152 study subjects were analysed prospectively. All the CBCT images are obtained at 90 Kvp,4 mA for 11.3 seconds at FOV(17"x13.5") voxel size of 300. The height and width of haller cell is measured by using Trophy Dicom Ink software programme on coronal images (DICOM images). *Results:* There was no statistically significant (P>0.05) co-relation between Haller cells height and width (right side) and age groups noted. The mean Haller cell height in right side was statistically significant (P<.05) in male and female. It was higher in females than males. Haller cell width in left side is directly associated with age of females and demonstrated a significant positive relation. *Conclusion:* The morphometric evaluation of haller cells can be used for age and sex determination in medico-legal cases, evidence lacking incidents etc.

Keywords: Haller Cells; Maxillary Sinus; Cone Beam CT.

Introduction

Haller's cells are described 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 are thought to arise in individuals with pneumatization of the lateral crus.Swiss anatomist Albert von Haller [2] described the Haller cells in 1765, are also known as maxilloethmoidal or orbitoethmoidal cells [3,4] as they arise from anterior ethmoid cells and are located in the medial orbital floor.With the increasing popularity of endoscopic sinus surgery and recent advances in CT technology, there has arisen interest in the complex radiological anatomy of the paranasal sinuses and ostiomeatal system. It is well documented that some of the anatomical variations of the paranasal sinuses can predispose to sinus pathology or can even complicate sinus surgery, and Haller cells are no exception [5]. These cells are frequently seen as incidental findings in CT examination of paranasal sinuses. The position of Haller cells in the medial portion of the orbital floor, lateral to the maxillary infundibulum, places them in a key position to disturb the normal pattern of mucociliary flow and predispose to recurrent maxillary sinusitis [6,7,8]. Several radiographic studies have shown a significant relationship between Haller cells' size (greater than 3 mm) and maxillary sinusitis [9,10].

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Materials and Methods

This study was an observational study in which Head and PNS CBCT images of 152 subjects (104 males and 48 females) in the age group of 7 yrs to 74 years were chosen. The CBCT images of subjects having no history of trauma, pathology diagnosed as normal have been included in study. Any CBCT with obvious pathology, trauma and facial asymmetry were excluded from this study. All the patients were

examined on CS9300 carestream CBCT machine. The coronal images were obtained at 90 Kvp,4 mA for 11.3 seconds at FOV (17"x13.5")voxel size of 300. The measurement of haller's cell dimensions were done directly on DICOM images using Trophy Dicom Ink software programme. The greatest measurement was taken after going through different slices in coronal sections of CBCT images. The measurements are done as follows-

1. The Haller's cell length was measured on coronal reconstructed image and was defined as the longest distance superio-inferiorly from the uppermost point to the lowest point of haller cells (Figure 1).
2. The Haller's cells width was measured on coronal reconstructed image and was defined as the longest distance mesiodistally (Figure 2).

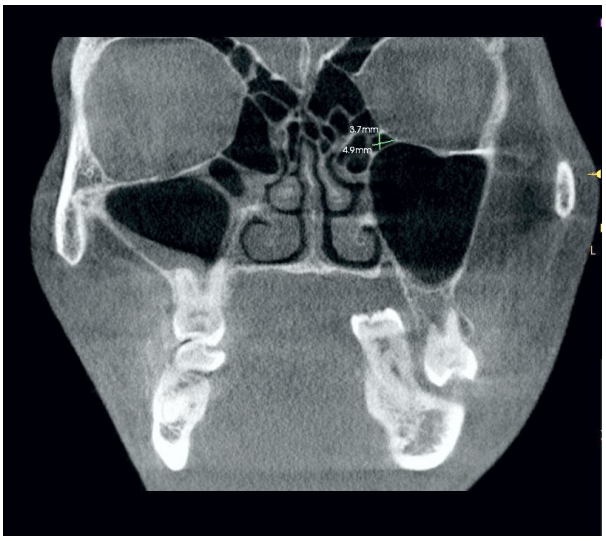


Fig. 1

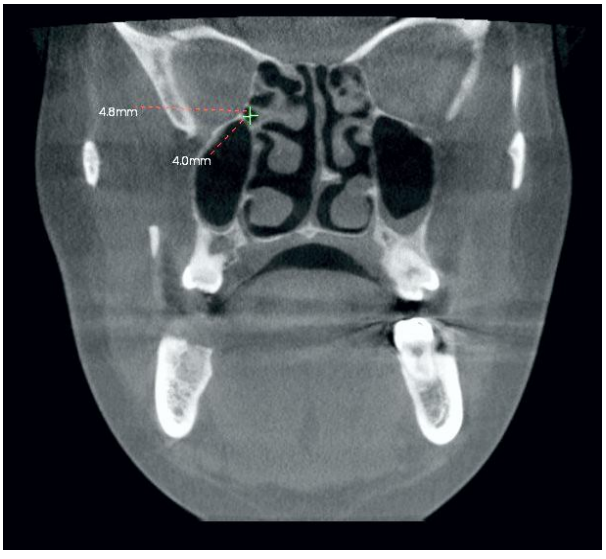


Fig. 2

Statistical Analysis

Categorical variables is presented in number and percentage (%) and continuous variables will be presented as mean and SD. Quantitative variables is compared using Unpaired t-test between two groups and ANOVA test between three groups. Pearson correlation coefficient is used to determine the relationship between two scale parameters while correlation was defined as a measure of the strength of a linear relationship between two variables. A p value of <0.05 is considered statistically significant. The data will be entered in MS Excel spreadsheet and analysis is done using Statistical Package for Social Sciences (SPSS) version 21.0.

Results

The study population consists of 152 study subjects with age range from 7 to 74 years with a mean age of 31.21±15.48 years (Table 1). The study subjects were divided in 5 age groups.Majority of the study subject were between 18 to 35 years of age(48%) followed by below 18 years (21.7%), 36 to 50 years (17.8%), 51 to 65 years (8.6%) and above 65 years (3.9%) (Table 2). The sex ratio in our study population showed that male subjects (68.4 %)proportion was higher than female (31.6%) (Table 3). The association between age groups and Haller cell height (Right side) was evaluated by applying one way ANOVA. There was no statistically significant (P>0.05) co-relation between haller cells height and width (right side) and age groups noted. The mean haller cell height (6.9) and width (6.8) was highest in age group > 65 years than other age groups (Table 4). The Haller cell height in left side was statistically non significant (P>.05) in all age groups. However the mean Haller cell height is lowest (3.76) in age group >65 years of age while all other age groups have approximately same mean value (Table 4). The Haller cell width in left side was statistically non significant (P>.05) in all age groups. The age group 36 to 50 years have highest mean (8.83) than other age groups.

The mean Haller cell height in right side was statistically significant (P<.05) in male and female. It was higher in females than males.However the Haller cell width in right side, Haller cell length and width in left side was statistically non significant (P>.05) in males and females (Table 5). The Pearson co-relation coefficient is used to determine association between age with Haller cell height and width (Right side) and Haller cell height and width (Left side). It was found that there was no significant correlation between age with Haller cells height and width (right

side) and Haller cells height and Width(left side) (Table 6).The mathematical equations are derived from Linear regression analysis for prediction of age if,

1. Right Haller Cells Height is known- Y=35.964+(-0.295)*X (Graph 1)
2. Right Haller Cells width is know- Y=36.148+(-0.301)*X (Graph 2)
3. Left Haller Cells Height is known- Y=34.145+(-0.788)*X (Graph 3)
4. Left Haller Cells Width is known- Y=27.734+0.384*X (Graph 4)

In male population age is co-related with study parameters with help of Pearson correlation coefficient and it was found that there is no significant correlation between age and study parameters (Haller cells height and width (Right side), Haller cells height and width left side) in study population (Table 7). In female population age is co-related with study parameters with help of Pearson correlation coefficient and it was found that there is no significant correlation between age and Haller cells height and width (Right side), Haller cells height (left side) in male population. However the Haller cell width in left side is directly associated with age of females and demonstrate a significant positive relation (r=0.340, p=0.049) (Table 8).

Table 1:

	Statistic	Std. Error
Age		
Mean	31.21	1.256
95% Confidence Interval for Mean		
Lower Bound	28.73	
Upper Bound	33.69	
5% Trimmed Mean	30.25	
Median	28.50	
Variance	239.902	
Std. Deviation	15.489	
Minimum	7	
Maximum	74	
Range	67	
Interquartile Range	21	

Table 2:

Age Intervals	Frequency	Percent
Below 18 years	33	21.7
18 to 35 years	73	48.0
36 to 50 years	27	17.8
51 to 65 years	13	8.6
Above 65 years	6	3.9
Total	152	100.0

Table 3:

Sex	Frequency	Percent
Male	104	68.4
Female	48	31.6
Total	152	100.0

Table 4:

		N	Mean	Std. Deviation	95% Confidence Interval for Mean		P value
					Lower Bound	Upper Bound	
Right Haller Cells Height	Below 18 years	12	4.9167	1.34356	4.0630	5.7703	
	18 to 35 years	31	5.6839	3.36413	4.4499	6.9178	
	36 to 50 years	9	5.9444	2.03108	4.3832	7.5057	0.520
	51 to 65 years	10	4.5700	.94874	3.8913	5.2487	
	Above 65 years	4	6.9000	3.47851	1.3649	12.4351	
	Total	66	5.4848	2.66073	4.8308	6.1389	

Right Haller Cells Width	Below 18 years	12	4.9000	1.98449	3.6391	6.1609	
	18 to 35 years	31	6.7387	3.25849	5.5435	7.9339	
	36 to 50 years	9	5.9667	1.87016	4.5291	7.4042	0.118
	51 to 65 years	10	4.5200	.77717	3.9640	5.0760	
	Above 65 years	4	6.8250	4.00864	.4464	13.2036	
	Total	66	5.9682	2.77207	5.2867	6.6496	
Left Haller Cells Height	Below 18 years	23	5.0261	1.48759	4.3828	5.6694	
	18 to 35 years	49	5.4694	1.99303	4.8969	6.0419	
	36 to 50 years	18	5.4778	1.20419	4.8789	6.0766	0.447
	51 to 65 years	7	5.0286	1.77643	3.3856	6.6715	
	Above 65 years	3	3.7667	1.16762	.8661	6.6672	
	Total	100	5.2870	1.73180	4.9434	5.6306	
Left Haller Cells Width	Below 18 years	23	4.9478	1.51833	4.2912	5.6044	
	18 to 35 years	49	5.1041	1.74857	4.6018	5.6063	
	36 to 50 years	18	8.8333	13.57714	2.0816	15.5851	0.163
	51 to 65 years	7	7.4143	3.24419	4.4139	10.4147	
	Above 65 years	3	3.5667	1.19304	.6030	6.5303	
	Total	100	5.8550	6.06046	4.6525	7.0575	

Applied one way ANOVA test for significance

Table 5:

	Sex	N	Mean	Std. Deviation	P value
Right Haller Cells Height	Male	47	5.0574	1.85458	0.039*
	Female	19	6.5421	3.88820	
Right Haller Cells Width	Male	47	5.9404	2.84480	0.899
	Female	19	6.0368	2.65711	
Left Haller Cells Height	Male	66	5.3061	1.67964	0.879
	Female	34	5.2500	1.85427	
Left Haller Cells Width	Male	66	6.1955	7.29228	0.437
	Female	34	5.1941	2.18229	

Applied unpaired t test for significance. *Significant

Table 6:

		Age	Right Haller Cells Height	Right Haller Cells Width	Left Haller Cells Height	Left Haller Cells Width
Age	Pearson Correlation	1	-.044	-.047	-.092	.157
	Sig. (2-Tailed)		.723	.706	.361	.118
	N	66	66	66	100	100

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Table 7:

	Age	Right Haller Cells Height	Right Haller Cells Width	Left Haller Cells Height	Left Haller Cells Width
Pearson Correlation	1	.211	.002	-.076	.162
P value		.154	.987	.546	.192
N	104	47	47	66	66

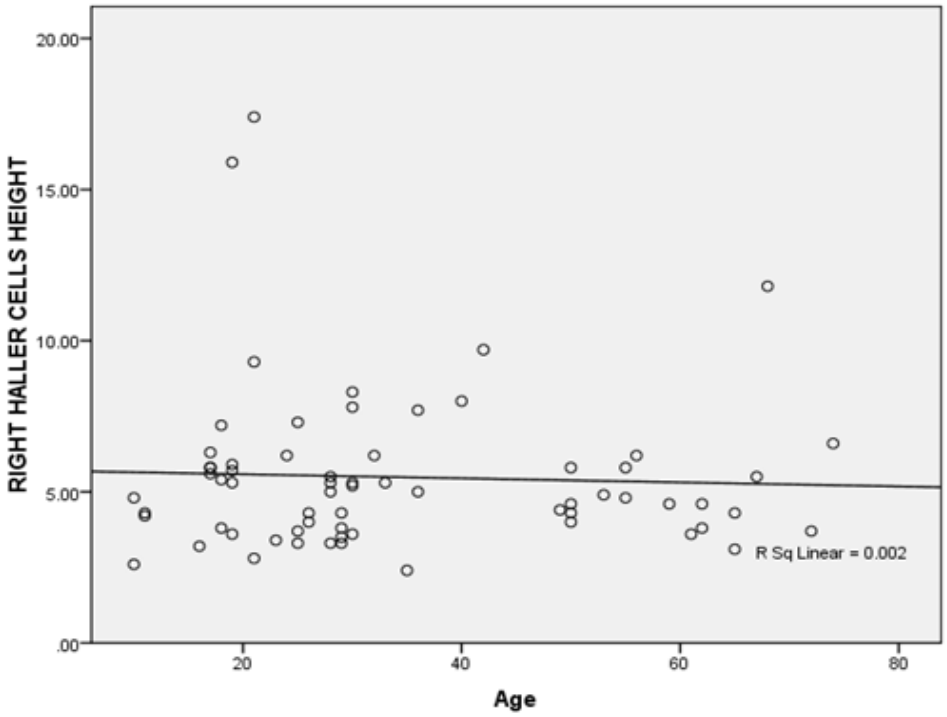
**Correlation is significant at the 0.01 level (2-tailed)
*Correlation is significant at the 0.05 level (2-tailed)

Table 8

		Age	Right Haller Cells Height	Right Haller Cells Width	Left Haller Cells Height	Left Haller Cells Width
Age	Pearson Correlation	1	-.349	-.186	-.119	.340*
	Sig. (2-tailed)		.143	.447	.504	.049
	N	48	19	19	34	34

* Correlation is significant at the 0.05 level (2-tailed).
**Correlation is significant at the 0.01 level (2-tailed).

Graph 1:



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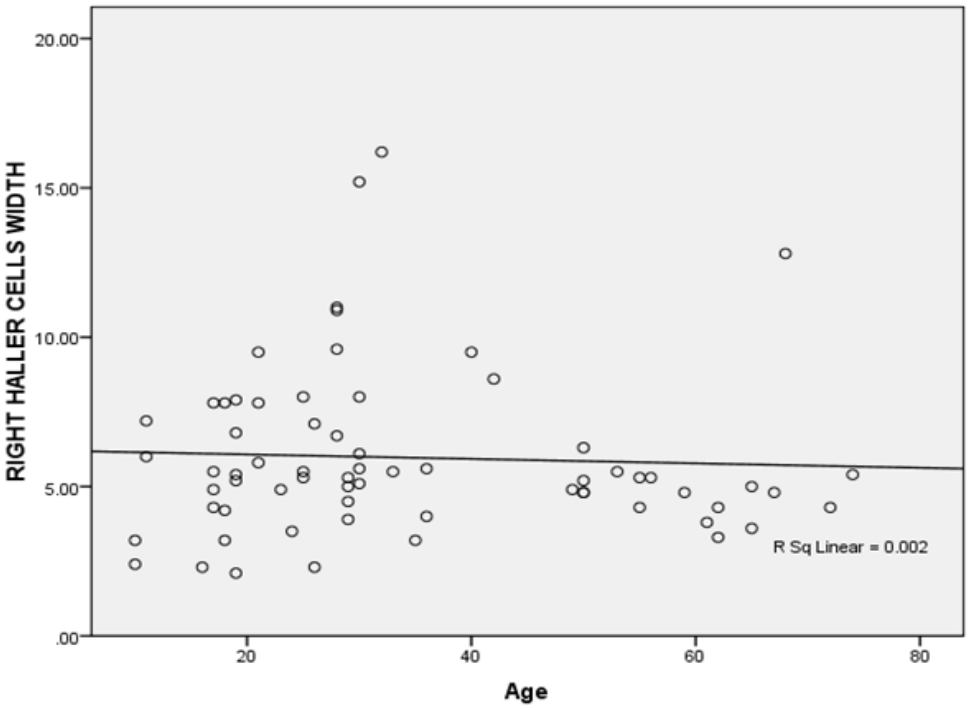

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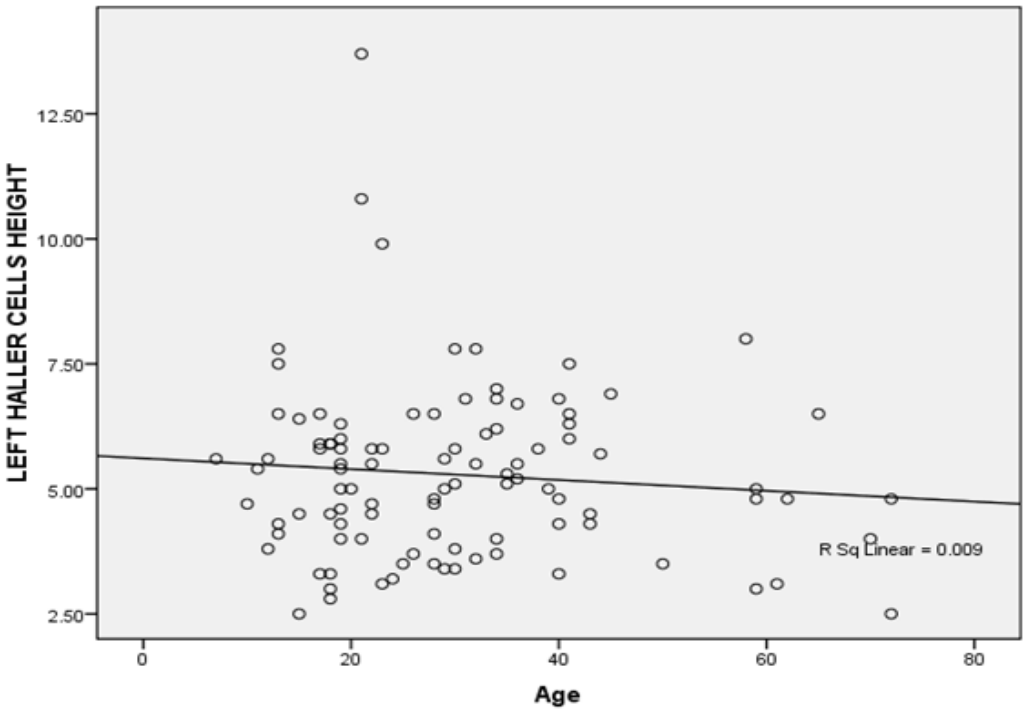
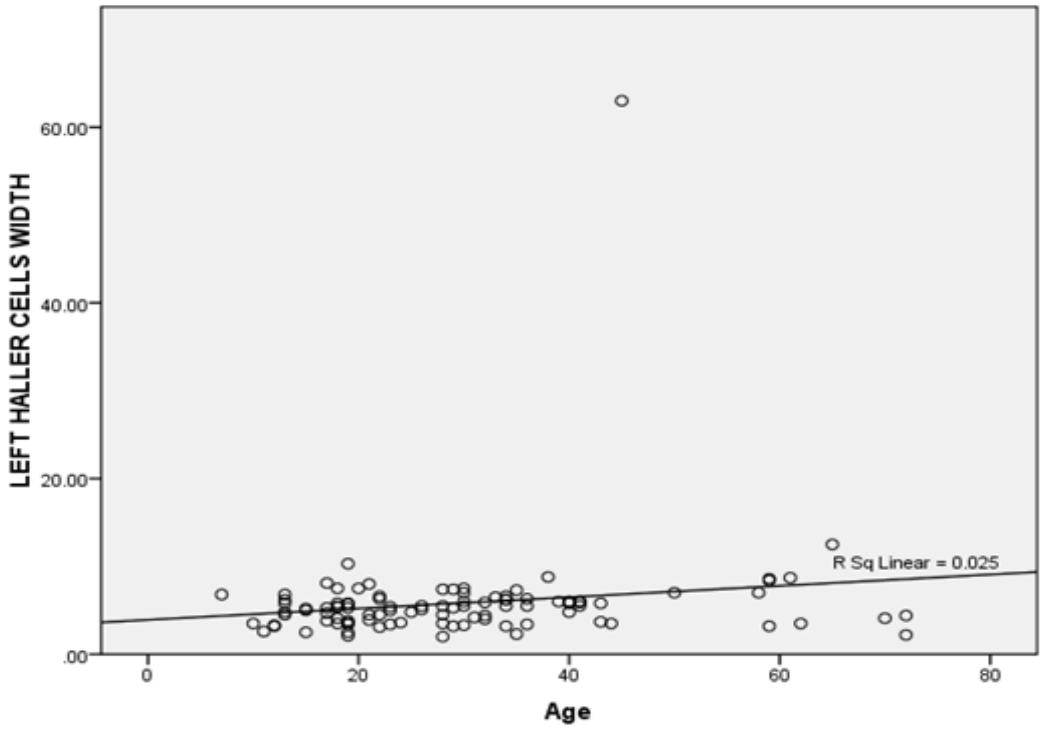


Graph 4:



Discussion

Various studies have reported the appearance of Haller's cells in their literature both in OPG and in CT imaging.The prevelance has varied hugely in various studies ranging from 4.7-45.1% [11,12,13]. Solanki J t al[14] stated that maximum number of cells was seen in the age range of 18-28 years. These findings are consistent with the study done by M Kantarci et al [15]. They found that there was no significant difference among prevelance of Haller's cells between males and females which was also supported with the findings of N Basic et al [16]. He also found that unilateral occurrence of Haller's cells was statistically significant. The unilateral occurrence

of the cells was found to be 74%. No statistically significant differences were noted in the occurrence of Haller's cells on the right and left side which were 69 and 73 cells respectively. Raina A et al [17] stated that 62 (64.6%) haller cells were found in patients aged 18–30 years with a male to female ratio of 1.46:1 for the presence of Haller's cells. They also found that the distribution of Haller's cells with respect to gender was not statistically significant.Kainz et al [18] defined the Haller cells as ethmoid cells developing within the orbital floor or maxillary sinus and found them in 43 of 528 cases (8±1%). They were more frequent in women than in men (2: 1). Whereas in our study we emphasize on prevalence as well as haller cells dimensions and its role in determination of gender.This is only our study which focuses on dimensions of Haller's Cells till date.We found that there was no statistically significant (P>0.05) co-relation between haller cells height and width (right side) and age groups noted. The mean haller cell height (6.9) and width (6.8) was highest in age group > 65 years than other age groups. The Haller cell height in left side was statistically non significant (P>.05) in all age groups. However the mean Haller cell height is lowest (3.76) in age group >65 years of age while all other age groups have approximately same mean value.The Haller cell width in left side was statistically non significant (P>.05) in all age groups.The age group 36 to 50 years have highest mean (8.83) than other age groups.

The mean Haller cell height in right side was statistically significant (P<.05) in male and female. It was higher in females than males. However the Haller cell width in right side Haller cell length and width in left side was statistically non significant (P>.05) in males and females. It was found that there was no significant correlation between age with Haller cells height and width (right side) and Haller cells height and Width(left side). In male population also there was no significant correlation between age and study parameters (Haller cells height and width (Right side), Haller cells height and width left side) in study population whereas in female population it was found that there is no significant correlation between age and Haller cells height and width (Right side), Haller cells height (left side) in male population. However the Haller cell width in left side is directly associated with age of females and demonstrate a significant positive relation (r=0.340, p=0.049).We also derived the mathematical equations are derived from Linear regression analysis for prediction of age if,

Right Haller Cells Height is known-

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Right Haller Cells width is known-

Y=36.148+ (-0.301)*X

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. Lang J. Clinical anatomy of nose, nasal cavity and paranasal sinuses: a basis for diagnosis and surgery. New York, NY: Thieme 1989.
3. Ahmad M, Khurana N, Jaberi 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 May; 101 (5):658–61. Epub 2006 Feb 28.
4. Yanagisawa E, Marotta JC, Yanagisawa K. Endoscopic view of a mucocele in an infraorbital ethmoid cell (Haller cell). Ear Nose Throat J 2001; 80:364–368.
5. Mathew, R., Omami, G., Hand, A., Fellows, D., & Lurie, A. Cone beam CT analysis of Haller cells: Prevalence and clinical significance. Dentomaxillo-facial Radiology, 2013; 42(9).
6. Stammberger H, Wolf G. Headaches and sinus disease: the endoscopic approach. Ann Otol Rhinol Laryngol 1988; 97:3–23.
7. Stackpole SA, Edelstein DR. The anatomic relevance of the Haller cell in sinusitis. Am J Rhinol 1997; 11: 219–223.
8. Kantarci M, Karasen RM, Alper F, Onbas O, Okur A, Karaman A. Remarkable anatomic variation in paranasal sinus region and their clinical importance. Eur J Radiol 2004; 50:296–302.
9. 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.
10. Kainz J, Braun H, Genser P. Haller's cells: morphologic evaluation and clinicosurgical relevance.Laryngorhinootologie 1993; 72:599–604.
11. Ahmed M, khurana N, Jaberi J, Sampair C, Kuba KR. Prevalence of infraorbital ethmoid (Haller's) cells on panoramic radiographs. Oral Surgery Oral Medicine Oral Pathology Oral Radiology and Endodontology. 2006; 101(1):658–61.
12. 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.
13. Wanamaker HH. Role of Haller's cell in headache and sinus disease: a case report. Otolaryngol Head Neck Surg. 1996; 114:324–27.

14. Solanki, J., Gupta, S., Patil, N., Kulkarni, V. V, Singh, M., & Laller, S. Prevelance of Haller's Cells: A Panoramic Radiographic Study. Journal of Clinical and Diagnostic Research: JCDR, 2014; 8(9).

15. 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.

16. 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.

17. Raina, A., Guledgud, M. V., & Patil K. Infraorbital ethmoid (Haller's) cells: A panoramic radiographic study. Dentomaxillofacial Radiology, 2012; 41(4): 305–308.

18. Kainz J, Braun H, Genser P. Haller's cells: morphologic evaluation and clinico-surgical relevance. Laryngology,Rhinology and Otology 1993; 72:599-604.