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Haller Cells and Accessory Maxillary Ostium: Prevalence and Association with Maxillary Sinusitis- A Retrospective CBCT Study

(Prevalence of Haller cells and AMO in CBCT and correlation with maxillary sinusitis)

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KEYWORDS

Haller cells, Cone beam computed tomography, Accessory maxillary ostium, Maxillary sinus, Sinusitis

ABSTRACT:

Background: To assess the frequency of Haller cells and accessory maxillary ostium (AMO) in cone-beam computed tomography (CBCT) images and to analyze the correlations among Haller cells, AMO, and maxillary sinusitis.

Materials and Methods: Volumetric CBCT scans from 400 patients were examined to assess the association of AMO and Haller cells with maxillary sinusitis. The CBCT images were assessed by two radiologists with experience of minimum 10years individually at different times.

Results: Of 1600 patient CBCT scans, Haller cells were recognized in 1184(74%), present exclusively on the right side in 240(20.27%) patients, left side in 208(17.56%) and bilaterally in 736(62.16%) patients. Maxillary sinusitis was noted in 560(35%) of the total sample of patients.

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AMO was observed in 896(56%) patients, present exclusively on the right side in 128(14.28%), 176(19.64%) only on the left side, and 592(66.07%) in bilaterally. The chi-square test showed a significant association between AMO and maxillary sinusitis in the presence of Haller cells.

Conclusion: Present study showed AMO and Haller cells are significantly associated with maxillary sinusitis. This study showed that CBCT can be useful for sinus endoscopic surgeons during the surgeries in maxillary sinus region.

INTRODUCTION

Largest of the paranasal sinuses, the maxillary sinus empties into the nasal cavity's middle meatus. Opening into the Hiatus semilunaris, the Accessory maxillary sinus ostium (AMO) is found at the superior section of the maxillary sinus. As a result, the main cause of ostial blockage the mucociliary activity of the lining mucosa was rather helpful for drainage than gravity. So, maxillary sinusitis is common among people.[1]

From its lining, adjoining paranasal sinuses, nasal cavity, dental and oral tissues, or nearby bone with subsequent expansion into the sinus, a range of clinical diseases can impact the maxillary sinus.[2] Otolaryngologists & Radiologists choose functional endoscopic sinus surgery more and more because sinusitis is so common and the paranasal sinus region it involves has complex radiographic anatomy. Three-dimensional imaging technologies help otolaryngologists and radiologists to better understand the complex and varied osseous structures than with traditional radiography. With Haller cells being a clear example, it is well known that particular structural variations of the paranasal sinuses could predispose individuals to sinus pathology or complicated sinus surgery. Found on the medial orbital floor, haller cells also known as infraorbital ethmoid cells—originate from the anterior ethmoid cells.

Although their location is thought to greatly influence sinusitis propensity, haller cells are incidental observations. Whether the accessory maxillary osmium (AMO) is acquired or an inherent anatomical variation is yet unknown. Genc et al. investigated the development of accessory ostium and confirmed that accessory maxillary ostium developed following sinusitis generated experimentally.[6] Those with a history of maxillary sinusitis or infundibular obstruction have a higher frequency of AMO, suggesting that AMO results from maxillary sinusitis. [7-9]

CBCT provides comparable high-contrast resolution but reduced low-contrast resolution in the framework of sinus scanning techniques as compared to multi-detector CT scanners (MDCT). [10] CBCT and other imaging technologies improve visibility of these deviations, therefore enabling diagnostic and surgical operations.[11] This work sought to assess the frequency of Haller cells and accessory maxillary ostia in CBCT images and investigate their relationship with maxillary sinusitis.

MATERIALS AND METHODS

This is a retrospective study compromising 400 CBCT scans of local population, who were referred to a CBCT center in oral medicine and radiology department in Kamineni institute of dental sciences. CBCT scans were taken and analyzed with CS9000 3D Carestream CBCT machine. CBCT scans with partially reconstructed

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images and artifacts compromising the diagnostic quality of the scans were excluded.

Principles used to identify Haller cells and AMO are based on criteria used by Ali IK et al. Haller cells are air cells of any size located medial to the infraorbital foramen on the orbital floor and roof of maxillary sinus, above the maxillary sinus ostium and within the ethmoid infundibulum. Maxillary sinusitis was defined as radiographic mucosal thickening and/or fluid accumulation at any level. AMO was considered to be any opening other than the primary ostium located below the uncinated process and above the inferior turbinates along the medial wall of the maxillary sinus.[12] [Figure1]

All CBCT images were transferred to another computer and CBCT images were assessed. The CBCT images were analyzed by two separate radiologists with experience of minimum 10years individually at different times. The observers were requested to assess the presence of Haller cells, AMO, and maxillary sinusitis. When disagreements occurred, the observers assessed the CBCT images together until a consensus was reached.

FIGURE 1:

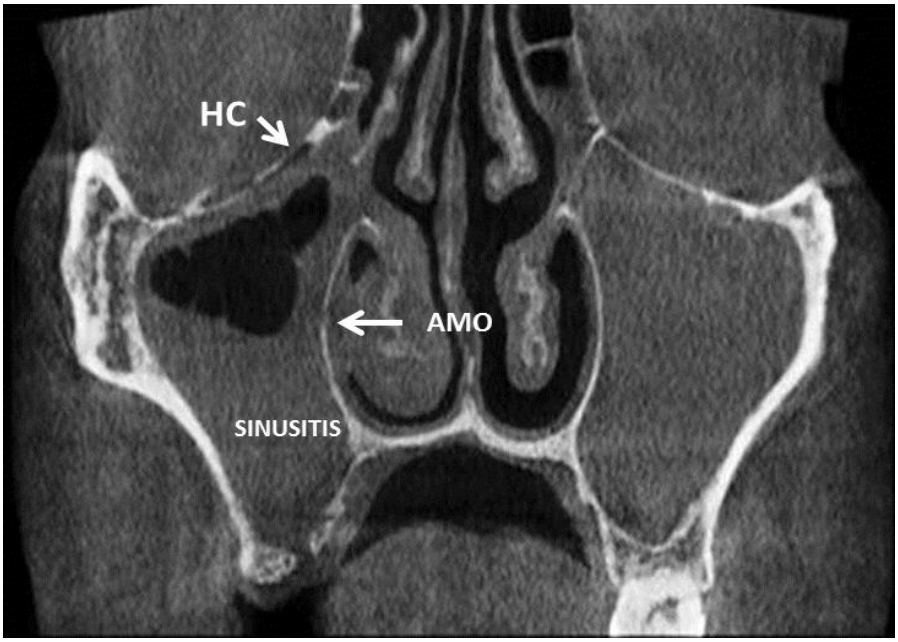

Figure 1: Coronal CBCT section showing Haller cell (HC), Accessory maxillary ostium (AMO) and sinusitis

RESULTS

Of 1600 patients, 952 were males and 648 were females with a mean age of 38 years. Haller cells were recognized in 1184(74%). They are present exclusively on the right side in 240(20.27%) patients, only on the left side in 208(17.56%) patients, and bilaterally in 736(62.16%) patients [Table 1]. Of the patients with Haller cells, 512(43.24%) demonstrated maxillary sinusitis. The chi-square test demonstrated a significant association between the presence of Haller cells and maxillary sinusitis (P value 0) [Table 2]. Maxillary sinusitis was noted in 560(35%) of the total sample of patients.

AMO was observed in 896(56%) patients. AMO was present exclusively on the right side in 128(14.28%),

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176(19.64%) only on the left side, and 592(66.07%) in bilaterally [Table1]. Of these patients, 112(50%) had both AMO and maxillary sinusitis. The chi-square test demonstrated a significant association between the presence of AMO and maxillary sinusitis (P value 0) [Table 3]. The chi-square test showed a significant association between AMO and maxillary sinusitis in the presence of Haller cells (P value 0) [Table 4].

DISCUSSION:

In 56% of patients, the current study found AMO; this revealed a statistically significant relationship between AMO and maxillary sinusitis. Previous research has shown that each person's AMO frequency falls between 0% to 43%. [13, 14] Out of 1,242 maxillary sinuses, 307 showed AMO (24.7%) according to Ozcan et al. [15] With AMO found in 72 patients 19.1% of their sample Yenuigun et al. In those with AMO, the disorder was noted bilaterally in 8.2%, on the left side in 3.7%, and on the right side in 7.2%. Maxillary sinusitis and AMO were shown to have a statistically significant correlation.[5] Using 800 sinonasal computed CT scans, Earwaker conducted an anatomical variance analysis indicating a 14% prevalence of AMO.[16] Although no incidences of AMO were found in the cadavers examined in their investigation, May et al. noted a 10% prevalence of AMO in sinus surgery patients.[17] Patients with maxillary sinusitis (19.9%) showed a higher frequency of AMO than did healthy volunteers (0.48%) by Mladina et al..[18]

Haller cell frequency shows great variation, ranging from 2% to 70.3%.[19] The imaging methods used as well as the demographics of the subjects, including age and ethnicity may influence this inconsistency. The investigation turned out to be a 76% prevalence of Haller cells. Ullas et al. discovered that the frequency of Haller cells was 15.6%; 74.2% of these cells linked to maxillary sinusitis.[20], Research by Ehsan Khayam found that in panoramic radiography, ethmoidal infraorbital cells were present in 32.5% prevalence. Moreover, using computed tomography, Kamal Badawi and Neha Koshal's investigation revealed respective prevalence rates of Haller cells at 39.4% and 30.39%.[21–23] A prevalence of 68% for Haller cells was found in a study on structural changes of the osteomatal complex in cone-beam computed tomography (CBCT) among candidates for rhinoplasty.[19] The present study shows a 76% frequency for Haller cells, well above results from previous computed tomography studies. One could explain this difference by CBCT's higher spatial resolution than conventional computed tomography. The higher frequency of Haller cells found in our work emphasizes how well CBCT delivers precise imaging of the orbital bony structures while significantly reducing radiation exposure.

Genc et al. carried out a trial whereby sinusitis was produced on five rabbits' right flanks. Following the experiment, the lateral nasal walls were examined for the appearance of AMO, which showed up on two of the five sides showing sinusitis (40%), thereby verifying that AMO developed later on in rabbits following sinusitis.[6] Many earlier studies have confirmed the relationship between maxillary sinusitis and Haller cells.[24,25,26] Like the studies of Ali IK, our examination revealed a substantial correlation between Haller cells and maxillary sinusitis as well as a clear link between AMO and sinusitis in the presence of Haller cells.[12] The results of Genc et al., which show that AMO developed in rabbits following induced sinusitis, help to clarify this. Furthermore well-documented in the literature are Haller cells' ability to block the maxillary sinus entrance and disturb mucociliary flow, therefore causing ongoing

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recurrent sinusitis.[19,21,22] As such, sinusitis caused by Haller cells can start AMO.

Finally, our results showed a relationship between maxillary sinusitis and AMO and Haller cells. This investigation showed that CBCT could effectively image the sinonasal complex's bone structure with much lowered radiation exposure and greatly increased accuracy. CBCT assessment with confirmed maxillary sinusitis with AMO and Haller cells and maxillary sinusitis requires further research.

TABLES:

Table: 1 Analysis of Haller cells, AMO and maxillary sinusitis.

	LEFT	RIGHT	BILATERAL	TOTAL
AMO	128(14.28%)	176(19.64%)	592(66.07%)	896(56%)
HALLER CELLS	240(20.27%)	208(17.56%)	736(62.16%)	1176(74%)
MAXILLARY SINUSITIS	112(20%)	208(37.14)	240(42.85)	560(35%)

Table: 2 Association of maxillary sinusitis and Haller cells (chi-square test)

HALLER CELLS	MAXILLARY SINUSITIS		
	PRESENT	ABSENT	TOTAL
PRESENT	512(43.24)	672(56.75%)	1184(100%
ABSENT	96(11.5%)	368(88.46%)	416(100%)
TOTAL	1120(35%)	1040(65%)	1600(100%)

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Table: 3 Association of accessory maxillary ostium and maxillary sinusitis (chi-square test)

ACCESSORY MAXILLARY OSTIUM	MAXILLARY SINUSITIS		
	PRESENT	ABSENT	TOTAL
PRESENT	448(50%)	448(50%)	896(100%)
ABSENT	112(15.9%)	592(84%)	704(100%)
TOTAL	560(35%)	1040(65%)	1600(100%)

Table: 4 Cross-tabulation of maxillary sinusitis (presence or absence) with the presence of the accessory maxillary ostium using the chi-square test in patients with Haller cells

ACCESSORY MAXILLARY OSTIUM	MAXILLARY SINUSITIS		
	PRESENT	ABSENT	TOTAL
PRESENT	416(49.52%)	424(50.47%)	840(100%)
ABSENT	72(20.93%)	272(79.06%)	344(100%)
TOTAL	488(41.21%)	696(58.78%)	1184(100%)

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