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Comparative analysis of CBCT and panoramic imaging in the detection of Haller's cells

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ABSTRACT

Comparative analysis of CBCT and panoramic imaging in the detection of Haller's cells

Background: The purpose of this study is to evaluate the efficacy of panoramic radiography for determining of Haller cells that were defined previously by CBCT images of the same patients. Additionally, we also aimed to assess the correlation with the presence of Haller cells and mucosal thickening of maxillary sinus.

Methods: 324 paranasal sinuses on panoramic radiographs of 162 patients with Haller cells identified on CBCT scans were analyzed. The presence of mucosal thickening of maxillary sinuses was evaluated on CBCT images. Pearson Chi-squared test, Kappa analysis, t-test were used for statistical analysis of collected data.

Results: A statistically significant difference was found between the CBCT and the panoramic radiography of patients. There was no correlation between the presence of Haller cells and mucosal thickening seen in maxillary sinus.

Conclusion: The visibility of Haller cells on CBCT scans does not appear to be correlated with the panoramic radiographs. And there was no relationship between the presence of Haller cells and mucosal thickening seen in maxillary sinus.

KEYWORDS

Cone-beam computed tomography, Haller's cells, mucosal thickening, panoramic radiographs

ÖZ

Haller hücrelerinin tespitinde KIBT ve panoramik görüntülemenin karşılaştırmalı analizi

Amaç: Bu çalışmanın amacı, KIBT ile daha önce tanımlanan Haller hücrelerinin belirlenmesinde panoramik radyografinin etkinliğini değerlendirmektir. Ek olarak, Haller hücrelerinin varlığı ile maksiller sinüsün mukozal kalınlaşması arasındaki ilişkiyi de değerlendirmeyi amaçladık.

Gereç ve Yöntemler: KIBT taramalarında tespit edilen Haller hücreli 162 hastanın panoramik radyografilerinde 324 paranazal sinüs analiz edildi. KIBT görüntülerinde maksiller sinüslerin mukozal kalınlaşma varlığı değerlendirildi. Toplanan verilerin istatistiksel analizinde Ki-kare testi, Kappa analizi, t testi kullanıldı.

Bulgular: KIBT ile hastaların panoramik radyografisi arasında istatistiksel olarak anlamlı bir fark bulundu. Haller hücrelerinin varlığı ile maksiller sinüste görülen mukozal kalınlaşma arasında bir ilişki bulunamadı.

Sonuç: Haller hücrelerinin KIBT taramalarında görünürlüğü panoramik radyograflarla korele görünmemektedir. Haller hücrelerinin varlığı ile maksiller sinüste görülen mukozal kalınlaşma arasında ilişki yoktu.

ANAHTAR KELİMELER

Haller hücresi, konik ışınlı bilgisayarlı tomografi, mukozal kalınlaşma, panoramik radyografi

INTRODUCTION

Infraorbital ethmoid cells are also known as Haller cells first described in 1743 by the Swiss anatomist Albert von Haller.[1] These cells may be observed below the ethmoid bulla on imaging and also named orbitoethmoidal cells or maxilloethmoidal cells. [2,3]

Especially large cells have been found to cause sinusitis, sinusal headache and mucoceles, nasal obstruction, impaired nasal breathing, headache and chronic cough.[2-6] Small Haller cells can also constitute these complaints so there is no general interaction between the size of cells and symptoms.[6-8] To establish a relationship between sinusitis and anatomic variants, such as Haller cell it is necessary to establish when the sinonasal mucosa is pathological. Eggesbo [9] has defined that a mucosal thickening ≥ 3mm is indicative of sinus inflammation. Haller

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cells may be seen by various imaging methods that show a view of the maxillary sinus. The prevalence rate of Haller cells is variable at 4.7-45.1 %.[6,10,11]

The purpose of this study is to evaluate the efficacy of panoramic radiography for determining of Haller cells that were defined previously by CBCT images of the same patients. Additionally, the correlation with the presence of Haller cells and mucosal thickening of maxillary sinus were assessed.

MATERIAL AND METHODS

This study was approved by the necessary institutional review board. A total of 162 CBCT scans and panoramic images obtained from same patients for various reasons were evaluated. Patients with known or suspected trauma and/or surgical intervention, developmental anomalies or pathologies in the maxillofacial region and radiographs or images with questionable quality or with artifacts were excluded from the study. Extramural air cells on the roof of the maxillary sinus which at least half of them are located laterally to the adjacent medial orbital wall and form the upper margin of the infundibulum on the coronal plane were stated as Haller cells. On panoramic radiographs, the recognition of Haller's cells was confirmed by Ahmad et al's criteria.[2]

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.

Additionally, the presence of mucosal thickening of maxillary sinuses was evaluated on CBCT images. Thickening of more than 3 mm was considered as pathologically.[9]

Statistical analyses were performed with IBM SPSS statistics 21 for Windows PC (IBM Corp., Armonk, NY, USA) and Pearson Chi-squared test, Kappa analysis, t-test were used. The p value < 0.05 was considered to be statistically significant.

Figure 1. Coronal cone beam CT image shows Haller's cell

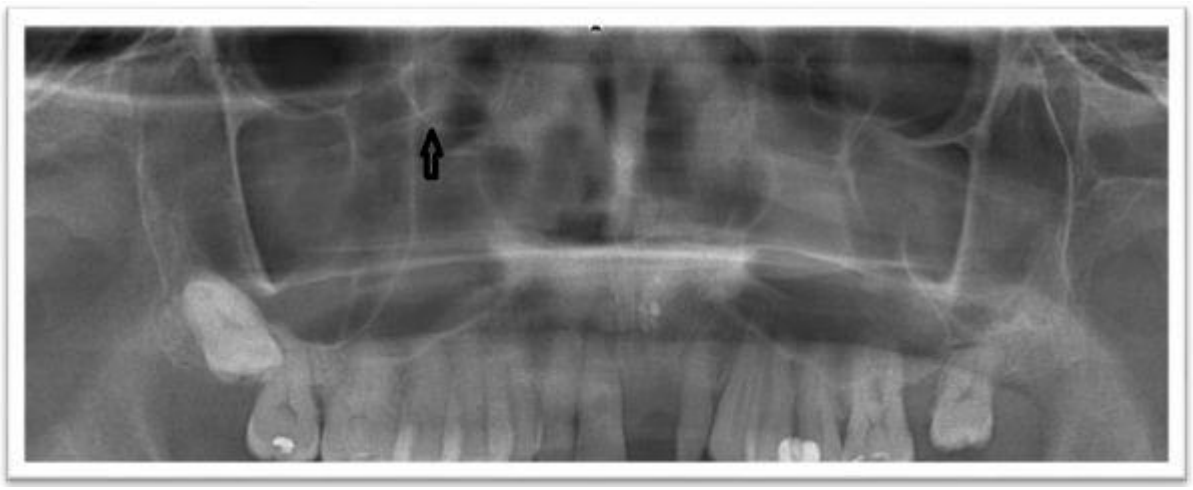

Figure 2. Arrow showing the presence of Haller's cell in cropped panoramic radiograph

RESULTS

In the present study 324 orbito-etmoidal regions of 162 patients were evaluated with CBCT images and panoramic radiographs. Of the 162 patients, 95 showed bilateral Haller cells and 67 showed unilateral Haller cells on CBCT evaluation. There was no statistically significant correlation between gender and the presence of Haller cells in the right or left regions ($p > 0.05$). When the right orbito-ethmoidal regions of the patients were examined, panoramic radiography revealed 73 (45.1 %) patients with Haller cells; whereas CBCT revealed 130 (80.2) patients with Haller cells. A statistically significant difference was found between the CBCT and the panoramic radiography for the right region of patients. ($p < 0.001$) When the left orbito-ethmoidal regions of the patients were examined, panoramic radiography revealed 68 (42 %) patients with Haller cells; whereas CBCT revealed 127 (78.4 %) patients with Haller cells. A statistically significant difference was found between the CBCT and the panoramic radiography for the left region of patients. ($p < 0.001$) Additionally, there was no correlation between the presence of Haller cells and mucosal thickening seen in maxillary sinus for both left and right sides on CBCT examination. ($p > 0.05$).

DISCUSSION

Haller cells, identified in the mid-18th century, are developmental invaginations of the ethmoidal cells into the floor of the orbit or into the roof of the maxillary sinus.[1,12] They may be an incidental finding or cause many different disorders.[3,6,7,12]

Studies using CT or CBCT for identifying Haller cells have found higher prevalence compared to studies using panoramic radiographs. Khojastepour L et al. [13] reported a prevalence of 68 % and Mathew R et al. [14] reported a prevalence of 60 % for Haller cells using CBCT. In another CBCT evaluation study in a Turkish population, Haller cells prevalence was found 43.3 %.[15] Valizadeh S et al. [16] assessed 310 panoramic radiographs and reported a prevalence of 37 % for Haller cells. The prevalence has varied hugely in various panoramic radiography studies ranging from 16-38.2 %.[2,17,18]

No statistically significant difference was found in prevalence of Haller cells between males and females similar to previous studies.[18-20] Additionally, no differences were noted in the occurrence of Haller cells on the right and left

side in harmony with the previous studies.[2,18] Haller cells were seen in a large number of cases bilaterally than unilaterally.

Friedrich et al. [20] evaluated 199 CBCT imaging and found a prevalence of 23.6 % for Haller cells. They also investigated the appearance of Haller cells on 30 patients' both using CBCT imaging and panoramic radiographs and reported a total of 13. In the present study 324 paranasal sinuses on panoramic radiographs of 162 patients with Haller cells identified on CBCT scans were evaluated. Our results showed there was no strong congruence between two techniques, leading us to conclude that a panoramic radiography is not really suitable for diagnosing the presence of Haller cells. There are various studies in the literature on the prevalence of infraorbital ethmoid cells on panoramic radiographs.[2,16-19,21] and has been noted that the presence of Haller cells could be clearly appreciated on panoramic radiographs.

Haller cells have been suggested as a causative factor in sinusitis because of their ability to cause narrowing of the infundibulum.[8,22,23] Stackpole and Edelstein have reported that medium and large Haller cells may be an etiologic factor in sinusitis. They have found an association between increasing Haller cells size and mucosal inflammation in the maxillary sinus.[8] Nevertheless, there was no correlation between the presence of Haller cells and mucosal thickening seen in maxillary sinus.[3,6,14,24,25] According to the results of the present study no statistically significant association was found between the Haller cells and mucosal thickening. However, the limitation of our study is that the size of the Haller cells did not evaluated in terms of mucosal thickening.

CONCLUSION

The visibility of Haller cells on CBCT scans does not appear to be correlated with the panoramic radiographs, so panoramic radiography is not really suitable for identifying infraorbital ethmoid cells. Additionally, there was no relationship between the presence of Haller cells and mucosal thickening seen in maxillary sinus. Further studies for the osteomeatal complex variations and sinus diseases are necessary to clarify CBCT and panoramic radiography findings.

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