Association between the Seasonal Changes and Mucous Retention Cyst of Maxillary Antrum in Cone Beam Computed Tomography Images in a Sample Population of Isfahan, Iran

Abstract

Objectives: Mucous retention cysts (MRCs) of the maxillary sinuses are incidental findings in radiographs of the oral and maxillofacial structures. These cysts usually appear as rounded, dome-shaped, and soft-tissue masses, most often on the floor of the maxillary sinus. The aim of this study was to determine the prevalence of maxillary antral MRC and the effect of seasonal variation, sex and age in cone beam computed tomography (CBCT) images. Materials and Methods: In this simple, nonrandomized, cross-sectional study, CBCT images of patients were reviewed to evaluate the prevalence of MRCs and its location in the antrum, uni or bilateral, size, and season in which MRC occurred. The findings were analyzed using Statistical software SPSS and t-tests (P > 0.05). Results: A total of 765 CBCT images were evaluated (380 males and 385 females); 180 were suggestive of MRCs, 110 occurred in males (28.9%) while 70 (18.2%) occurred in females, which resulted in a prevalence of 23.5%. The peak prevalence of MRC was found in spring (41.6% of all radiographs), but there was no significant statistical difference between the occurrence of MRCs in different seasons (P > 0.05). Conclusion: This study showed no significant difference between the occurrences of MRCs in different seasons. There was no significant difference between male and female and different decades of life. Furthermore, there was no significant difference between the involvement of right and left maxillary sinuses and different walls of the antrum.

Keywords: Cone beam computed tomography, maxillary sinus, mucous retention cyst

Introduction

Mucous retention cysts (MRCs) of the antrum are usually found incidentally during the evaluation of radiographs.\[1,2\] MRC is the most frequent lesion of the antrum.\[1,4\]

This benign entity is an accumulation of mucous in the lining of the antrum, usually due to an obstruction of a gland duct in the lining.\[5\] It is usually found on the floor of the antrum, perhaps because of gravity.\[6\]

This chronic inflammatory cyst is radiographically seen as a single or multiple radiopaque lesion of the sinus wall. It grows slowly and preserves the integrity of the membrane; it has soft and well-defined borders without cortical bone [Figure 1a-d]. Some MRCs increase gradually, some of them do not change for a long time, others disappear spontaneously. Most of them are asymptomatic\[4,5,7-9\] although some discomfort such as stuffiness, fullness, postnasal drip, gushing of yellow fluid from the nose, and headache may be reported.\[10,11\] The pathogenesis of MRCs is uncertain,\[12,13\] although they are associated with allergic, inflammatory, and infectious processes,\[4,9,10\] but not with dental or gingival pathologies.\[11,13\] Wang et al. reported that most retention cysts of the antrum spontaneously regress or show nonsignificant change in size.\[14\] Although its etiology is controversial, many investigators have suggested an environmental cause.\[12,15-17\] The formation of MRCs has been related to the seasons, particularly the first of spring and autumn.\[11,13\]

Imaging examinations provide opportunities for dentists to detect changes in the antrum. Panoramic radiography has been used as a screening tool for the evaluation of the maxillomandibular complex. Although it is not suitable for evaluating maxillary sinuses along all their extension\[18\] despite its limitations, panoramic radiography is still used because of its low cost, availability, and ease of interpretation.\[19\] Cone beam...
computed tomography (CBCT) may become an important tool to diagnose changes and plan the treatment of maxillary sinus alterations.[20]

The aim of this study was to determine the prevalence of maxillary antral MRC and the effect of seasonal variation, sex, and age in CBCT images of a sample of an Iranian population.

**Materials and Methods**

This simple, nonrandomized, cross-sectional study was done on CBCT images taken at the department of oral and maxillofacial radiology, Isfahan University of Medical Sciences, Iran. CBCT scans prescriptions were due to dental treatment plans such as dental implant treatment (more than other causes of prescriptions), maxillofacial surgeries, and orthodontic treatments. The Inclusion criteria for participation in this study were as follow: (1) The CBCT image was taken using standard parameters (120 kVp, 15 mA, 9.6 s); (2) the occlusal plane of the image was parallel to the floor; (3) the sinus had no sign of acute sinusitis, such as air-fluid level or complete opacification; and (4) all of the maxillary sinus can be seen in panoramic, axial, and cross-sectional views. The sample consisted of 765 CBCT scans taken using GALILEOS Comfort three-dimensional imaging system (Sirona Dental Systems Inc., Bensheim, Germany). The radiographs were evaluated by an oral and maxillofacial radiologist. The presence of a MRC was assessed in the panoramic, axial, and cross-sectional views. The criterion for radiographic detection was a radiopaque dome-shaped or hemispherical image on the floor or other walls of the antrum with sharp demarcation of lateral borders and a smooth spherical outline[21] [Figure 1a-d]. The location of the MRC in the sinus, unilateral, or bilateral, and size in millimeters (Superoinferior and lateromedial measurements) were recorded. Image analysis was done with CBCT measurement software. Furthermore, the month of the year and seasons in which CBCT images were prepared and recorded.

**Results**

A total of 765 radiographs were evaluated (380 males and 385 females); 180 were suggestive of MRCs, 110 occurred in males (28.9%) while 70 (18.2%) occurred in females, which resulted in a prevalence of 23.5%. Chi-square tests showed no significant difference between the prevalence of MRC between males and females ($P < 0.05$). Furthermore, the prevalence was independent of age in both genders.

The peak prevalence of MRC was found in spring with 41.6% of all radiographs but the difference in prevalence between different months and seasons of the year was not significant ($P < 0.05$) [Figure 2].

From 180 MRC, 155 were unilateral (85 in left antrum and 70 in right antrum), and 25 were bilateral. Furthermore, most of MRCs (48.6%) were on the inferior wall of antrum (medial 20%, posterolateral 17.1%, and 2 walls 14.3%).

Differences of MRC size ranged from 1.5 mm to 27 mm, and in the inferior wall had the average size of 12.8 mm. The mean size of MRC between different seasons, age groups, a wall of antrum, and side were also analyzed, but no differences were statistically significant (ANOVA).

**Discussion**

Imaging detection of MRC may help to define its characteristics and behavior, as well as to establish a therapeutic protocol. MRC does not affect the integrity of maxillary sinus walls[41] and is usually asymptomatic,[2,14,22] although some discomfort such as stuffiness, fullness, postnasal drip, gushing of yellow fluid from the nose, and headache may be reported.[10,11] In most cases, it resolves spontaneously and requires no treatment.[14] Clinical and radiographic examinations are essential to define alternative treatments and to rule out other pathologies such as mucocele, polyps, and sinusitis.[7,22]

There was no predilection in the current study, which is in keeping with that found by Bösö[23] and unlike other investigators.[5,6,24,25] Allard et al. and White and Pharoah[13] reported that MRC occurrence is higher among men than women, at a ratio of 2:1.

![Figure 1: (a-d) Mucous retention cyst of the maxillary sinus. (a) Panoramic view. (b) Cone beam computed tomography image (tangential view). (c) Cone beam computed tomography image (axial view). (d) Cone beam computed tomography image (coronal view)](image)

![Figure 2: Pie chart of occurrence of mucous retention cysts in different seasons](image)
Myall et al.\textsuperscript{[5]} and Gothberg et al.\textsuperscript{[10]} reported that MRCs might be found in all age groups, except among children. They reported that most cases occur after the first and particularly in the second decade of life.\textsuperscript{[4,12]} Casamassimo and Lilly\textsuperscript{[7]} found that MRC was diagnosed in the third decade of life in 69% of the cases and that there was no association between cyst size and the patient’s age. The third decade is the age at which a higher prevalence of MRCs is observed.\textsuperscript{[7,16]} In Rodrigues study, a preference for the second and third decades was found, and a decrease in the frequency of cases was seen with increasing age, possibly because younger patients were examined more often.\textsuperscript{[24]} In our study, there was no association between cyst size and age and most cases were found in the sixth decade.

The lesion was found in the right maxillary sinus in 70 cases and in the left maxillary sinus in 85 cases. The difference in a number of cysts between the right and left sides for each sex was not significant. These findings show that the frequency of MRCs among this Iranian sample is in agreement with that reported in previous studies with other populations.\textsuperscript{[5,6,16,24]} In our study, cysts were found in both sinuses in only 25 cases.

Paparella suggested that an environmental cause was responsible for the high prevalence of both sinusitis and MRCs in Americans serving with the US army in Germany.\textsuperscript{[17]} A similar correlation between the presence of antral cysts with that of sinusitis during the late summer months was observed by Casamassimo.\textsuperscript{[7]} Ruprecht speculated that the variation in the prevalence favoring in the last quarter of the year in North America might be due to an increased incidence in the common cold or irritation from central heating.\textsuperscript{[5]} Carter’s finding supports Ruprecht’s contention of the adverse effects of forced air heating.\textsuperscript{[25]} In contrast, patients in Riyadh, Saudi Arabia, a locale with a mild winter season, did not show this seasonal variation.\textsuperscript{[5]}

In our study, the peak prevalence of MRC was found in spring with 41.6% of all radiographs. The difference in prevalence between seasons of the year was not significant. This is of interest since the findings of other studies\textsuperscript{[5,7,17,25]} are different. In Iran, there is not the same winter climate such as North America nor the same summer such as Riyadh, Saudi Arabia, we have four seasons, but the temperature variation does not have a wide latitude.\textsuperscript{[26]} Perhaps other environmental causes such as relative air humidity may be involved. The mean air humidity, especially in Isfahan, is low but needs more research to find out.

**Conclusion**

The results of the present study that was done on the sample of Isfahan city of Iran, a city with four distinct but mild climate seasons, showed that unlike the other studies in different countries with a great difference of temperature between seasons, there was no significant difference between the occurrences of MRCs in different seasons.

Furthermore, there was no significant difference between male and female and different decades of life. There was no significant difference between the right and left maxillary sinuses. There was no significant difference between different walls of the antrum and with a higher prevalence in the inferior wall.

**Acknowledgment**

The authors thank the Department of Oral and Maxillofacial Radiology of Dental School of Isfahan University of Medical Sciences for their great support.

**Financial support and sponsorship**

Nil.

**Conflicts of interest**

There are no conflicts of interest.

**References**

1. Neville BW, Damm DD, Allen CM, Bouquot JE. Oral and Maxillofacial Pathology. Philadelphia: W.B. Saunders Company; 1995. p. 231-2.
2. Hadar T, Shvero J, Nageris BI, Yaniv E. Mucus retention cyst of the maxillary sinus: The endoscopic approach. Br J Oral Maxillofac Surg 2000;38:227-9.
3. Mardinger O, Manor I, Mijiritsky E, Hirshberg A. Maxillary sinus augmentation in the presence of antral pseudocyst: A clinical approach. Oral Surg Oral Med Oral Pathol Radiol Endod 2007;103:180-4.
4. Myall RW, Eastep PB, Silver JG. Mucous retention cysts of the maxillary antrum. J Am Dent Assoc 1974;89:1338-42.
5. Ruprecht A, Batniji S, el-Neweihl E. Mucous retention cyst of the maxillary sinus. Oral Surg Oral Med Oral Pathol 1986;62:728-31.
6. Allard RH, van der Kwast WA, van der Waal I. Mucosal antral cysts. Review of the literature and report of a radiographic survey. Oral Surg Oral Med Oral Pathol 1981;51:2-9.
7. Casamassimo PS, Lilly GE. Mucosal cysts of the maxillary sinus: A clinical and radiographic study. Oral Surg Oral Med Oral Pathol 1980;50:282-6.
8. Christen AG, Meffert RM, Cornyn J, Tiecke RW. Oral health of dentists: Analysis of panoramic radiographic survey. J Am Dent Assoc 1967;75:1167-8.
9. Killey HC, Kay LW. Benign mucosal cysts of the maxillary sinus. Int Surg 1970;55:235-44.
10. Gothberg KA, Little JW, King DR, Bean LR. A clinical study of cysts arising from mucosa of the maxillary sinus. Oral Surg Oral Med Oral Pathol 1976;41:52-8.
11. Sammartino FJ. Radiographic appearance of a mucoid retention cyst. Report of a case. Oral Surg Oral Med Oral Pathol 1965;20:454-5.
12. Halstead CL. Mucosal cysts of the maxillary sinus: Report of 75 cases. J Am Dent Assoc 1973;87:1435-41.
13. White SC, Pharoah MJ. Oral Radiology: Principles and Interpretation. 4th ed. St. Louis: Mosby; 2000. p. 535-6.
14. Wang JH, Jang YJ, Lee BJ. Natural course of retention cysts of...
the maxillary sinus: Long-term follow-up results. Laryngoscope 2007;117:341-4.
15. Lilly GE, Cutcher JL, Steiner M. Spherical shadows within the maxillary antrum. J Oral Med 1968;23:19-21.
16. MacDonald-Jankowski DS. Mucosal antral cysts in a Chinese population. Dentomaxillofac Radiol 1993;22:208-10.
17. Paparella M. Mucosal cyst of the maxillary sinus: Diagnosis and management. Arch Otolaryngol 1963;77:650-7.
18. Ohba T. Value and limitation of panoramic radiography in the diagnosis of maxillary sinus pathosis. Int J Oral Surg 1977;6:211-4.
19. Maestre-Ferrín L, Galán-Gil S, Carrillo-García C, Peñarrocha-Diago M. Radiographic findings in the maxillary sinus: Comparison of panoramic radiography with computed tomography. Int J Oral Maxillofac Implants 2011;26:341-6.
20. Maillet M, Bowles WR, McClanahan SL, John MT, Ahmad M. Cone-beam computed tomography evaluation of maxillary sinusitis. J Endod 2011;37:753-7.
21. Kanagalingam J, Bhatia K, Georgalas C, Fokkens W, Miszkiel K, Lund VJ, et al. Maxillary mucosal cyst is not a manifestation of rhinosinusitis: Results of a prospective three-dimensional CT study of ophthalmic patients. Laryngoscope 2009;119:8-12.
22. Cashman EC, Macmahon PJ, Smyth D. Computed tomography scans of paranasal sinuses before functional endoscopic sinus surgery. World J Radiol 2011;3:199-204.
23. Bósio JA, Tanaka O, Rovigatti E, de Gruner SK. The incidence of maxillary sinus retention cysts in orthodontic patients. World J Orthod 2009;10:e7-8.
24. Rodrigues CD, Freire GF, Silva LB, Fonseca da Silveira MM, Estrela C. Prevalence and risk factors of mucous retention cysts in a Brazilian population. Dentomaxillofac Radiol 2009;38:480-3.
25. Carter LC, Calamel A, Haller A, Aguirre A. Seasonal variation in maxillary antral pseudocysts in a general clinic population. Dentomaxillofac Radiol 1998;27:22-4.
26. Donizeth-Rodrigues C, Fonseca-Da Silveira M, Gonçalves-De Alencar AH, Garcia-Santos-Silva MA, Francisco-De-Mendonça E, Estrela C, et al. Three-dimensional images contribute to the diagnosis of mucous retention cyst in maxillary sinus. Med Oral Patol Oral Cir Bucal 2013;18:e151-7.