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CONE BEAM COMPUTED TOMOGRAPHY ANALYSIS OF ACCESSORY MAXILLARY OSTIUM- ITS PREVALENCE AND CLINICAL SIGNIFICANCE: A RETROSPECTIVE STUDY

Dentistry

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ABSTRACT

The osteomeatal complex contributes to the final drainage pathway of maxillary, anterior ethmoidal and frontal sinuses. Primary maxillary sinus ostium is present in all population while if extra opening present in addition then it is called accessory maxillary sinus ostium. Its presence may be associated with increase in incidence of mucus retention cysts, mucosal thickening and maxillary sinusitis. The assessment of AMO is recommended to investigate the patients with definitive maxillary sinus pathology. **Aim:** To access the prevalence of AMO and its association with mucosal thickening, polyps, antral secretions and mucous retention cyst. **Methodology:** CBCT scans of 100 patients were selected in the study and analyzed for prevalence of accessory maxillary ostium &for any subsequent presence of maxillary sinus pathologies like mucosal thickenings, polypoidal thickenings and opacification of sinus **Results:** The overall prevalence of AMO is 39%. Prevalence of incidental pathologies like mucosal thickening, polypoidal thickenings and sinus opaifications were seen in 26%, 14% & 8% & association of AMO was found in 53.8% in mucosal thickenings, 17.9% of polypoidal thickenings & 10.3% of sinus opacification with high statistical significance between presence of AMO with mucosal thickenings.

KEYWORDS

Accessory Maxillary Ostium, Paranasal Sinus Disease, Prevalence, Cone Beam Computed Tomography

INTRODUCTION

Paranasal sinuses are air-filled cavities covered by a thin layer mucous membrane that adheres to the periosteum.[1] They are the frontal, ethmoidal, sphenoidal and maxillary sinuses, housed within the bones of the same name. The maxillary sinus is the largest paranasal sinus, and it is of great interest to field of otorhinolaryngology and dental medicine alike[2]

The primary maxillary ostium (PMO) is a natural opening located at the junction of the medial wall of the maxillary sinus and the floor of the orbit. Its patency contributes to an adequate drainage from the sinus into the hiatus semilunaris, the middle meatus, and then the nasal cavity. The PMO helps to maintain a physiological and healthy condition of the maxillary sinus[3]

The accessory maxillary ostium (AMO) is regarded as any extra opening other than the PMO. It is usually present in the region of the nasal fontanelle(NF) or hiatus semilunaris (HS).The development of accessory maxillary ostium is still questionable.

A possible mechanism of formation of accessory ostia is obstruction of the primary ostium by maxillary sinusitis or due to anatomic and pathologic factors in the middle meatus resulting in the rupture of membranous areas known as fontanelle. The presence of an AMO enables to not only increase the ventilation rate of the maxillary sinus, but also leads to an inverse drainage from the middle meatus into the sinus[4]. This results in a reduced nitric oxide concentration and mucus accumulation in the sinus, which possibly contributes to pathological changes, such as mucosal thickening, mucous retention cyst formation, and maxillary sinusitis[3] .A study conducted by Shreya Rangarajan et al indicate the significant role of the AMO in sinus dynamics, as their presence can disrupt normal mucociliary clearance and promote mucus recirculation between the natural and accessory ostia, which may contribute to the persistence or recurrence of chronic maxillary sinusitis[5]. Various sinus surgeries like sinus floor elevation procedures and functional endoscopic sinus surgeries has led to the emergence of interest in the complex radiological anatomy of paranasal sinus region[6]. In addition to that, other oral surgical procedures such as apical surgery or the removal of impacted teeth in the posterior maxilla, posterior maxillary implant placements, orthodontic surgeries also risk to impinge on the integrity of the sinus, and thus, could cause pathological changes. [7]

It is therefore critical to confirm patency of the maxillary sinuses prior to oral surgical procedures in close relation to the sinus and to detect pathological changes of the sinus that might not only compromise the surgical outcome but also be aggravated following these surgical interventions.

The increase in use of CBCT by dentists and maxillofacial surgeons opens up an opportunity for assessment of the prevalence of incidental findings of maxillary sinus, which would be relevant for further evaluation.[8]

Emphasizing the importance of accessory maxillary ostium for common surgical procedures in dental medicine including SFE, apical surgery, or removal of impacted teeth in the posterior maxilla, the objective of the present study was to assess presence of AMOs and its significant association with maxillary sinus pathologies association using CBCT images.

Inclusion and Exclusion Criteria

The age range of this study was 20 years and above. Both males and females included. Patients with radiographic evidence of surgery, trauma and tumors in sinonasal region are excluded and cone beam computed tomographic images with artifacts and poor quality images are excluded.

METHODOLOGY

The CBCT scans of 100 patients were selected in the study based on the inclusion and exclusion criteria. These scans were made using a SIRONAORTHOPHOS XG 3D machine. The exposure factors were set with 70 kVp, 10 mA using 3D head rest method in standard positions. The images were analyzed with Galileos viewer software version 1.8. The reconstructed images were assessed in axial, sagittal, and coronal planes and analyzed for the prevalence of accessory maxillary ostium and for any subsequent presence of maxillary sinus pathologies like mucosal thickenings, polypoidal thickenings and sinus opacification.

Accessory Maxillary Ostium

Accessory maxillary ostium was regarded as any additional opening

other than the primary maxillary ostium which is located in the medial wall of the maxillary sinus below the uncinate process and above the inferior turbinates of the maxillary sinus. The prevalence of AMO was analysed as radiographically present or absent.

The normal mucosal lining of the paranasal sinus composed of respiratory epithelium which is approximately 1 mm thick, and is not usually visualized on the radiograph. Any thickening greater than 3 mm is most likely to be pathological.

The CBCT images analyzed for presence of mucosal thickening and concurrent presence of accessory maxillary ostium. Radiographically the polyps and retention cysts appears as smooth, outwardly convex soft-tissue masses and cannot be differentiated. Hence any dome shape structure in the maxillary sinus was considered to be Polypoidal thickenings and its presence and association with accessory maxillary ostium was noted in CBCT images.

Chronic sinusitis may result in persistent radiopacification of the sinus with sclerosis and/ or thickening of the sinus wall with unusual resorption of thebony border. The presence of partial or complete opacification of the sinus and its concurrent association with presence of accessory maxillary ostium also noted.

Statistical Analysis

All data was transferred to an Excel spreadsheet 4. The collected data were evaluated with IBM.SPSS statistics software 23.0 Version. To describe the above mentioned data, descriptive statistics frequency analysis, and percentage analysis were used for categorical variables and the mean & S.D were used for continuous variables. To find the significance in categorical data Chi-Square test was used. Likewise if the expected cell frequency is less than 5 in 2×2 tables then the Fisher's Exact was used. In both the above statistical tools the probability value 0.05 is considered as significant level.

RESULTS

Out of 100 CBCT images 51.0% are Male, 49.0% are Female. 26 patient's images with 21-30 years, 24 images with 31-40 years, 26 images with 41-50 years, 24 images with 51-60 years. The accessory maxillary ostium was present in 39% and absent in 61%.

Mucosal thickening was present in 26.0% and absent in 74%. Mucosal thickening associated with AMO was present in 21(53.8%). Comparison between Mucosal thickening with AMO by Pearson's chi-squared test were χ^2=25.767 , p=0.0005<0.01 which shows highly statistical significant association between Mucosal thickening and AMO.

Polypoidal thickening was present in 14.0% and absent in 86.0%. Polypoidal thickening associated with AMO was present in 7(17.9%) which shows no statistical significant association between Polypoidal thickening and AMO.

Out of 100 CBCT images Sinus Opacification was present in 8.0% and absent in 92.0%. sinus opacification associated with AMO was present in 4(10.3%) which shows no statistical significant association between Sinus Opacification and AMO.

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DISCUSSION

The study was conducted emphasizing the importance of analyzing the accessory maxillary ostium before performing endoscopic surgeries of maxillary sinus and common oral surgical procedures including Sinus floor elevation surgeries, apical surgery, or removal of impacted teeth in the posterior maxilla, since it is proved to be associated with incidental maxillary sinus pathologies like mucosal thickenings, polypoidal thickenings and sinus opacifications which delays the post-operative healing in sinus surgeries.

Since CBCT has higher resolution and low radiation dosage comparing with CT and is most widely paractised by dentists and otolaryngologists to assess paranasal sinuses our study was conducted in cone beam computed tomography.

In our study the frequency of AMOs in the sinuses assessed is 39% (39/100), which is above the range reported by previous cadaveric (0–43%, median 23%) [8,10] endoscopic (9–23%,median19.3%) [9,11] CT (19.1and 37.1%) [4,12] and CBCT [13] 65%This increased prevalence in CBCT images could be because of high spatial resolution of CBCT which increases the accuracy of identifying small anatomical variations in the maxillary sinus.

Regarding the distribution of AMO in different age groups our study showed the CBCT images with 21-30 years AMO was present in 11(28.2%) patients, among the age group of 31-40 years AMO was present in 10(25.6%), among the age group of 41-50 years AMO was present in 11(28.2%), among the age group of 51-60 years AMO was present in 17(27.9%) and no statistically significant association found between age and AMO.

Association with Sinus Pathologies

In the present study the maxillary sinus pathologies like mucosal thickening, polypoidal thickenings and sinus opaifications were seen in 26%, 14% & 8% respectively and the mucosal thickenings are the most frequent incidental pathology noticed. This is concurrent with other studies conducted by Mamta Raghav et al[14], Ritteret al [15] , vallo et al [16], Havas et al[17] Nurşat Türker et al[18] in which mucosal thickenings are the most frequent incidental pathology detected.

The average size of AMO in relation to length was found to be 4.17 ± 1.62mm in the left side and 4.16 ± 1.93mm in the right side. This is in concurrence with study conducted by Shishir shetty al where the average size was less than 4mm [19].

In our study, correlating the association of accessory maxillary ostium with incidental maxillary sinus maxillary sinus pathologies, the prevalence of incidental pathologies like mucosal thickenings, polypoidal thickenings and sinus opaifications were seen in 26%, 14% & 8% respectively & the association of AMO was found in 53.8% in mucosal thickenings, 17.9% of polypoidal thickenings & 10.3% of sinus opacification with high statistical significance between the presence of AMO with mucosal thickenings.

This result indicates the presence of accessory maxillary ostium has more chances of association with incidental maxillary sinus pathologies which compromise the outcome of dental surgeries. This is contradictory with study conducted by Mahapatra et al[20] where the unilateral presence of AMO seen in 5% of healthy individuals with no radiographic evidence of maxillary sinusitis. The reason for such occurrence being is that AMO can develop due to closure defect of the maxillary sinus fontanelles.

Limitations and Future Prospectus

The maxillary sinus scans of the chennai population with limited sample size were used in this retrospective study to determine the overall prevalence of accessory maxillary ostium. The study sample should be drawn from around India and have a large sample size.

Prevalence Of Accessory Maxillary Ostium

AMO		
	Frequency	Percent
Present	39	39.0
Absent	61	61.0
Total	100	100.0

Comparison Between Mucosal Thickening With Amo

			AMO		Total
			Present	Absent	
Polypoidal thickening	Present	Count	7	7	14
		%	17.9%	11.5%	14.0%

	Absent	Count	32	54	86
		%	82.1%	88.5%	86.0%
Total		Count	39	61	100
		%	100.0%	100.0%	100.0%

Comparison Between Polypoidalthickening With Amo

			AMO		Total
			Present	Absent	
Mucosal thickening	Present	Count	21	5	26
		%	53.8%	8.2%	26.0%
	Absent	Count	18	56	74
		%	46.2%	91.8%	74.0%
Total		Count	39	61	100
		%	100.0%	100.0%	100.0%

Comparison Between Sinus Opacification With Amo

			AMO		Total
			Present	Absent	
Sinus Opacification	Present	Count	4	4	8
		%	10.3%	6.6%	8.0%
	Absent	Count	35	57	92
		%	89.7%	93.4%	92.0%
Total		Count	39	61	100
		%	100.0%	100.0%	100.0%

Comparison Between Pathological Outcome With Amo

			AMO		Total
			Present	Absent	
Pathological outcome	Present	Count	31	13	44
		%	79.5%	21.3%	44.0%
	Absent	Count	8	48	56
		%	20.5%	78.7%	56.0%
Total		Count	39	61	100
		%	100.0%	100.0%	100.0%

CONCLUSION

In the current study, the frequency of accessory maxillary ostium in the sinus was 39%. This result indicates that there might have been an increased combination of mucosal thickening, polypoidal thickenings, accessory ostium that develop as complications following maxillary sinusitis. Further prospective studies specifically addressing prevalence of AMO with maxillary sinus pathologies would be needed to further assess its clinical relevance and also to analyse cause effect relationship of accessory maxillary ostium with maxillary sinusitis.

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Conflict of Interest

The authors declare no conflicts of interest.

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