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Research Article

PREVALENCE OF INCIDENTAL MAXILLARY SINUS PATHOLOGIES IN DENTAL PATIENTS: A RETROSPECTIVE CBCT STUDY

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ABSTRACT

Incidental findings are common in the maxillary sinus. Fewer studies have addressed the prevalence of maxillary sinus pathologies. These sinus abnormalities are benign, self limiting and usually go unnoticed in asymptomatic patients but are important for avoiding failures in future procedures involving maxillary sinus.

Aim: To assess the prevalence of incidental maxillary sinus pathologies on CBCT scans

Objectives: To categorize incidental findings based on the parameters- Age, gender, type of pathology and to increase the awareness of the reporting radiologists and dental practitioners with regards to the range of findings.

Materials and methods: Retrospective study was carried out using 271 CBCT scans for evaluation of maxillary sinus pathologies. The CBCT Scans were observed in the Coronal, Sagittal and Axial views, for evaluating radiopacities and mucosal thickening. Chi-square test was used for statistical analysis.

Results: Out of 271 scans, only 118 CBCT scans showed incidental maxillary sinus pathologic findings. Total prevalence of incidental pathologies was **43.54%** in the total scans examined.

Most prevalent incidental pathologic maxillary sinus findings in CBCT scans was Mucosal thickening in 74 (62%) (p -0.006) followed by Polypoidal thickening in 31 (26.3%)(p - 0.000). The difference in the frequency was observed to be statistically significant.

Conclusions: Based on our study, it can be concluded that the prevalence of incidental maxillary sinus pathologies is high in the dental patients. Pathological changes in the maxillary antrum can be easily identified on CBCT images. CBCT as a new 3D imaging modality could be of clinical value in screening for the maxillary sinus pathologies.

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INTRODUCTION

Maxillary sinus pathologies are commonly seen in patients with dental pathologies. Maxillary sinus can be evaluated on the panoramic radiograph, Water's view, computed tomography (CT), cone beam computed tomography (CBCT). The cone beam computed tomography (CBCT) is an advanced form of three dimensional imaging which was pioneered by [Mozzo et al. 1998](#) and [Aral et al 1999](#).

Dental implant site assessment, maxillofacial trauma, periapical, bony and inflammatory pathologies, endodontic lesions, sinus augmentation, impacted and supernumerary teeth and orthodontics are frequent indications for CBCT, wherein the area of maxillary sinus maybe within the imaging field. Incidental findings are common in the area of maxillary sinus.

The increase in use of CBCT by dentists and maxillofacial surgeons requires an assessment of the prevalence of incidental findings relevant for further evaluation.

AIM AND OBJECTIVES

The aim of the present study is to estimate the prevalence of incidental maxillary sinus pathologies on CBCT scans and to identify the frequency and type of these pathologies.

MATERIALS AND METHODS (STUDY DESIGN)

The study was approved by the Institutional Research Board (IRB) of the institute. The retrospective study included a total of 271 scans obtained at a private CBCT centre between November 2013 and July 2014. Consent was obtained from the private imaging centre to use and share the information from the scans for purposes of education, including teaching and research. The scans were obtained from Kodak CS 9300.

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Configuration of machine Kodak CS 9300. Software: Carestream kVp: 76-100 mA : 12 mA Rotation Time: 18.6 sec. FOV – Medium and Full Volume scans visualizing the sinuses were examined. Resolution ranging from 90 um to 300 um and slice thickness ranging from 0.09 mm to 0.3mm.

All the patients had been referred for CBCT diagnosis and treatment planning, which included dental implants, maxillofacial surgery, orthodontics, endodontics, periapical pathologies etc. Age, gender and indication/purpose for scanning were recorded.

Inclusion criteria

All CBCT scans visualizing the entire maxillary sinuses unilaterally or bilaterally with at least four of sinus surfaces (medial and lateral walls, anterior wall, posterior wall roof and floor) were included in the study sample.

Exclusion criteria

Patients under 12 years of age were excluded because of their incomplete sinus development.

Patients referred for a CBCT scan of the maxillary sinus because of sinus symptoms or suspected diseases. Images of low resolution quality and those in which the presence of metallic artifacts impaired sinus visualization were excluded from the study.

Criteria for recognizing pathologies: Radiopacities or any mucosal thickenings observed in the maxillary sinus.

Method of Data analysis

Data collected was sorted and categorized based on the incidental maxillary sinus pathologies. Percentage table used to present the data and chi-square test was applied for the statistical analysis.

RESULTS

Out of 271 scans, only 118 CBCT scans showed incidental maxillary sinus pathologic findings. Total prevalence of incidental pathologies was **43.54%** in the total scans examined.

In our study, maximum number of CBCT scans included in the study were indicated for implant site assessment 58 (49.15%), followed by Endodontics 32 (27.11%), Exodontia 13 (11.01%). Other indications were for periodontics, orthodontics, post implant assessment.

Age group ranged from 18 to 80 years, patients in the age group of 4th to 6th decade showed higher prevalence of maxillary sinus pathologic findings, which was observed to be statistically significant (p = 0.003). Out of the 118 patients with detected maxillary sinus pathologies 60 (50.84%) were males and 58 (49.15 %) were females. No gender predilection was observed for the occurrence of maxillary sinus pathologies. Among 118 scans with pathologic findings, 41.5 % scans showed pathologies on both the sides whereas the percentage of pathologies on the Right and Left side was 28.8 % each. The difference in frequency was statistically significant (p = 0.00). Table 1.

Most prevalent incidental pathologic maxillary sinus findings in CBCT scans was Mucosal thickening in 74 (62%) [Fig 1], followed by Polypoidal thickening in 31 (26.3%) [Fig 2],

Partial sinus opacification in 21 (17.8%), Total sinus opacification in 9 (7.6%), Perforations in 3 (2.5%), Calcifications in 2 (1.7%). Out of 118 CBCT scans, mucosal thickening was present in 74 (62.70%) and absent in 44 (37.30%). The difference in the frequency was statistically significant (p = 0.006). Table 1.

Out of 118 CBCT scans, polypoidal thickening was present in 31 (26.30 %) and absent in 87 (73.70%). The difference in the frequency was statistically significant (p = 0.000). Table 1.

Partial opacification of the sinus was present in 21 CBCT scans (26.30 %) and absent in 97 CBCT scans (73.70%). The difference in the frequency was statistically significant (p = 0.000). Table 1.

Table 1 Prevalence of Maxillary sinus pathologies

		Number	Percentage	P value*
Side	Right	34	28.8 %	0.000
	Left	34	28.8 %	
	Both	49	41.5 %	
Mucosal Thickening	Absent	44	37.3 %	0.006
	Present	74	62.7 %	
Polypoidal Thickening	Absent	87	73.7%	0.000
	Present	31	26.3 %	
Partial Opacification	Absent	97	82.2 %	0.000
	Present	21	17.8 %	
Total Opacification	Absent	109	92.4 %	0.000
	Present	09	7.6 %	
Perforation	Absent	115	97.5 %	0.000
	Present	03	2.5 %	
Calcification	Absent	116	98.3%	0.000
	Present	02	1.7 %	

*Chi square test applied for statistical analysis

Total opacification of the sinus was present in 9 CBCT scans (7.6 %) and absent in 97 CBCT scans (92.40 %). The difference in the frequency was statistically significant (p = 0.000).

Out of 118 CBCT scans, perforation of the floor of the maxillary sinus was observed in 3 (2.50 %) and absent in 115 (97.50%). The difference in the frequency was statistically significant (p = 0.000).

Calcifications in the sinus was present in 2 CBCT scans (1.7 %) and absent in 116 CBCT scans (98.30 %). The difference in the frequency was statistically significant (p = 0.000). Table1.

DISCUSSION

Incidental findings are defined as any or all discovered findings that are unrelated to the clinical indication for imaging being performed. Their identification may have significance in diagnosis and treatment planning. For effective identification of such incidental maxillary sinus findings, it is important for users of CBCT to be familiar with their prevalence. Therefore, the purpose of the present study is to retrospectively to identify the maxillary sinus pathologies and to determine the prevalence of these findings.

In the present study, 271 CBCT scans were retrospectively evaluated for incidental pathologic findings in the maxillary sinus. The present study showed a prevalence of 43.54% of maxillary sinus pathologies which was similar to the study Pazerra and Gracco.^{1,2} Higher prevalence was reported by

Ritter and Rege who had prevalence of 56.3% and 68.2% respectively.^{3,4}

Based on the results of our study, there was no gender predilection in the study population for the prevalence of pathologic findings in the maxillary sinus. However, the study results are in contrast to some previous studies which have found a higher frequency of pathologic findings in males. Raghav *et al* and Rege *et al* have observed statistical difference between the genders for the prevalence of maxillary sinus pathologies.^{3,4}

Age group of the study population ranged from 18 to 80 years, patients in the age group of 4th to 6th decade showed higher prevalence of maxillary sinus pathologic findings, the difference in the frequency was observed to be statistically significant. Our study results are in concordance with observations of Gracco *et al* who have reported that patients in the age group of 41 to 60 years have the highest risk for maxillary sinus pathologies.² Raghav *et al* have found that the patients in 3rd to 5th decade showed higher prevalence of maxillary sinus pathologic findings. There was no statistical significance for the prevalence of maxillary sinus pathologic findings in the different age groups as observed by Rege I *et al* and Dobele I.⁴

In our study, maximum number of CBCT scans included in the study were indicated for implant site assessment 58 (49.15%) followed by Endodontics 32 (27.11%), Exodontia 13 (11.01%). Other indications were for periodontics, orthodontics, post implant assessment.

Most prevalent finding in our study population was Mucosal thickening followed by Polypoidal thickening, Sinus Opacifications [Fig 1 to Fig 4]. Mucosal thickening was the most common pathologic finding in our study [Fig 1]. Similar observation was seen in study conducted by Ritter and Raghav *et al*.^{3,5}

Mucosal thickenings are inflammatory changes in the maxillary sinus, they may be caused due various etiologies most commonly related to dental infections as the maxillary teeth are in close proximity to the floor of maxillary sinus. Other reasons could be due to allergy, trauma microbial infections. These could manifest in the maxillary sinus as linear mucosal thickening which may progress to partial and total opacification.^{6,7}

Present study showed that findings were equally seen in the right and left maxillary sinuses which is in concordance with previously reported studies. Differences in the prevalence found in the present study compared with other reported studies can be explained by certain factors. Different age and patient groups, definitions for pathologic changes and its classification varies, various imaging modalities explaining the range of pathologic findings prevalence.

Though in our study we have not been able to co-relate it with the symptoms of patients. Most of the patients were found to be asymptomatic for maxillary sinus pathology. Multiplanar images are available in CBCT which makes it easier to analyse all the surfaces of the maxillary sinus and found to be very useful diagnostic tool and be used in the initial evaluation of the maxillary sinus. So the dental surgeon needs to be well aware of these incidental findings especially when it comes to

planning for implant placement, sinus graft procedures which may result in failure of procedures if underlying pathologies are not diagnosed.

Although incidental, maxillary sinus pathologies were main focus of our study, there were certain shortcomings because various studies have different parameters for assessment of these pathologies and also no standardization protocol. Therefore, there will be wide variations in the results by different researchers. Also there is no differentiation between the nature of fluid in the sinus as blood, mucous or pus appear same in the images.

The etiology of Maxillary sinus pathology is multi-factorial. A multidisciplinary approach involving the dentist, oral and maxillofacial surgeon, Ear Nose and Throat (ENT) specialist, pulmonologist, allergy experts and the radiologist may be required in the diagnosis and management of significant maxillary sinus findings.^{8,9} Pathological changes in the maxillary antrum can be easily identified on CBCT images. CBCT could be applied in the initial evaluation of the maxillary sinus due to its low cost and less radiation as compared to CT scan.¹⁰

Based on our study, it can be concluded that the prevalence of incidental maxillary sinus pathologies is high in the asymptomatic dental patients. Therefore, oral radiologists, dentists, medical practitioners, maxillofacial and ENT surgeons should be aware of these incidental sinus pathologies. A comprehensive radiological examination of the entire CBCT volume helps clinician in early diagnosis, to make appropriate referrals, treatment planning and follow-up of the patient.

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