

Incidence of Maxillary Sinus Abnormalities in Asymptomatic Patients: A CBCT Study.

Abstract:

Background: Cone beam computer tomography (CBCT) when imaged for maxillary jaw generally depicts maxillary sinus. This region is frequently neglected by dentist and maxillofacial radiologist. Signs and symptoms in odontogenic diseases of the jaw and the maxillary sinus may overlap each other. A dental surgeon primarily encounters these lesions in routine dental radiographs..

Aim: The present study was undertaken to evaluate the occurrence of maxillary sinus anomalies in CBCT images of asymptomatic patients and to determine their prevalence, type and location.

Materials and methods: Study consisted of 256 CBCT images of the patients depicting maxillary sinus who has been advised limited volume CBCT as part of routine dental investigation for implant planning, orthodontic assessment, oral surgical procedure, oral pathology etc..The CBCT images were scrutinized for various maxillary sinus pathologies like mucosal thickening, opacification, polyp and retention pseudocyst

Result: Out of 236 subjects, 106 (44.9%) presented with maxillary sinus abnormalities. The maxillary sinus abnormalities which were found in the study were as follows, mucosal thickening 60 (25.4%), opacification 32 (13.6%), sinus polyp 8 (3.4%) and retention pseudocyst 6 (2.5%).Right maxillary sinus were involved in 58 (24.6%) cases and left in 44 (18.6%) cases respectively, whereas bilateral sinus involvement was seen in 4 (1.7%) cases.

Conclusion: The results are suggestive of high incidence of abnormalities in asymptomatic maxillary sinus. Thus a prompt recognition of these abnormalities by dental surgeons and referral to specialist may help in treating these diseases at an early stage.

Keyword: CBCT, maxillary sinus, incidental findings.

Introduction:

Maxillary sinuses always remain a concern for dental surgeons because of their location adjacent to the tooth structures. The maxillary sinus was first described by Nathaniel Highmore in 1651; hence it is also named as Antrum of Highmore. [1] There are four pairs of paranasal sinuses that are named according to the bone in which they are located; i.e. maxillary, frontal, sphenoid and ethmoid sinuses. Maxillary sinus is the first to develop among these sinuses and increases in size up to 20 years of age and coincides with the eruption of third molars [2] Cone beam computed tomography (CBCT) was originally developed to reduce artifacts in cardiac angiography in 1982 and recently it has been used enthusiastically in maxillofacial radiology too. As the name signifies, CBCT is a modification of Computed Tomography, which utilizes a cone-shaped source of x-ray and an area array detector fixed on a rotating gantry to acquire multiple sequential lateral projection, in a complete scan around the area of interest. [3] CBCT is known

by different names including Dental Volume Tomography, Cone Beam Volumetric Tomography (CBVT), Digital Volume Tomography (DVT), Dental Computed Tomography, Cone Beam Imaging and Cone Beam 3D Imaging. Due to isotropic nature of voxels, CBCT provides high definition,

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Received : 20 August, 2021, **Published :** 31 December 2021

| Access this article online | |
|---|---|
| Website: www.ujds.in | Quick Response Code  |
| DOI: https://doi.org/10.21276/ujds.2021.7.3.7 | |

How to cite this article: Choudhary, A. Choudhary, Kesarwani, P., K. S., VERMA, S., VERMA, S., & KUMAR, A. (2021). Incidence of Maxillary Sinus Abnormalities in Asymptomatic Patients: A CBCT Study . UNIVERSITY JOURNAL OF DENTAL SCIENCES, 7(3).

three dimensional digital data and precise anatomical information of all the oral and maxillofacial structures.[3] CBCT has an added advantage over conventional CT, as it causes less radiation exposure and is more economical to the patient.[4]

While imaging the maxillary jaw for routine dental procedures like implant site analysis, maxillofacial trauma, orthodontics or regarding any oral pathology using CBCT, the maxillary sinuses are visible within the imaging field.[5] The diseases of the maxillary sinus usually arise from the lining wall, the dental and oral tissues, or from the adjacent bone encroaching the sinus.[6] Most of these changes are asymptomatic in the initial stages and are left untreated, unaware of the future consequences.[5]

A dental surgeon routinely encounters such CBCT with incidental findings in maxillary sinus. The comprehensive radiologic examination of the maxillary sinus combined with the clinical examination, may help in formulating further treatment options or referral to a specialist. Hence, the present retrospective study was carried out to find the prevalence of these lesions.

Methodology:

The study was done using 236 CBCT images portraying the maxillary sinus, retrieved from the archives of the Department of Oral Medicine and Maxillofacial Radiology, Hazaribagh College of Dental Sciences and Hospital. The images selected for the study were of patients age ranging between 18 -70 years, who had been referred for CBCT imaging regarding various dental procedures like dental implants, maxillofacial surgery, orthodontics, endodontics, oral pathology, etc.

The scans of patients with asymptomatic sinus involvement were included in the study while the patients who presented with maxillary sinus related symptoms were excluded from the study. The scans which showed the maxillary sinus completely were selected for the study. All the necessary protocols were followed namely ethical committee approval and written informed consent for usage of scan data.

The CBCT machine which was used in the study was Cranex 3D CBCT Machine (Soredex, Finland) with largest field of view of (6cm X 8 cm). A third party software On Demand 3DTM Dental Software Version 5.2 (Cybermed Inc., Finland) was used to reformat the images.

Orthogonal reformation views (axial, coronal and sagittal) were utilized to examine the maxillary sinus. The radiographic appearances of maxillary sinus in CBCT were considered abnormal in cases if there was any (1) changes in cortical lining (2) partial or complete haziness and (3) mucosal thickening greater than 3mm. Changes in both the right and left maxillary sinuses were observed independently for each patient. The findings noted were broadly classified into 1) Mucosal thickening 2) Opacification, 3) Sinus polyp and 4) Retention pseudocysts (Fig.1).

The data obtained was sent for statistical analysis using chi square test. Intergroup comparison was performed using Kappa statistics. SPSS Software version-20 (2016) was used for statistical analysis.

Results:

The CBCT images of 236 subjects were used in study out of which 106 patients (44.9%) presented with maxillary sinus abnormalities (68 males and 38 females).

In the present study mucosal thickening was reported in 60 (25.4%), opacification in 32 (13.6%), sinus polyp in 8 (3.4%) and retention pseudocyst observed in 6 (2.5%) cases. (Table-1, Figure-1) Involvement of right and left maxillary sinus was reported in 58 (24.6%) and 44 (18.6%) cases respectively and both the sinuses were involved in 4 (1.7%) cases. (Table 2)

In males, mucosal hypertrophy was observed in 40 (16.9%), opacification in 18 (7.6%), sinus polyp in 4 (1.7%) and retention pseudocyst in 6 (2.5%) cases respectively. In females, mucosal thickening was reported in 20 (8.5%), opacification in 14 (5.9%) and sinus polyp in 4 (1.7%) cases. (Table 3)

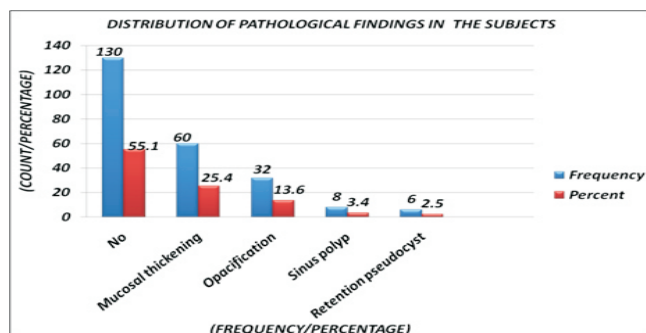
Table 1: Distribution of maxillary sinus abnormalities in the patients.

| Types of sinus abnormality | Frequency | Percentage % |
|----------------------------|-----------|--------------|
| Absent | 130 | 55 |
| Mucosal thickening | 60 | 26 |
| Opacification | 32 | 13.6 |
| Sinus polyp | 8 | 3.4 |
| Retention cyst | 6 | 2.5 |
| Total | 360 | 100 |

Table 2: Comparison of maxillary sinus abnormalities on the basis of the side of occurrence.

| Side | Frequency | Percentage % |
|------------|-----------|--------------|
| Absent | 130 | 55.1 |
| Right side | 58 | 24.6 |
| Left side | 44 | 18.6 |
| Both side | 4 | 1.7 |
| Total | 236 | 100 |

Table 3: Comparison of maxillary sinus abnormalities on the basis of gender.



Graph 1: Distribution of maxillary sinus abnormalities in the patients.

| Gender | Findings | Frequency | Chi square | Degree of freedom(df) | P value |
|--------|----------------------|-----------|------------|-----------------------|---------|
| Male | Absent | 76(52.8%) | 153.239 | 12 | 0.00 |
| | Mucosal thickening | 40(27.8%) | | | |
| | Opacification | 18(12.5%) | | | |
| | Sinus polyp | 4(2.8%) | | | |
| | Retention pseudocyst | 6(4.2%) | | | |
| | Total | 144(100%) | | | |
| Female | Absent | 54(58.7%) | 98.808 | 6 | 0.00 |
| | Mucosal thickening | 20(21.7%) | | | |
| | Opacification | 14(15.2%) | | | |
| | Sinus polyp | 4(4.3%) | | | |
| | Retention pseudocyst | 0(0%) | | | |
| | Total | 92(100%) | | | |

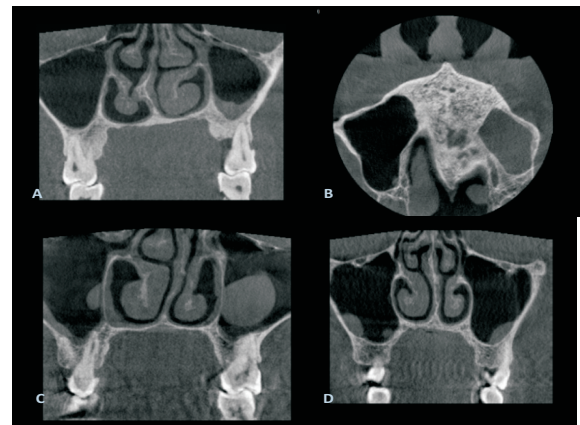


Figure : CBCT images showing A) Sinus mucosa thickening B) Opacification C) Polyp D) Retention pseudocyst

Discussion:

In the present study, after in depth evaluation of the entire volume of every CBCT image, including the maxillary sinuses and the surrounding landmarks, a high prevalence of incidental abnormalities were observed in CBCT images.

CBCT is one of the recent advancement in the field of oral and maxillofacial radiology. The dentist should be familiar with the detail anatomy of maxillofacial region including sinuses and nasal region because symptoms of pathologies of odontogenic origin and those arising in the maxillary sinus overlap each other.

The CBCT examination of maxilla is commonly advocated for procedures like sinus lift, implant placement, orthodontics, maxillofacial trauma, endodontic treatment etc. Some times incidental findings such as mucosal thickening can result in sinus overflow obstruction and alter the treatment plan.[5]

The abnormalities in maxillary sinus have been investigated in past using CT and CBCT scans. The frequency of these abnormalities reported varied from 24.6% to 56.3% in CBCT [7, 8] and around 30% in case of CT scan. [9, 10]

In the present study, incidental abnormalities were observed in 43.2% of the cases, which were in agreement with studies of Havas et al. 42.5%, Glacier et al. 46.8%, Beaumont et al. 40%, and Drumond et al. 41.57%. [10-13]

In our study the mucosal thickening was observed to be the most common finding (25.4%), which was in accordance with previous studies in literature, Drumond et al. (21.25%), Christopher et al. (16.8%) and Valloet et al. 19%. [13-15] In contradiction, Regeet et al. reported 66% of cases with mucosal thickening as a prominent finding. [16]

The etiology for such lesions can be either traumatic, infectious or allergic. Among them, the incidence of mucosal thickening is most common in allergic rhinitis. Various pathologies of odontogenic origin like periapical and periodontal abscess, lesions associated with impacted tooth, oro-antral fistula etc. may secondarily manifest as thickening of the mucosal lining. [15] The dissimilarity in the results may be attributed due to difference in imaging modality used, population addressed, sample size and characterization of abnormality.

Opacification or cloudiness was the next frequent finding reported (13.6%) which generally arises either due to infection or sinusitis. Sometimes opacification can also be visualized in mechanical trauma, barotraumas and hemorrhage. [17]

The mucous retention cysts and antrochoanal polyps usually manifest as a polypoid lesion in the sinus. The mucous retention cysts often appear as dome-shaped opacities in the maxillary sinus walls, which may be result of obstruction of mucous glands opening.

In the present study the occurrence of sinus polyp and retention pseudocyst 3.4% and 2.5% respectively which was in accordance with studies done by Christopher et al. (7.6%) and Regeet et al. (5.6%). [15,16] Whereas, retention pseudocyst was reported as 29%, 7% and 10.1% by Beaumont et al., Valloet et al. and Regeet et al. respectively [12,15,16] Discrepancies in

abnormality may be due to several factors, such as variations in image interpretation and diagnostic criteria, influence of the climatic condition in different geographical location and variation in working environment.

Inferior wall of the maxillary sinus was most commonly involved (left 42%, and right 40%). Similar findings were seen in studies by Regeet et al. which may be attributed commonly due to odontogenic sinusitis. [15]

In the current study, the prevalence of abnormality was more in male subjects with 45.1% which may be accredited to the fact that males are more exposed to outdoor antigens and also because the number of male subjects were more in the study. [15, 16]

Limitations of the study: In this study only benign mucosal lesions were considered, however changes in maxillary sinus associated with any malignancy and bony lesion were not considered. Further studies are required using a larger perspective of pathological lesions involving the maxillary sinus along with their CT characterization of lesion are required.

Conclusion:

A high prevalence of incidental findings in maxillary sinus of asymptomatic patients were observed. Oral radiologists should comprehensively view the whole volume of CBCT to evaluate these incidental findings and investigate the underlying disease process. This study also highlights use of CBCT as a potential imaging modality for paranasal sinuses. A dental surgeon primarily encounters these lesions during routine CBCT examination, a prompt acknowledgement of these lesions for any treatment modification and cross referral to specialist may be helpful for patient. The study also highlights the importance of inclusion of the entire CBCT landmarks including the maxillary sinus, the surrounding structures and the soft tissues in the UG curriculum of Oral and Maxillofacial Radiology.

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