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Assessment Of the Role of Cone Beam Computed Tomography in Diagnosing Space Occupying Lesions in Maxillary Sinus

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ABSTRACT

Introduction: Cone Beam Computed Tomography (CBCT) is an advanced imaging modality with high clinical applications and represents a radical change for dental and maxillofacial radiology. It can visualize 3D structures and can provide precise information about complex anatomical structures.The aim of the study is to assess the role of CBCT in diagnosing space occupying lesions in maxillary sinus.

Methodology: A retrospective CBCT images were collected that were taken from 2021-2022.A total of 250 CBCT images were evaluated. The results obtained were processed using SPSS software and descriptive statistical analysis was made.

Results: The frequency of space occupying lesions observed in our study were mucosal thickening (66.0%), mucous retention cysts (10.1%) , antral polyps(5.6%) and mucormycosis (3.2%).

Conclusion: Mucosal thickening was the most frequently observed abnormality (66.0%). The incidental maxillary sinus abnormalities are highly prevalent in the asymptomatic dental patients,hence oral radiologists should be aware of these incidental findings and comprehensively evaluate the entire captured CBCT volume, which can help in early diagnosis, treatment and follow-up of the patient.

Keywords: *Cone Beam Computed Tomography, Space occupying lesions, maxillary sinus*

INTRODUCTION

Cone Beam Computed Tomography (CBCT) is an advanced imaging modality with high clinical applications and represents a radical change for dental and maxillofacial radiology. It can visualize 3D structures and can provide precise information about complex anatomical structures.[1]CBCT can precisely visualize teeth and surrounding anatomical structures with high resolution, despite the lower radiation dose levels than standard multi-detector CT.[2,3]

CBCT has numerous significant applications in dentistry, including bone valuation for placement of dental implants, orthodontic treatment planning, assessment of the temporomandibular joints for deteriorating osseous changes, estimation of the impacted teeth prior to extraction, and valuation for signs of infection, cysts and tumors, dentoalveolar trauma, cleft lip, cleft palate and endodontic review.[4] CBCT drawback consists of beam hardening and scatter from dental materials and little soft-tissue contrast.[5]Although CBCT units produce a higher radiation dose than one would receive from a single traditional dental radiograph, the radiation dose delivered typically is less than that produced during a medical computed tomographic scan.[6] The device used, x-ray energy and filtration, tolerance for image noise and motion artifacts, followed by the size of imaging area (field of view) that is used to obtain volumetric data all of these vary the radiation doses of CBCT.[2] On comparison with conventional CT, CBCT is cost effective, have rapid scan time, limit the beam to the head and neck, reduced radiation and multiplanar reformation, making them more suitable for use in dental practices.

The anatomical variations of the maxillary sinus usually seen are the presence of pneumatization and septa, mucosal thickening, fluid retention, bone thickening, and sinus opacification related to the occurrence of maxillary sinusitis, discontinuity of the sinus related to perforations between the maxilla and sinus, and space occupying lesions (SOLs) such as retention cysts, polyps, and tumors.[7] CBCT scans typically cover a field of view larger than the practitioner's area of expertise. [8]This leads to the possibility of overlooking incidental findings outside these regions of interest, even though the practitioner is responsible for evaluating the entire volume for pathology. Such findings may be significant and warrant further investigation. The aim of the study is to assess the role of CBCT in diagnosing space occupying lesions in maxillary sinus.Our team has extensive knowledge and research experience that has translated into high quality publications.[9–21]

METHODOLOGY

A retrospective study was conducted in the Department of Radiology at Saveetha Dental College from September 2021 to June 2022.The college database was reviewed.A total of 250 CBCT images were evaluated.The retrieved data was then collected and formulated into an excel sheet and imported into SPSS software. Frequency distribution using bar graphs and descriptive statistical analysis was made.

RESULTS

TABLE 1: Table showing the frequency distribution of space occupying lesions in maxillary sinus in CBCT.

S.NO	Space occupying lesions	Right side(%)	Left side(%)	Total
1)	Mucosal thickening	33.2%	32.8%	66.0%
2)	Mucous retention cysts	3.8%	6.3%	10.1%
3)	Antral polyps	3.8%	1.8%	5.6%
4)	Mucormycosis	1.8%	1.4%	3.2%

The retrieved CBCT images were evaluated to assess space occupying lesions in maxillary sinus.The frequency of space occupying lesions observed in our study were mucosal thickening (66.0%),mucous retention cysts (10.1%) , antral polyps(5.6%), mucormycosis (3.2%).The frequency of mucosal thickening in right maxillary sinus is 33.2 % and left maxillary sinus is 32.8%. The frequency of mucous retention cysts in the right maxillary sinus is 3.8% and left maxillary sinus is 6.3%. The frequency of antral polyps in the right maxillary sinus is 3.8% and left maxillary sinus is 1.8%. The frequency of

mucormycosis in the right maxillary sinus is 1.8% and left maxillary sinus is 1.4% .

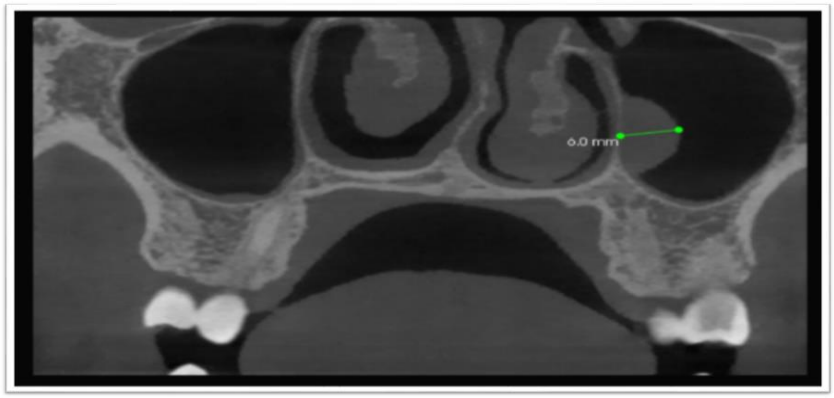

FIGURE 1 : Coronal section of the antral polyp on the left maxillary sinus.

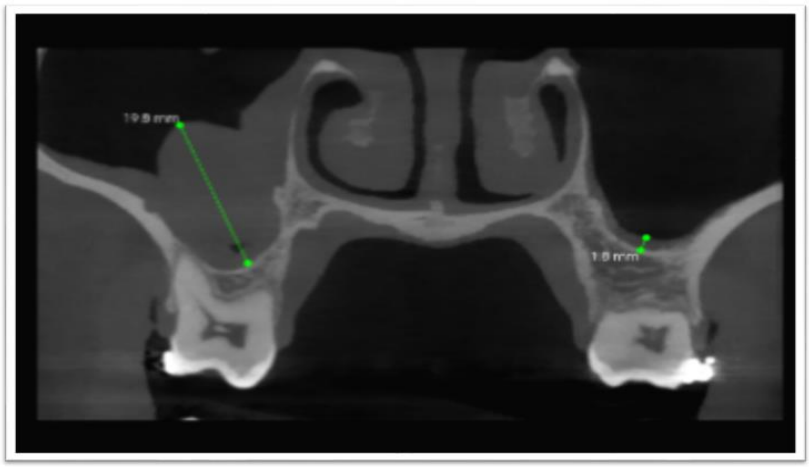

FIGURE 2: Coronal section of mucosal thickening on the right maxillary sinus.

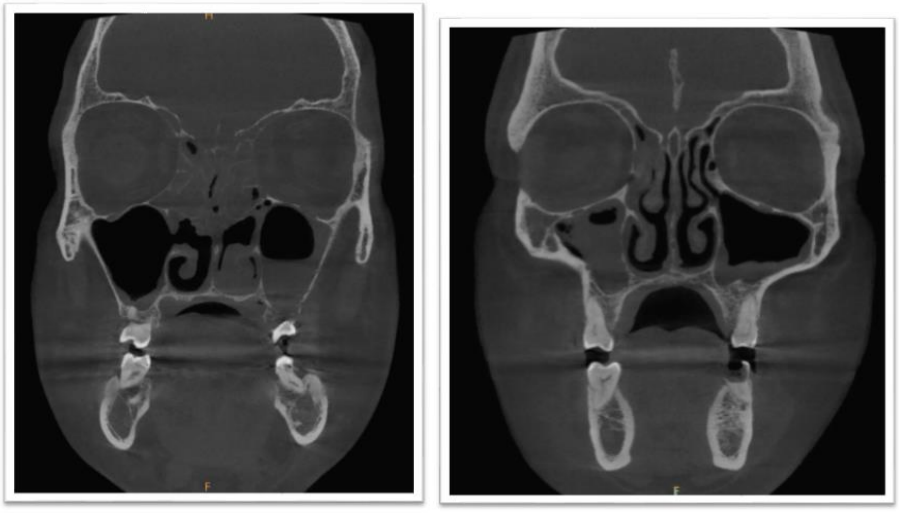

FIGURE 3: Coronal sections of mucormycosis on left and right maxillary sinuses respectively.

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DISCUSSION

Cone-beam computed tomography (CBCT) is a noninvasive technique that facilitates a comprehensive investigation of both the external and the internal anatomy of the structures from different angles obtained by reconstruction of images in three planes to acquire three-dimensional (3D) images.[3,22]Diagnosing lesions in the maxillary sinus should be precisely and fully done to assess bone quality, bone quantity, and anatomical complexity before treatment planning.[7] It is very important to pay attention to imaging of the maxillary sinus.[23]The diagnosis is often made accidentally when images of the area are obtained for other purposes.[24]

Our study results showed that frequency of space occupying lesions observed in our study were mucosal thickening (66.0%),mucous retention cysts (10.1%) , antral polyps(5.6%), mucormycosis (3.2%).The frequency of mucosal thickening in right maxillary sinus is 33.2 % and left maxillary sinus is 32.8%. The frequency of mucous retention cysts in the right maxillary sinus is 3.8% and left maxillary sinus is 6.3%. The frequency of antral polyps in the right maxillary sinus is 3.8% and left maxillary sinus is 1.8%. The frequency of mucormycosis in the right maxillary sinus is 1.8% and left maxillary sinus is 1.4%.According to Som, sinus mucosa in normal conditions should not be evident and its thickening would be considered pathological.[25]Other authors defined a significant thickening of the sinus mucosa to be normal.[24,26] Rak et al. stated that a mucosal thickening > 3 mm can be detected in an asymptomatic patient , while Phothikhun et al. concluded that a 5mm thickness in many cases is not accompanied by clinical manifestations.[27] Mucosal thickening was evaluated by measuring the distance between the mucosal interface and the inner bony margins of the maxillary sinus.[28] The sinus pathology was considered when the mucosal thickening was more than 3 mm.[29] Any dome shaped radiopacity in the maxillary sinus was considered as antral polyp.[30]Among the 250 CBCT images, mucosal thickening is the most frequently observed space occupying lesion followed by mucous retention cysts.The literature has reported that about 25% of CBCT images taken for orthodontics and other dental purposes show incidental findings.[31]The limitation of this study is that the sample size was not large, and the subjects were all patients in a private dental office.

It can be inferred that the frequency of incidental maxillary sinus pathologies in asymptomatic patients is high.[32] The reason is unclear, but the proximity of dental structures to paranasal sinuses might be related to the high incidence. [33]The association between the periapical pathology and type of maxillary sinus abnormality is still not proven. The detection of incidental maxillary sinus pathologies can also help in early diagnosis and treatment and the patient can be further followed-up for the development and progress of the disease.

CONCLUSION

Mucosal thickening was the most frequently observed abnormality (66.0%). Mucous retention cysts were the second most frequently observed abnormality (10.1%).The high occurrence of abnormalities in asymptomatic maxillary sinus emphasizes how important it is for the dentomaxillofacial radiologist to undertake a comprehensive interpretation of the whole volume acquired in CBCT images including the entire maxillary sinus when analyzing the imaging exams of routine patients and make suitable recommendations.

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