Section: OMFS

OriginalResearchArticle

PREVALENCE AND CLINICOPATHOLOGICAL FEATURES OF MAXILLARY SINUS DISEASE

Jasbinder Kumar[1], Ramandeep Singh Brar[2], Gursimrat Brar[3], Jasmine[4], Ramandeep Grewal[5], Robin K Mathew[6]

[1]*Associate Professor, Department of Oral & Maxillofacial Surgery, DIRDS, Faridkot.*
[2]*Professor and Head, Department of Oral & Maxillofacial Surgery, DIRDS, Faridkot.*
[3]*Professor, Department of Oral & Maxillofacial Surgery, DIRDS, Faridkot.*
[4]*Associate Professor, Department of Oral & Maxillofacial Surgery, DIRDS, Faridkot.*
[5]*Associate Professor, Department of Oral & Maxillofacial Surgery, DIRDS, Faridkot.*
[6]*Post-Graduate, Department of Oral & Maxillofacial Surgery, DIRDS, Faridkot.*

Received *: 04/08/2026*
Received in revised form *: 01/09/2026*
Accepted *: 13/09/2026*

Corresponding Author:
Dr. Jasbinder Kumar,
Associate Professor, Department of Oral & Maxillofacial Surgery, DIRDS, Faridkot
Email: jasbinderk068@gmail.com

DOI: 10.70034/ijmedph.2026.3.798

Source of Support: Nil,
Conflict of Interest: None declared

Int J Med Pub Health
2026; 16 (3); 5164-5171

ABSTRACT

Background: The requirement of CBCT has been increased considerably since last few years in dentistry and maxillofacial fields. CBCT imaging has overcome the limitations associated with to D imaging, provides high quality images and also ensure short scanning duration and reduce radiation exposure. The aim of the study is to find the prevalence of maxillary sinus disease using the Cone beam computed tomography (CBCT).

Materials and Methods: This study was conducted in the department of OMFS over a period of one year. The size of the sample was 130 patients who had sign and symptoms of maxillary sinus pathology and had been advised CBCT images. Data were collected using a data collection sheet, including the participant demographic information, dental scan indications, CBCT findings. The diseases of maxillary sinus were diagnosed using three CBCT slice views (axial, coronal and sagittal). The diseases were classified as: Mucosal thickening, Polyp, Complete Opacification, Partial opacification and Antrolith.

Results: Among the CBCT findings in the study subjects, partial opacification was the most common abnormality, reported in 46 participant (35.4%). Mucosal thickening was the second most frequent abnormality, observed in 35 participants (26.9%), followed by complete opacification in 24 participants (18.5%). Polyps were seen in 19 participants (14.6%), while antroliths were the least common finding, present in 6 participants (4.6%).

Conclusion: CBCT is a favourable imaging modality for evaluating the maxillary sinus anatomy and associated pathologies. This study highlights the prevalence of various maxillary sinus abnormalities detected on CBCT scans. Therefore, oral and maxillofacial radiologists should comprehensively evaluate CBCT images and remain aware of maxillary sinus abnormalities to facilitate their early detection, appropriate treatment and followup.

Keywords: CBCT; Sinus abnormalities; Maxillary sinus pathology; Maxillary sinus.

INTRODUCTION

Maxillary sinus is a pyramid shape cavity with its base near the nasal wall and apex pointing to the zygomatic process of maxilla. It contains an ostium which is situated toward the cranial side and which connect it to the middle meatus of nasal cavity which helps in its drainage .[1] It is the largest air sinus located in the body of the maxilla on both sides. It measures approximately 8 x 4 mm at birth.[2]It develops at the third month of intrauterine life between the oral cavity and the floor of the orbit. During development evagination of the mucous membrane occurs from the lateral wall of nasal cavity.

Maxillary sinus growth is proportional to growth of the facial bones. The first phase occurs during first three years of life. The second phase of growth

occurs during 6 - 12 years with lateral extension to the zygomatic process of maxilla and inferior extension to the level of hard palate. Subsequently sinus expansion during the third phase comes from pneumatization of maxillary alveolus as the permanent molar and premolar teeth erupt displacing the floor of the sinus 4 - 5 mm below the floor of the nasal cavity.[3,4] Dimension of adult maxillary sinus is 38 – 45 mm in length, 25-35 mm in width and 36 – 45 mm in height. The average maxillary sinus volume is 150 cubic mm with a range of 100 – 250 cubic mm.[5,6]

Abnormalities of the maxillary sinus can be grouped as: Mucosal thickening, Chronic sinusitis, Odontogenic sinusitis, Neoplasms, Foreign bodies, Oroantral fistula. Prior to any surgical intervention on the maxillary sinus it is important to diagnose it using diagnostic imaging techniques, by performing a clinical radiological study.[7]In many cases, the histopathological study is important in determining a definitive diagnosis for a correct therapeutic approach.[8]

The use of CBCT has been increased in dentistry and maxillofacial fields. CBCT imaging has overcome the limitations associated with to dimaging provides high quality images and also ensure short scaning duration and reduce radiation exposure.

The aim of the study is to find the prevalence of maxillary sinus disease using the Cone beam computed tomography (CBCT).

MATERIALS AND METHODS

Ethical approval from Institutional ethical committee of Dasmesh Institute of Research and Dental Science, Faridkot has been taken before the commencement of study.

This cross sectional study was conducted in the department of OMFS over a period of one year. The size of the sample was 130 patients who had sign and symptoms of maxillary sinus pathology and had been advised CBCT images. Informed, written consent was obtained from each patient, prior to imaging, including a clause for using the image for research purpose. Data were collected using a data collection sheet, including the participant demographic imfomation, dental scan indications, CBCT findings.

Inclusion Criteria

1. Patient who have sign and symptom of maxillary sinus pathology.
2. Patients having age greater than 12 years.

Exclusion Criteria

1. Patients with lesions localized in a region other than maxillary sinus.
2. Lesions which affect the maxillary sinus due to loco – regional spreading.
3. Relapse of previously diagnosed and treated lesions.
4. Patients having age less than 12 years.

Maxillary sinus abnormalities were diagnosed using three CBCT slice views (axial, coronal and sagittal). The abnormalities had been classified as:

1) Mucosal thickening
2) Polyp
3) Complete Opacification
4) Partial opacification
5) Antrolith

The wall of the maxillary sinus that was affected was also recorded as anterior, posterior, upper, lower, lateral or medial and right or left side.

Statistical Analysis

The data for the present study was entered in the Microsoft Excel 2007 and analyzed using the SPSS statistical software 23.0 Version. The descriptive statistics included frequency and percentage. The level of the significance for the present study was fixed at 5%.

The ordinal and nominal variable will be compared using Chi Square test The Shapiro–Wilk test was used to investigate the distribution of the data and Levene's test to explore the homogeneity of the variables.

Mean

$$\overline{X} = \frac{\Sigma X}{N}$$

Where:
$\overline{X}$ = the data set mean
$\sum$ = the sum of
X = the scores in the distribution
N = the number of scores in the distribution

Range

$$range = X_{highest} - X_{lowest}$$

Where:
$X_{highest}$ = largest score
X_{lowest} = smallest score

Variance

$$SD^2 = \frac{\Sigma(X - \overline{X})^2}{N}$$

The simplified variance formula

$$SD^2 = \frac{\Sigma X^2 - \frac{(\Sigma X)^2}{N}}{N}$$

Where:
SD^2 = the variance
$\sum$ = the sum of
X = the obtained score
$\overline{X}$ = the mean score of the data
N = the number of scores

Standard Deviation (N)

$$SD = \sqrt{\frac{\Sigma(X - \overline{X})^2}{N}}$$

The simplified standard deviation formula.

RESULTS

Figure 1: CBCT showing partial opacification of maxillary sinus

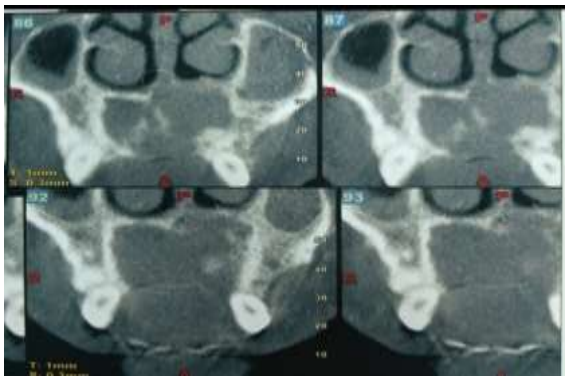

Figure 2: CBCT showing mucosal thickening of maxillary sinus

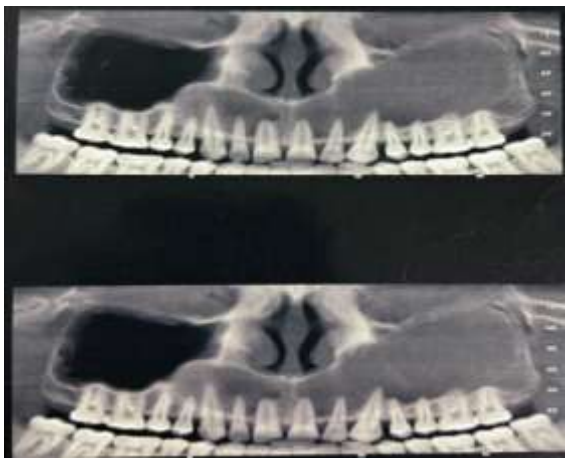

Figure 3: CBCT showing complete opacification of maxillary sinus

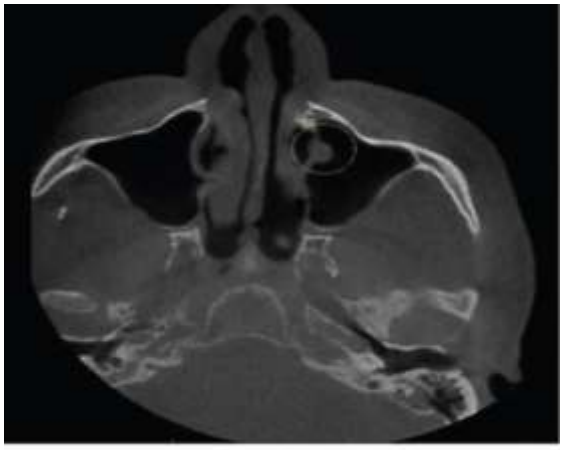

Figure 4: CBCT showing polyp on axial view in maxillary sinus

Table 1:Age DistributionAmong Study Subjects

Variable	N	Minimum	Maximum	Mean	Standard Deviation
Age (years)	130	20.00	80.00	57.86	11.68

This study included 130 study subjects with an age range of 20 to 80 years. The mean age of the participants was 57.86 ± 11.68 years, indicating that the majority of subjects belonged to the middle- to older-age group.

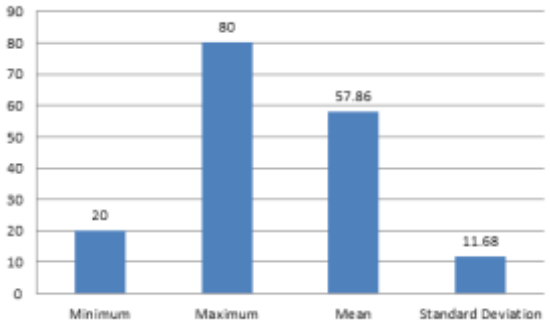

Figure 5

Table 2: Gender Distribution Among Study Subjects

Gender	Frequency (n)	Percentage (%)
Female	96	73.8
Male	34	26.2
Total	130	100.0

Among the 130 study subjects, females patients were in majority with 96 participants (73.8%), while males accounted for 34 participants (26.2%). This indicates a female predominance in the study sample.

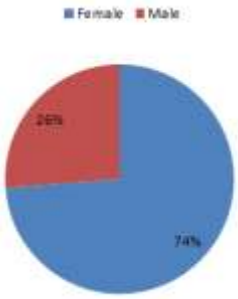

Figure 6

Table 3: Side DistributionAmong Study Subjects

Side Involved	Frequency (n)	Percentage (%)
Left Side	78	60.0
Right Side	41	31.5
Bilateral	11	8.5
Total	130	100.0

Among the 130 study subjects, left-sided involvement wasmost commonfinding, reported in 78 participants (60.0%). Right-sided involvement was observed in 41 participants (31.5%), while bilateral involvement was present in 11 participants (8.5%). These findings indicate that the left side was more frequently affected compared to the right and bilateral sides among the study population.

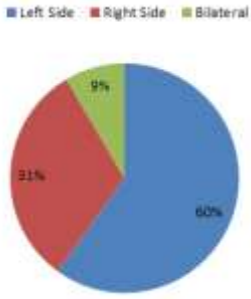

Figure 7

Table 4: Wall of Maxillary Sinus Involved Among Study Subjects

	Frequency	Percent
inferior	59	45.4
Medial	26	20.0
lateral	23	17.7
anterior	11	8.5
Posterior	11	8.5
Total	130	100.0

Among the various walls of the maxillary sinus involved, the inferior wall was the most commonly affected site, observed in 59 participants (45.4%). This was followed by involvement of the medial wall in 26 participants (20.0%) and the lateral wall in 23 participants (17.7%). Anterior wall and posterior wall involvement were comparatively less common, each observed in 11 participants (8.5%). These findings suggest that the inferior wall was predominantly involved among the study subjects.

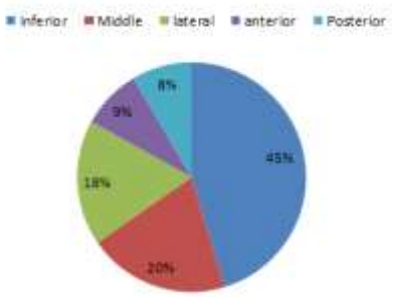

Figure 8

Table 5: CBCT Findings Among Study Subjects

	Frequency	Percent
partial opacification	46	35.4
Completeopacification	24	18.5
mucosal thickening	35	26.9
Polyp	19	14.6
Antrolith	6	4.6
Total	130	100.0

Among the CBCT findings observed in the study subjects, partial opacification was the most common finding, reported in 46 participants (35.4%). Mucosal thickening was the second most frequent finding, observed in 35 participants (26.9%), followed by complete opacification in 24 participants (18.5%). Polyps were identified in 19 participants (14.6%), while antroliths were the least common finding, present in 6 participants (4.6%). These findings indicate that partial opacification and mucosal thickening were the predominant CBCT findings among the study population.

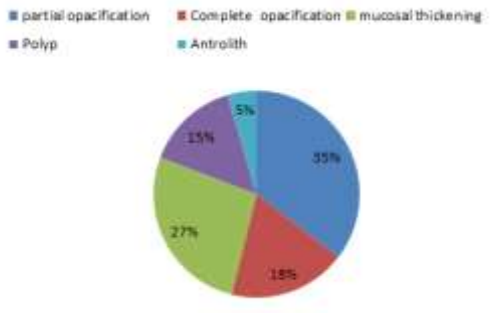

Figure 9

Table 6: Association Between Wall and Gender

Gender	Inferior Wall n (%)	Medial Wall n (%)	Lateral Wall n (%)	Anterior Wall n (%)	Posterior Wall n (%)	Chi Square value	P value
Female	40 (41.7%)	21 (21.9%)	17 (17.7%)	9 (9.4%)	9 (9.4%)	2.487	0.647
Male	19 (55.9%)	5 (14.7%)	6 (17.6%)	2 (5.9%)	2 (5.9%)		

Among female participants, inferior wall involvement was the most common finding, observed in 40 subjects (41.7%), followed by medial wall involvement in 21 subjects (21.9%) and lateral wall involvement in 17 subjects (17.7%). Anterior and posterior wall involvement were observed in 9 female participants (9.4%).

Similarly, among male participants, inferior wall involvement was also the most frequently observed finding, reported in 19 subjects (55.9%). Medial wall involvement was seen in 5 participants (14.7%), while lateral wall involvement was present in 6 participants (17.6%). Anterior and posterior wall involvement were each observed in 2 male participants (5.9%).

Chi-square analysis demonstrated no statistically significant association between gender and wall involvement of the maxillary sinus ($\chi^2 = 2.487$, $p = 0.647$).

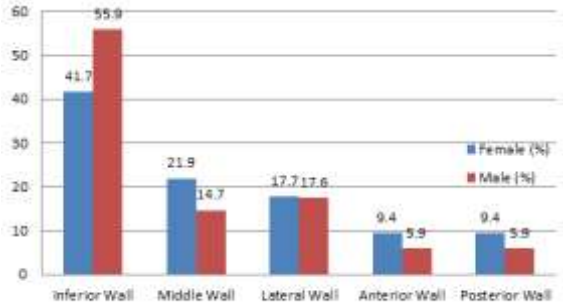

Figure 10

Table 7: Association between CBCT finding and gender

	Partial opacification	Complete opacification	Mucosal thickening	Polyp	Antrolith	Chi Square value	P value
Female	33 (34.4%)	17 (17.7%)	24 (25.0%)	16 (16.7%)	6 (6.2%)	3.904	0.213
Male	13 (38.2%)	7 (20.6%)	11 (32.4%)	3 (8.8%)	0 (0.0%)		

Among female participants, partial opacification was the most common CBCT finding, observed in 33 subjects (34.4%), followed by mucosal thickening in 24 subjects (25.0%) and complete opacification in 17 subjects (17.7%). Polyps were identified in 16 female participants (16.7%), while antroliths were observed in 6 participants (6.2%).

Among male participants, partial opacification was also the most frequently observed finding, present in 13 subjects (38.2%). Mucosal thickening was observed in 11 participants (32.4%), followed by complete opacification in 7 participants (20.6%). Polyps were identified in 3 male participants (8.8%), whereas no cases of antrolith were reported among males.

Chi-square analysis revealed no statistically significant association between gender and CBCT findings ($\chi^2 = 3.904$, $p = 0.213$).

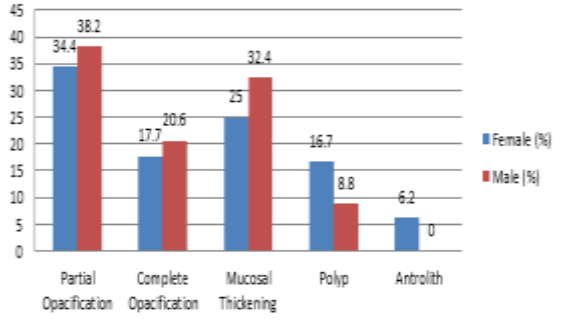

Figure 11

Table 8: Association Between Side Involvement and CBCT Findings

Side Involved	Partial Opacification n (%)	Complete Opacification n (%)	Mucosal Thickening n (%)	Polyp n (%)	Antrolith n (%)	Chi-Square Value	p-value
Left Side	25 (32.1%)	15 (19.2%)	22 (28.2%)	14 (17.9%)	2 (2.6%)	5.658	0.686
Right Side	15 (36.6%)	8 (19.5%)	11 (26.8%)	4 (9.8%)	3 (7.3%)		
Bilateral	6 (54.5%)	1 (9.1%)	2 (18.2%)	1 (9.1%)	1 (9.1%)		

Among subjects with left-sided involvement, partial opacification was the most common CBCT finding, observed in 25 participants (32.1%), followed by mucosal thickening in 22 participants (28.2%) and complete opacification in 15 participants (19.2%). Polyps and antroliths were observed in 14 (17.9%) and 2 (2.6%) participants, respectively.

Among subjects with right-sided involvement, partial opacification was also the predominant finding, present in 15 participants (36.6%), followed by mucosal thickening in 11 participants (26.8%) and complete opacification in 8 participants (19.5%). Polyps and antroliths were identified in 4 (9.8%) and 3 (7.3%) participants, respectively.

In subjects with bilateral involvement, partial opacification remained the most frequent CBCT finding, observed in 6 participants (54.5%). Complete opacification, polyp, and antrolith were each observed in 1 participant (9.1%), while mucosal thickening was seen in 2 participants (18.2%).

Chi-square analysis demonstrated no statistically significant association between side involvement and CBCT findings ($\chi^2 = 5.658$, $p = 0.686$).

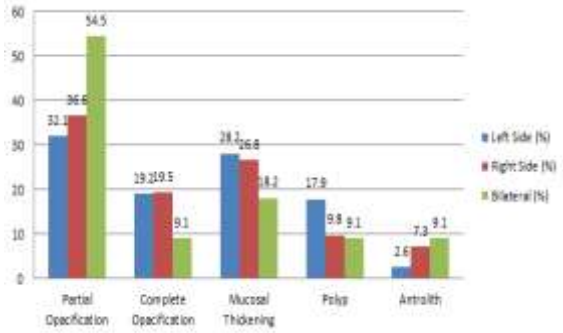

Figure 12

Table 9: Association Between Side Involvement and Wall of Maxillary Sinus Involved

Side Involved	Inferior Wall n (%)	Middle Wall n (%)	Lateral Wall n (%)	Anterior Wall n (%)	Posterior Wall n (%)	Chi-Square Value	p-value
Left Side	40 (51.3%)	16 (20.5%)	10 (12.8%)	6 (7.7%)	6 (7.7%)	7.671	0.466
Right Side	16 (39.0%)	7 (17.1%)	9 (22.0%)	5 (12.2%)	4 (9.8%)		
Bilateral	3 (27.3%)	3 (27.3%)	4 (36.4%)	0 (0.0%)	1 (9.1%)		

Among subjects with left-sided involvement, the inferior wall was the most commonly affected site, observed in 40 participants (51.3%), followed by the medial wall in 16 participants (20.5%) and the lateral wall in 10 participants (12.8%). Anterior and posterior wall involvement were each observed in 6 participants (7.7%).

Among subjects with right-sided involvement, inferior wall involvement was also the most frequent finding, reported in 16 participants (39.0%). Lateral wall involvement was observed in 9 participants (22.0%), followed by middle wall involvement in 7 participants (17.1%). Anterior and posterior wall involvement were seen in 5 (12.2%) and 4 (9.8%) participants, respectively.

In subjects with bilateral involvement, lateral wall involvement was the most common finding, observed in 4 participants (36.4%), followed by equal involvement of the inferior and middle walls in 3 participants each (27.3%). Posterior wall involvement was observed in 1 participant (9.1%), while no anterior wall involvement was reported in bilateral cases.

Chi-square analysis revealed no statistically significant association between side involvement and wall involvement of the maxillary sinus ($\chi^2 = 7.671$, $p = 0.466$).

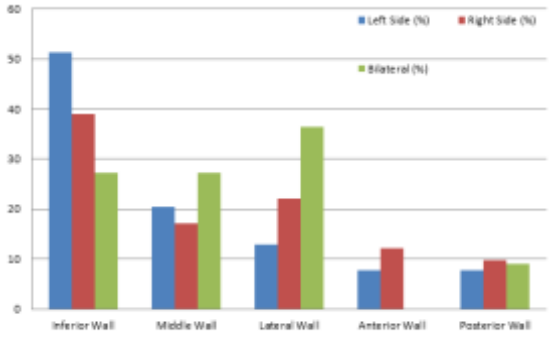

Figure 13

DISCUSSION

In this study, 130 patients were included to detect abnormalities within the maxillary sinus.

The present study showed that sixth decade represent highest percent of abnormalities having mean age of patients 57±11.6 years. (Table 1, Fig.5) Same findings has also been mentioned by other studies, Ritter et al.[9]This is in contrast to the study like Raghav et al in which third decade showed more abnormalities.[10]

Our study showed significant difference between the genders showing greater incidence in female (73.8%) as compared to male (26.2%)which is in contrast to other studies in which male patients were predominant.[11](Table 2, Fig.6)

Regarding the sinus wall the lower wall of the maxillary sinus was most common wall affected (45%) followed by medial wall(20%), lateral wall (17%), anterior (8.5%) and posterior (8.5%) with(60%) for left side, (31%) for right side and bilateral (8.5%). Same finding were seen in study of Rege et al.[12](Table 3,4 & Fig. 7,8)

Regarding CBCT findings, Partial opacification was the most frequently observed abnormality (35%) followed by mucosal thickening (26.9%), complete opacification (18.5%), polyp (14.6%) and antrolith (4.6%). (Table 5, Fig.9) These findings are different from other study such as Raghav et al in which mucosal thickening was the most common abnormality.[10]

Most of the partial opacification of maxillary sinus were found subsequent to oro-antral fistula formation. Oro antral fistula is an abnormal communication between oral cavity and maxillary sinus. Most commonly it occurs after dental extraction,[1314] inflammatory conditions.[15]

CBCT scans showed disruption of the bony floor of the maxillary sinus with communication to the oral cavity. Out of total 46 partial opacification patients, 27 patients were partial edentulous, 11 were completely edentulousand 8 patients had one missing tooth.

In most oro antral cases, patient had a history of recent tooth extraction and complained of a salty taste and escape of air into the mouth on blowing the nose.

In our study mucosal thickening was seen in 35 patients (26.9%). Mucosal thickenings are in the form of a diffuse radioopaque line parallel to maxillary sinus wallwith clear border. If the mucosal thickness is grater than 1 mm, it is considered as mucosal thickening. If the mucosal thickening is more than 2mm, it is considered as sinus inflammation. The close relationship of roots of maxillary posterior teeth causes pathogenic micro organism as well toxin to reach the sinus through spongy bone and causes mucosal thickening.[16,17]

Complete opacification of maxillary sinus were seen in 24 patients (18.5%). The most common cause were chronic sinusitis subsequent to long standing sinus inflammation leading to build of pus or fluid.[18,19,20]Other causes of complete opacification of maxillary sinus were carcinoma like Adenoid cystic carcinoma, inverted papilloma,[21,22] which were surgically treated as well as histopathological diagnosed.

Polyp was seen in 19 patients (14.6%) which were surgically treated and histopathological diagnosed. Antral polyps are asymptomatic and can lead to displacement, expansion or destruction of surrounding bone.[23]

In our study, antrolith was seen in 6 patients (4.6%). Antrolith is defined as pathologicalcalcifications consisting of mineral salt depositions around a central nidus in the maxillarysinus.[24]Most of the cases were asymptomatic and therefore were left alone.

Surgical removal was done for cases who had complications,[25] and Caldwell Luc procedure was done under Local anaesthesia. The calculi was retrieved and sent for histopathologic evaluation.

With respect to association between wall and gender, it was found that irrespective of the gender, inferior wall was most commonly involved followed by medial, lateral, anterior and posterior in both sexes. (Table 6, Figure 10)

Similarly with respect to association between CBCT finding and gender, it was found that irrespective of gender, partial opacification was most commonly CBCT finding followed by mucosal thickening, complete opacification, polyp and then antrolith in both sexes. (Table7, Figure 11)

Association between CBCT finding and side involved reveals that on both left as well as right side, partial opacification was most commonly involved CBCT finding followed by mucosal thickening, complete opacification, polyp and antrolith. (Table 8, Figure 12)

Similarly with respect to association between side involved and wall of maxillary sinus involved, it was found that inferior wall was most commonly involved wall followed by medial, lateral, anterior and posterior on both left as well as right side. (Table 9, Figure 13)

CONCLUSION

To evaluate the prevalence of maxillary sinus disease, CBCT is favourable in the examination of maxillary sinus anatomy as well as examination of maxillary sinus pathologies. This study highlights the prevalence of maxillary sinus disease noticed in CBCT scans. In our study, partial opacification was the most frequently observed abnormality followed by mucosal thickening, complete opacification, polyp and then antrolith. Thus, oral radiologist should comprehensively evaluate the CBCT images and should be aware of maxillary sinus abnormalities for early detection, treatment and follow up of sinus abnormalities.

REFERENCES

1. Whyte A, Boeddinghaus R. The maxillary sinus: physiology, development and imaging anatomy. Dentomaxillofac Radiol. 2019;48(8): 20190205. Doi.org/10.1259/dmfr.20190205.
2. Lawson W, Patel ZM, Lin FY (2008) The development and pathologic processes that influence maxillary sinus pneumatization. Anat Rec 291: 1554-1563.
3. Scuderi AJ, Harnsberger HR, Boyer RS. Pneumatization of the Paranasal sinuses: normal features of importance to the accurate interpretation of CT scans and MR images. American Journal of Roentgenology 1993;160: 1101-4.doi :https://doi.org/10.2214/ajr.160.5.8470585.

4. Lovasova K, Kachlik D, Rozpravkova M. Three-Dimensional CAD/CAM imaging of the maxillary sinus in ageing process. Ann Anat 2018; 218:69-82. Doi: https://doi.org/10.1016/j.aanat.2018.01.008.
5. Whyte A, Boeddinghaus R. Imaging of odontogenic sinusitis. Clin Radiol 2019;74: 503-16.doi: https://doi.org/10.1016/j.crad.2019.02.012.
6. Przystanska A, Kulczyk T, Rewekant A et al. Introducing a simple method of maxillary sinus volume assessment based on linear dimensions. Ann Anat 2018; 215: 47-51.doi: https://doi.org/10.1016/j.aanat.2017.09.010.
7. Constantine S, Clark B, Anderson PP. Panoramic radiography is of limited value in the evaluation of maxillary sinus disease. Oral Surg Oral Med Oral Pathol Oral Radiol, 2019;127(3):237-46.
8. Lopez F, Devaney KO, Hanna EY. A metastases to nasal cavity and paranasal sinus. Head Neck. 2016;38(12): 1847-54.
9. Ritter L, Lutz J, Neugebauer J, Scheer M et al (2011). Prevalence of pathologic findings in the maxillary sinus in cone beam computerized tomography. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 111: 634-40.
10. Raghav M, Karjodkar R, Sontakke S, Sansare K (2014). Prevalence of incidental maxillary sinus pathologies in dental patients on Cone beam computed tomographic images. Contemp Clin Dent 5: 361-365.
11. Vallo J, Taipale LS, Huumonen S, Soikkonen K, Norblad A (2010). Prevalence of mucosal abnormalities of the maxillary sinus and their relationship to dental disease in panoramic radiography: results from the health 2000 Hearth Examination survey. Oral Surg Oral Med Oral Pahtol Oral Radiol Endod 109: e80-e87.
12. Rege IC, Sousa TO, Leles CR, Mendonca EF(2012). Occurrence of maxillary sinus abnormalities detected by cone beam CT in asymptomatic patients. BMC Oral Health 12:30.
13. Kurien M, Anandi V et al. Maxillary sinus fusarosis in immunocompetent hosts. J Laryngol Otol 1992; 106:733-736.
14. Felix DH, Wray D, Smith GL et al. Oro- antral fistula: an ususal complication of HIV – associated periodontal disease. Br Dent J 1991; 171: 61-62.
15. Edwards MB, Buckerfield JP. Wegener's granulomatosis : a case with primary mucocutaneous fistula. Oral Pathol 1978;46:53-63.
16. Nascimento, E.H. et al. Association between odontogenic conditions and maxillary sinus disease: A study using cone beam computed tomography. J Endod.42(10),1509-1515(2016).
17. Kuligowski,P. et al. Association between odontogenic and maxillary sinus conditions: A retrospective cone beam computed tomographic study. J Clin. Med . 10(13),2849(2021).
18. Ahsan F, El- Hakim H, Ah-See KW, et al. Unilateral opacification of paranasal sinus CT scans. Otolaryngol Head Neck Surg 2005; 133:178-80.
19. Rudralingam M, Jones K, Woolford T. The unilateral opaque maxillary sinus on computed tomography. Br J Oral Maxillofac Surg 2002;40:504-7.
20. Kaplan BA, Kountakis SE. Diagnosis and pathology of unilateral maxillary sinus opacification with or without evidence of contralateral disease. Laryngoscope 2004;114:981-5.
21. Woo HJ, Bae CH, Song SY et al. Actinomycosis of paranasal sinus. Otolaryngol Head Neck Surg 2008;139:460-2.
22. Whyte A, Chapeikin G. Opaque maxillary antrum : a pictorial review. Australas Radiol 2005;49: 203-13.
23. White S, Pharaoh M. Oral Radiology Principles and Interpretation,6th edition. Philadelphia, Mosby Elsevier, 2010.
24. M. Nass Duce, D.U.Talas, C.Ozer, A. Yildiz, F.D. Apaydin. Antrolithiasis: a retrospective study, J. Laryngol. Otol.117(2003) 637-640.
25. P.Guneri,A. Kaya, M.K. Caliskan, Antroliths: Survey of the literature and report of a case, Oral Surg. Oral Med. Oral Pathol, Oral Radiol. Endod.99(2005)517-521.