



## A study on maxillary sinus dimensions by computed tomography in population of UTTAR PRADESH

Monika Singh<sup>1\*</sup>, Sangita Chauhan<sup>2</sup>, Sachin Khanduri<sup>3</sup>

<sup>1</sup> \*Department of Anatomy, NIMS UNIVERSITY, Jaipur, Rajasthan, India

<sup>2</sup> Department of Anatomy, NIMS UNIVERSITY, Jaipur, Rajasthan, India

<sup>3</sup> Department of Radio-Diagnosis, ERA UNIVERSITY, Lucknow, Uttar Pradesh, India

\*Corresponding author: Monika Singh

\*Department of Anatomy, NIMS UNIVERSITY, Jaipur, Rajasthan, India

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### Introduction

The maxillary sinuses are the largest of the paranasal air sinuses and are contained within the body of the maxilla one on each side. They are of the shape of an irregular three sided pyramid. The apex extends into the zygomatic process of the maxilla and the base is the lower part of the lateral wall of the nose. The sinuses lie superior to the upper molar and premolar teeth<sup>[1]</sup> Computed tomography images can provide valuable means for measurements of maxillary sinuses<sup>[3]</sup>. Maxillary sinuses are the largest paranasal sinuses of variable dimensions. The maxillary sinus dimensions can be better ascertained by using computed tomography instead of plain radiography<sup>[4]</sup>. Surgical interventions involving the maxillary sinuses are increasing because of intimate relationship between teeth and maxillary sinuses<sup>[5]</sup>. This study was planned for highlighting the variations in the dimensions of the maxillary sinuses of people of UTTAR PRADESH region. The aims of the present study were to estimate different dimensions of the maxillary sinuses using computed tomographic (CT) scan of the head of patients from UTTAR PRADESH and compare the data gender wise and sidewise.

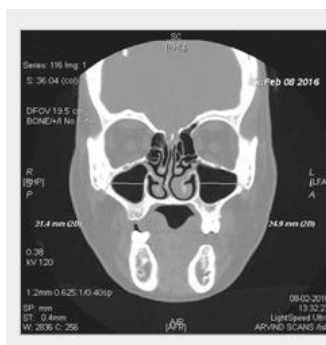
### Materials and Methods

This study was carried out using CT images of head region of 100 males and 100 females who underwent CT scanning for indications other than the pathology of the maxillary sinuses. The CT images obtained from patients of 20 to 50 years of age taken were included in this study. The CT images of patients with facial deformities, facial injuries, tumours or other pathologies of maxillary sinuses were excluded.

The following measurements of the maxillary sinuses were ascertained using the in built electronic scales available in the CT scans:

1. Maximal width (transverse diameter).
2. Maximal height (cranio-caudal diameter).
3. Maximal depth (antero-posterior diameter).

The maximal width was measured on coronal reconstructed image between medial wall of the sinus to the outermost point of the lateral wall of the sinus



**Fig 1:** showing the measurement of the maximum width of the maxillary width of the maxillary sinus both side in coronal view of CT head

The maximal height of the sinus was measured on coronal reconstructed image between the lowest point of the sinus floor to the highest point of the sinus roof



**Fig:2** showing the measurement of the maximum height of the maxillary sinus both side in coronal view of CT head.

The maximal depth was measured on sagittal reconstructed image between the most anterior point to the most posterior point of the sinus



**Fig 3:** showing the measurement of the maximum depth of the maxillary sinus in sagittal viewed CT head Comparison of data between genders and sides was carried out.

### Statistical analysis

Mean, standard deviation (SD) and the 95% confidence interval (CI) for all the parametric variables were found out. The statistical inference was derived by applying unpaired student “t” test and the p value was obtained (p value <.05 was considered statistical significant).

## Results

The comparison of the various dimensions of right maxillary sinus between males and females is shown in (Table 1). It can be seen from the table that the mean depth, height and width are comparatively less in females than the males and the difference is found to be statistically significant (pc. 0001) and the similar type of results are also observed on the left maxillary sinus which is shown in (Table 2).

Maxillary Sinus dimensions	Males			Females			T test Value	P Value
	Mean	SD	95% CI	Mean	SD	95% CI		
Right depth	34.48	0.75	34.34-34.62	32.95	0.53	32.85-33.05	3.283	<.0001
Right height	36.18	0.40	36.11-36.25	33.14	3.17	32.52-33.76	3.124	<.0001
Right Width	24.31	0.30	24.26-24.35	23.07	0.62	22.95-23.19	3.291	<.0001

Comparison of right side maxillary sinus dimensions (in mm) between males (n=100) and females (n=100)

Maxillary Sinus dimensions	Males			Females			T test Value	P Value
	Mean	SD	95% CI	Mean	SD	95% CI		
Right depth	34.47	0.75	34.34-34.62	32.84	1.04	32.64-33.04	3.284	<.0001
Right height	36.17	0.40	36.11-36.25	33.31	2.86	32.75-33.87	3.154	<.0001
Right Width	24.31	0.30	24.25-24.36	23.60	1.08	22.39-23.81	3.288	<.0001

Comparison of left side maxillary sinus dimensions (in mm) between males (n=100) and females (n=100)

Maxillary sinus dimensions	Mean	SD	95% CI	t test value	P value
Right depth	33.71	1.00	33.58-33.84	0.674	0.571
Left depth	33.65	1.22	33.49-33.81		
Right height	34.66	2.71	34.29-35.03	0.312	0.762
Left height	34.74	2.48	34.40-35.08		
Right width	23.69	0.78	23.59-23.79	0.291	0.0014
Left width	23.96	0.86	23.84-24.08		

Comparison of right and left side maxillary sinus dimensions (in mm) among the study population (n=200)

Comparison was also made between the maxillary sinuses of two sides (Table 3). It can be seen from the table that the depth and the height of maxillary sinus do not show any significant difference in the measurements ( $p > .05$ ), whereas the width of the left side (23.96 mm) is higher than that of the right side (23.69) and the difference is found to be statistically significant ( $p < .05$ ).

## Discussion

In the present study, the mean value for the maximum depth of maxillary sinus for male group was  $34.48 \pm 0.75$  mm for the right side and  $34.47 \pm 0.75$  mm for the left side which was significantly greater than that recorded for female group which was  $32.95 \pm 0.53$  mm for the right side and  $32.84 \pm 1.04$  mm for the left side and with statistically significant difference.

Uthman et al<sup>[3]</sup> estimated the mean value for the maximum depth of maxillary sinus for male group as  $39.3 \pm 3.8$  mm for the right side and  $39.4 \pm 3.7$  mm for the left side which was significantly greater than that recorded for female group which was  $36.9 \pm 3.8$  mm for the right side and  $37 \pm 4$  mm for the left side and with statistically significant difference.

Teke et al<sup>[6]</sup> estimated the mean value for the maximum depth of maxillary sinus for male group as  $42.58 \pm 7.9$  mm for the right side and  $43.7 \pm 7.78$  mm for the left side which was significantly greater than that recorded for female group which was  $37.8 \pm 5.69$  mm for the right side and  $37.6 \pm 6$  mm for the left side and with statistically significant difference.

In the present study, the mean value for the maximum height of maxillary sinus for male group was  $36.18 \pm 0.40$  mm for the right side and  $36.17 \pm 0.40$  mm for the left side which was greater than that recorded for

female group  $33.14 \pm 3.17$  mm for the right side and  $33.31 \pm 2.86$  mm for the left side and with statistically significant difference.

Uthman et al<sup>[3]</sup> estimated the mean value for maximum sinus height recorded for male group as  $43.3 \pm 4.8$  mm for the right side and  $45.1 \pm 4.1$  mm for the left side which was significantly greater than that recorded for female group which was  $39.9 \pm 5.2$  mm for the right side and  $40 \pm 4.8$  mm for the left side.

Teke et al<sup>[6]</sup> reported the mean value for the maximum height of maxillary sinus for male group as  $47.6 \pm 6.4$  mm for the right side and  $47.2 \pm 6.5$  mm for the left side which was greater than that recorded for female group  $45.1 \pm 4.6$  mm for the right side and  $43.6 \pm 4.4$  mm for the left side and with statistically significant difference. In the present study, the mean value for the maximum width of maxillary sinus for male group was  $24.31 \pm 0.30$  mm for the right side and  $24.31 \pm 0.31$  mm for the left side. Female group had statistically significant lower values for both right and left sides as  $23.07 \pm 0.62$  mm and  $23.60 \pm 1.08$  mm respectively.

Uthman et al<sup>[3]</sup> reported the mean value for maximum width of maxillary sinus for male group as  $24.7 \pm 4$  mm for the right side and  $25.6 \pm 4.4$  mm for the left side. Female group had statistically significant lower values for both right and left sides as  $22.7 \pm 3.2$  mm and  $23 \pm 4$  mm respectively.

Teke et al<sup>[6]</sup> estimated the mean value for the maximum width of maxillary sinus for male group as  $27.19 \pm 5.46$  mm for the right side and  $26.89 \pm 5.52$  mm for the left side. Female group had statistically significant lower values for both right and left sides as  $24.44 \pm 3.61$  mm and  $24.27 \pm 3.98$  mm respectively.

In study by Masri et al<sup>[7]</sup>, maxillary sinus depth and height were found to be larger in males than females in 21-30 years age category.

Only height and width showed significant differences in study by Kawarai et al<sup>[8]</sup> which showed that male tended to have larger sinuses.

In a study by Ekizoglu et al<sup>[9]</sup>, on 140 subjects, each dimension of the maxillary sinus was smaller in female gender.

According to Ahmed et al<sup>[10]</sup>, the dimensions of the maxillary sinus can be used as an adjunct tool for sex determination and the overall mean dimension for each parameter is statistically greater for males when compared with females. This is consistent with the reports by Jasim et al<sup>[11]</sup>, Kiruba et al<sup>[12]</sup> and Kim et al<sup>[13]</sup>. Teke et al<sup>[6]</sup> attributed these greater mean dimensions in males to sex-specific differences in energy intake, nutrition, body composition and genetics.

In the study conducted by Sharma et al<sup>[14]</sup> in Gwalior (India) region, on comparison of dimensions between males and females, the mean values of the depth of the maxillary sinus had statistically significant difference. But, in the present study, the mean values of all the three dimensions (width, height and depth) had statistically significant differences with mean values less for the females.

In the study conducted by Pawar et al<sup>[15]</sup> at Mumbai, it was found that the mean of the depth, the width, and the height of maxillary sinus in males on both right and left sides as (38, 38) (27, 26) and (34, 33) mm respectively but in females as (37,36), (26,26) and (34, 33) mm respectively. In this study, the average heights of maxillary sinuses are equal in both genders. But, in the present study, all the dimensions are found less in females.

In a study carried out in South India by Vidya et al<sup>[16]</sup> using the skulls of known sex obtained from recently buried bodies, scanned by 3D Multiaxial CT scan, the dimensions of maxillary sinuses were observed by using dedicated software. The dimensions of maxillary sinuses were greater in males compared to female skulls in this study as well.

## Conclusions

The data from the present study provides the combined average maxillary sinus dimensions (in mm) common for both genders in the study population of UTTAR PRADESH as follows: Right side depth:  $33.71 \pm 1.00$ ; Left side depth:  $33.65 \pm 1.22$ ; Right side height:  $34.66 \pm 2.71$ ; Left side height:  $34.74 \pm 2.48$ ; Right side width:  $23.69 \pm 0.78$  and Left side width:  $23.96 \pm 0.86$ . On comparison of right and left side maxillary sinus dimensions among the study population, the average width of the maxillary sinuses on the left side is significantly more than that of right sided sinuses. On comparison of dimensions between males and females, the mean values of all the three dimensions (width, height and depth) have statistically significant difference with all dimensions

in females less than that of males. Computed tomography measurements of maxillary sinuses may be useful in gender determination.

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