

MEASUREMENTS OF MAXILLARY SINUS IN CORRELATION TO AGE AND GENDER BY COMPUTED TOMOGRAPHY

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ABSTRACT

Introduction: The sinonasal region is often imaged because of infectious and allergic diseases of the nasal cavity and paranasal sinuses. Improved knowledge of normal pneumatization and development of paranasal sinuses is important to allow sinus diseases to be evaluated and an adequate treatment to be proposed.

Materials and methods: 100 patients (72 males and 28 females) undergoing coronal and axial sections of computed tomography scan of maxillary sinus of head and neck aged between 1 year to 90 years at the Radiology Department, Vydehi Institute of Medical Science & Research Centre Bangalore for reasons other than due to craniofacial abnormalities or sinus problem were taken for the study. Volume and dimensions of the maxillary sinuses with its anatomical variations were obtained. Mean, SD, significant difference between age & gender was calculated.

Results: Maxillary sinuses in Males on both sides have higher values in mean height, depth and volume than females except right side width which was lesser in value than females. All the mean parameters were more on left sinus both in male and females, except mean height of right sinus in males, on side comparison all the mean parameters were more on right side in females. There is a significant difference in mean height of right and left maxillary sinus in between male and female. There is a significant difference on right and left side width between male and female in the age group 51-60 yrs and 61-70 yrs. The maximum age growth in males was during 11-20 yrs and 41-50 yrs in height, width and volume, in 21-30 yrs and 31-40 yrs in depth, later dimensions were decreasing in growth by 61-70 yrs in height and 81-90 yrs both in depth, width and volume. In females maximum growth was in 21-30 yrs and 51-70 yrs for height, depth, volume, 11-20 yrs and 51-60 yrs for width dimensions, later decreases by 61-70 yrs onwards in height, width and 11-20 yrs in depth and volume.

Conclusion: These results will be helpful in understanding normal and pathological conditions of the maxillary sinuses and useful in clinical planning of medical or surgical interventions of the maxillary sinuses

KEY WORDS: Maxillary sinus, Computed tomography (CT), Pneumatization, Functional Endoscopic Sinus Surgery (FESS), Growth, Pneumatisation, Sinusitis.

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INTRODUCTION

The maxillary sinus is the largest of the paranasal sinuses. It fills the body of the maxilla and is pyramidal in shape. The base is medial on lateral wall of the nasal cavity. The floor is formed by the alveolar process and part of the palatine process of the maxilla. It is related to the roots of the teeth, especially the second premolar and first molar. The roof of the sinus forms the major part of the floor of the orbit. The apex extends into the zygomatic process of the maxilla. The facial surface of the maxilla forms its anterior wall, and is grooved by the anterior superior alveolar nerve and vessels as they pass forwards from the infra-orbital canal. The posterior wall is formed by the infratemporal surface of the maxilla. The medial wall is to form an ostium opens into the inferior part of the ethmoidal infundibulum and thence into the middle meatus [1]. It serves many functions such as to decrease the weight of the skull, increases voice resonance, protects against blows to the face, insulation of the eyes and roots of the teeth against temperature fluctuations, humidification of inhaled air and contributes to the maxillary growth [2].

The maxillary sinus is present as a small air space at birth. Spurts of maxillary sinus growth occur for both genders from birth to 2 years, from 7.5 to 10 years, and from 10 to 12 years. Thereafter, growth is slow but steady until 14 to 18 years [3]. Genetic diseases, environmental conditions and past infections may affect this process [4]. CT scans are an excellent imaging modality used to evaluate the sinonasal cavities as they provide three-dimensional information and an accurate assessment of the paranasal sinuses [5]. Providing normative values for paranasal sinus size and their changes with age could be helpful in evaluating the presence of any abnormality. The normative size rather than the comparison with the opposite side can be used for treatment planning procedures such as functional endoscopic sinus surgery and evaluation of the outcome [6].

MATERIALS AND METHODS

The retrospective analytical study consisting of 100 patients (both male-72 and female-28) ages ranging from 1 year to 90 years who had their

computed tomography scan of head and neck (coronal and axial sections) at the Radiology Department, Vydehi Institute of Medical Science & Research Centre, Bangalore for reasons other than due to craniofacial abnormalities or sinus problem. Age groups 1 year to 90 years of male and females were included for the study. Patients with history of trauma to the face, diseases of the nasal cavity and of paranasal sinuses were excluded from the study. The various parameters like height, width, depth and volume of the maxillary sinus was measured using Computed tomography scans in the Radianat dicom software.

Fig. 1: Showing the Measurement of maximum height of Maxillary sinus by Computed Tomography scan coronal view.

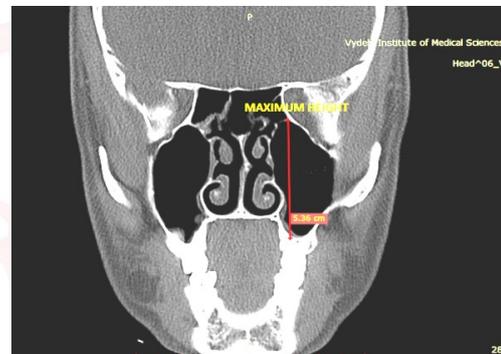


Fig. 2: Showing the Measurement of maximum width of Maxillary sinus by Computed Tomography scan coronal view.



Fig. 3: showing the Measurement of maximum depth of Maxillary sinus by Computed Tomography scan transverse (axial) view.



The following measurements of maxillary sinus were done:

1. Maxillary sinus Height was measured as the longest distance from the lowest point of the sinus floor to the highest point of the sinus roof in the coronal view (Figure 1).
- 2 Maxillary sinus Width was measured as the longest distance perpendicular from the medial wall of the sinus to the most lateral wall of the lateral process of the maxillary sinus in the axial view (Figure 2).
3. Maxillary sinus Depth was measured as the longest distance from the most anterior to the most posterior point of the medial wall in the axial view (Figure 3).
4. Maxillary sinus volume was measured, using the following equation: (Width × anteroposterior × height × 0.52) [5].

SPSS for Windows 11.0 was used for the statistical assessment. Descriptive statistics are provided as the mean with standard deviation (SD). Analytic assessment was done by the Student t-test and a P value less than 0.05 accepted as statistically significant difference between.

RESULTS

Table 1: showing mean and standard deviation of Computed Tomography Measurements of different parameters of Maxillary sinus in male and female.

Measurements of Maxillary Sinus	Male	Female	t - value	P value
	Mean±SD	Mean±SD		
Right height(cm)	5.47±0.93	4.89±1.41	2.305	0.023
Right width(cm)	2.67±0.54	2.80±0.69	0.93	0.354
Right depth(cm)	3.74±0.50	3.60±0.67	1.094	0.277
Right volume(cm ₃)	29.44±11.51	28.56±14.3	0.301	0.764
Left height(cm)	5.36±1.11	4.76±1.37	2.11	0.037
Left width(cm)	2.73±0.59	2.69±0.64	0.23	0.819
Left depth(cm)	3.85±0.56	3.60±0.56	1.839	0.069
Left volume(cm ₃)	30.53±12.78	26.73±12.6	1.235	0.22

Table 2: Showing significant difference between right and left maxillary sinus in male and in females.

Right & Left Maxillary Sinus	Males P Value	Female P Value
Height(cm)	0.496	0.771
Width(cm)	0.495	0.617
Depth(cm)	0.219	0.992
Volume(cm ₃)	0.577	0.656

The above table1 and 2 shows that the mean value of height, width, depth and volumes of the maxillary sinus. On Comparison between male and female on both sides, maxillary sinus in males has higher values in height, width, depth and volume than females, except right side width which was lesser in value than females. There is a significant difference in mean height of right and left maxillary sinus in between male and female. When compared between the sides, all the parameters were more on right side in females, height of right sinus in males was more, whereas width, dept, volume was more on left sinus in males. Between the sides there is a significant difference between right and left maxillary sinus in males, also in right and left side significance difference in females.

Table 3: showing age wise Height comparison of Maxillary sinus between males and females on both sides in different age groups.

S.No.	Age groups(yrs)	Males		Females		P Value	
		Right(cm)	Left(cm)	Right(cm)	Left(cm)	Right	Left
1	1-10	-	-	1.4	1.5	-	-
2	11-20	5.62	5.76	5.2	5.2	0.314	0.176
3	21-30	5.43	5.23	5.45	5.15	0.964	0.907
4	31-40	5.52	5.2	-	-	-	-
5	41-50	5.95	5.78	-	-	-	-
6	51-60	5.3	5.9	5.21	5.16	0.878	0.228
7	61-70	5	4.89	5.1	4.8	0.7	0.992
8	71-80	-	-	-	-	-	-
9	81-90	5.6	5.5	-	-	-	-

The maxillary sinus in males the maximum height was observed on right side in 51-60 yrs, left side in 51-60 yrs and least in both sides was in 61-70yrs age group, right side sinus being more than left side sinus except in age group 11-20yrs and 51-60 yrs. In females maximum height of maxillary sinus on right was in 21-30 yrs and on left side in11-20 yrs age groups, least in both sides was in 1-10 yrs age groups. Right side maxillary sinus was being more than left sinus except in age 1-10 yrs. There is a significant difference in the height of sinus both in male and females. Maximum height of sinus was more in right side males than females.

The above table no 4, shows that maximum width of maxillary sinus was observed in males on both sides in the age group 41-50 yrs, least on right side in 81-90 yrs and on left side 61-70 yrs. In females maximum width of maxillary sinus on both sides was in the age group in

51-60 yrs and least in 1-10 yrs, right side sinus was more than left side in all age groups except 61-70 yrs. The maximum width of sinus was more in left side in males compared to females. There was a significant difference in width of right and left side maxillary sinus between male and female in the age group 51-60 yrs and 61-70 yrs age groups.

Table 4: Showing width comparison of Maxillary sinus between males and females on both right and left sides in different age groups.

S.No.	Age groups(yrs)	Males		Females		P Value	
		Right(cm)	Left(cm)	Right(cm)	Left(cm)	Right	Left
1	1-10	-	-	1.47	1.33	-	-
2	11-20	3	3.01	2.88	2.67	0.782	0.457
3	21-30	2.68	2.77	2.81	2.81	0.634	0.891
4	31-40	2.68	2.49	-	-	-	-
5	41-50	3.05	3.16	-	-	-	-
6	51-60	2.25	2.43	3.11	2.93	0.011	0.042
7	61-70	2.12	2.23	2.63	2.69	0.013	0.0179
8	71-80	-	-	-	-	-	-
9	81-90	2.02	2.31	-	-	-	-

Table 5: Showing depth comparison of maxillary sinus between males and females on both right and left sides in different age groups.

S.No.	Age groups(yrs)	Males		Females		P Value	
		Right(cm)	Left(cm)	Right(cm)	Left(cm)	Right	Left
1	1-10	-	-	2.18	2.34	-	-
2	11-20	3.75	3.83	2.95	3.37	0.075	0.234
3	21-30	3.81	4	4.1	4.03	0.416	0.933
4	31-40	3.92	4.22	-	-	-	-
5	41-50	3.8	3.93	-	-	-	-
6	51-60	3.43	3.46	3.85	3.73	0.115	0.223
7	61-70	3.46	3.29	3.49	3.57	0.854	0.067
8	71-80	-	-	-	-	-	-
9	81-90	3.08	3.12	-	-	-	-

Table 6: Showing measurements of volume of maxillary sinus in males and females on both right and left sides in different age groups.

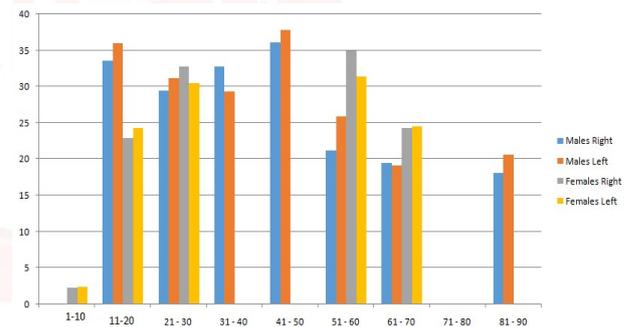
S.No.	Age groups(yrs)	Males		Females		P Value	
		Right(cm ³)	Left(cm ³)	Right(cm ³)	Left(cm ³)	Right	Left
1	1-10	-	-	2.33	2.43	-	-
2	11-20	33.55	36	22.97	24.33	0.227	0.293
3	21-30	29.51	31.21	32.81	30.45	0.579	0.91
4	31-40	32.76	29.35	-	-	-	-
5	41-50	36.08	37.78	-	-	-	-
6	51-60	21.22	25.89	34.9	31.43	0.052	0.335
7	61-70	19.5	19.14	24.35	24.56	0.106	0.303
8	71-80	-	-	-	-	-	-
9	81-90	18.12	20.61	-	-	-	-

The above table no 5, shows that maximum depth of maxillary sinus was observed in males on both sides in the age group 31-40 yrs, least 81-90 yrs on both sides. Left side maxillary sinus was being more than right side in all age

groups except 61-70 yrs and 81-90 yrs. In females maximum depth of maxillary sinus was observed both sides was in age group in 21-30 yrs, least was in 1-10 yrs in both sides. Left side sinus was being more than right side in all age groups except 21-30 yrs and 51-60 yrs. The maximum depth of maxillary sinus was more in left side males than females.

In this above table no 6, we infer that the maximum volume of the maxillary sinus is seen in males in the age group of 41-50 yrs and least in 81-90 yrs on both sides, volume being more on left sinus than right sinus except in 31-40 yrs, 61-50 yrs age group. In females maximum volume of maxillary sinus was observed in 51-60 years, least in 1-10 yrs in both sides, right side sinus being more than left sinus except in 1-20 yrs age groups. Left sinus was more in males compared to females.

Graph 1: Showing the comparison between the volumes of the maxillary sinuses in different age groups between males and females of both right and left side.



There was maximum age growth of maxillary sinus in males was observed during 11-20yrs and 41-50yr in height, width and volume, during 21-30yrs and 31-40yrs in depth. These dimensions decrease onwards in the growth of sinus by 61-70yrs in height and 81-90 yrs in depth, width and volume. In females maximum growth was during 21-30yrs and 51-70yrs for height, depth and volume, and during 11-20yrs and 51-60yrs for width dimensions. The decreased dimensions were seen in 1-10 yrs age group in all dimensions. Later decreases by 61-70 yrs onwards in height, width and 11-20 yrs in depth and volume.

When compared between age groups, height on right side maxillary sinus was more than left in both male and female. Width on right side sinus was more in females and was more in left side in males. Depth on left side sinus was

being more than right side in all age groups in males and females. The volume of sinus was being more on left side sinus in males. The right side sinus was being more than left sinus in females in all the age groups. The maximum width, depth and volume was on left maxillary sinus was more in males except for height which was more in right side in males compared to female in all age groups.

On comparison of sides of maxillary sinus in age group, in males left side dimensions of sinus were more in width, depth and volume compared to right side which was more in height. In females right side dimensions are more in height, width and volume compared to left sinus except depth, where left sinus was more than right side.

When compared between male and female, on both sides maxillary sinus in males have higher values in mean height, depth and volume than females except right side width which was lesser in value than females. When compared between sides, all the mean parameters were more on left sinus except mean height of right sinus in males all the mean parameters were more on right side in females. Between the sides there is a significant difference in the mean value between right and left maxillary sinus in males and also difference in females and there is a significant difference in mean height of right and left maxillary sinus in between male and female. There is a significant difference of width of right and left side between male and female in the age group 51-60 and 61-70 yrs.

DISCUSSION

Table 7: showing the mean height of Maxillary sinus of both sides between male and female.

Authors	Male		Female	
	Right(cm)	Left(cm)	Right (cm)	Left (cm)
Suresh K et al [5]	3.60±0.61	3.67±0.56	3.45±0.40	3.46±0.44
Utham AT et al [7]	4.3±0.48	4.5±0.41	3.9±0.52	4.0±0.48
Teke HY et al [8]	4.76±0.64	4.72±0.65	4.5±0.46	4.3±0.44
Hussain Haleem J et al [9]	3.96±0.06	3.95±0.06	3.50±0.09	3.51±0.08
Sahlstrand Johnson P et al [10]	3.4±0.5	3.3±0.5	3.0±0.3	3.0±0.3
Ahmed Azhar GH et al [11]	3.2±0.70	3.3±0.68	2.9±0.7	2.9±0.61
Baweja S et al [12]	3.73±0.8	-	3.69±0.74	-
Present study	5.4±0.9	5.3±1.1	4.8±1.4	4.7±1.4

In the present study maxillary sinus mean height was more than other authors study both in male and female, right side being more than left similar to others studies.

Table 8: showing the mean width of Maxillary sinus of both sides between male and female.

Authors	Male		Female	
	Right(cm)	Left(cm)	Right (cm)	Left (cm)
Suresh K Sharma et al [5]	2.43±0.42	2.49±0.48	2.33±0.38	2.38±0.38
Utham AT et al [7]	2.47±0.4	2.56±0.44	2.27±0.32	2.3±0.4
Teke HY et al [8]	2.71±0.54	2.68±0.55	2.44±0.36	2.42±0.39
Hussain Haleem et al [9]	2.4±0.06	2.4±0.06	2.2±0.09	2.2±0.09
Sahlstrand JohnsonP et al [10]	2.5±0.4	2.5±0.5	2.3±0.3	2.3±0.3
Ahmed Azhar GH et al [11]	2.5±0.56	2.5±0.60	2.2±0.47	2.1±0.44
Jehan M et al [13]	2.18±0.34	-	2.16±0.37	-
Present study	2.6±0.5	2.7±0.6	2.8±0.7	2.6±0.6

In the present study right side width of maxillary sinus in male was less compared to Teke HY et al [8] studies and more compared to other studies both in males and female and side wise also.

Table 9: showing the mean depth of Maxillary sinus of both sides between male and female.

Authors	Male		Female	
	Right(cm)	Left(cm)	Right (cm)	Left (cm)
Suresh k Sharma et al [5]	3.48±0.32	3.50±0.35	3.32±0.29	3.35±0.29
Utham et al [7]	3.93±0.38	3.94±0.37	3.69±0.38	3.7±0.4
Teke HY et al [8]	4.25±0.79	4.37±0.78	3.78±0.56	3.76±0.6
Hussain Haleem Jet al [9]	3.6±0.06	3.9±0.06	3.5±0.09	3.5±0.08
Sahlstrand Johnson et al [10]	3.6±0.3	3.5±0.4	3.5±0.4	3.56±0.4
Ahmed Azhar GH et al [11]	3.5 ± 0.47	3.6 ±0.53	3.4±0.42	3.5±0.39
Jehan M et al [13]	3.6±0.4	-	3.49±0.41	-
Baweja S et al [12]	3.41±0.51	-	3.3±0.56	-
Mehemet Emergioglu et al [6]	19.8±6.3	-	16.0±5.0	-
Present study	3.7±0.5	3.8±0.5	3.6±0.6	3.6±0.5

In the present study depth of maxillary sinus in males on right side was lesser compare to Uthman AT et al [7], Teke HY et al [8] and more compared to others studies but on left side sinus in males was lesser compared to Uthman AT et al [7], teke HY et al [8], Hussain haleem J et al [9] and more compared to rest others studies. In females on right side depth of sinus was similar to Uthman AT et al [7], lesser to Teke HY et al [8], but more compared to rest others studies, on left side depth of the sinus was lesser to Uthman AT et al [7] & Teke HY et al [8] but more than rest others studies.

Table 10: Showing comparison of mean values of volume of maxillary sinus with other authors.

Authors	Male		Female	
	Right (cm ₃)	Left (cm ₃)	Right (cm ₃)	Left (cm ₃)
Suresh K. Sharma et al [5]	15.8 ± 5.8	16.4 ± 6.14	13.6 ± 5.9	14.18 ± 4.6
Karakas S et al [4]	12.36 ± 5.62	13.09 ± 5.85	10.67 ± 4.39	10.47 ± 5.51
Ahmed, Azhar Gh. Et al [11]	30.35	30.4	22.73	22.35
Sehlstrand Johnson et al [10]	18±6	18±7	14±3	15±4
Hussein Haleem et al [9]	23.98 ± 0.81	23.9 ± 0.83	22.96 ± 0.44	23.02 ± 0.46
Present study	29.4±11.5	30.5±12.7	28.5±14.3	26.7±12.6

In the present study mean volume of maxillary sinus was more compared to other authors both in males and females but lesser than Ahmaed Maseri et al [11] studies in males. Comparing with the sides left side sinus was more than right sinus in males which coincides with Karakas S et al [4] studies, right sinus was more than left sinus in females which coincides with Karakas S et al [4] studies.

Table 11: Showing age wise volume comparison of maxillary sinus with different authors in male.

Volume in Age group in males (yrs)	Ahmed Azhar et al [11]		Karakas S et al [4]		Present study	
	Right	Left	Right	Left	Right	Left
	Mean(cm ³)					
1-5	1.89	1.74	-	-		
6-10	10.4	10	5.34±0.56	6.70±1.10	33.55	36
11-15			11.34±3.1	11.01±3.10		
16-20	17.2	17.4	14.74±5.79	14.55±4.72	29.51	31.21
21-25	20.3	19.2	15.11±4.95	16.86±5.77		
26-30			15.04±5.20	15.97±6.65	32.76	29.35
31-40	-	-			36.08	37.78
41-50	-	-	21.22	25.89		
51-60	-	-	19.5	19.14		
61-70	-	-	18.12	20.61		
70-90						

From the above table in males the maximum increase in maxillary volume was observed during 21-25yrs in Ahmad Azhar et al [11], 16-20 yrs in saccade karakas and right side sinus was more than left sinus. In our study it was during 11-20yrs and 41-50 yrs, thereafter decrease where left side sinus was more than right sinus.

Table 12: Shows age wise volume comparison of maxillary sinus with different authors in females.

Age groups Females (yrs)	Ahmed Azhar et al [11]		Karakas S et al [4]		Present study	
	Right	Left	Right	Left	Right	Left
	Mean(cm ³)					
1-5	2.75	2.87	-	-	2.33	2.43
6-10	9.8	8.73	7.03 ± 2.02	6.60 ± 2.25	22.97	24.33
11-15			10.03 ± 4.41	9.57 ± 4.48		
16-20	14.2	12.8	14.29 ± 3.42	13.78 ± 3.41	32.81	30.45
21-25	14.9	14.1	10.89 ± 4.50	10.92 ± 3.63		
26-30			11.13 ± 4.52	11.53 ± 5.45		
31-40	-	-				
41-50	-	-				
51-60	-	-	34.9	31.43		
61-70	-	-	24.35	24.56		

From the above table in females, maximum volume of maxillary sinus was observed more in 21-30 yrs in Ahmad Azhar et al [11] and Karakas S et al [4] which coincides with our study, being more in sinus volume during 21-30 yrs and also in 51-60 yrs. with the side comparison, right side sinus volume was more than left

sinus which coincides with above others.

On comparison of maxillary sinus both in males and females with other authors, the mean maxillary sinus volume was in the age group 41-50 yrs in male and 51-60 yrs in female, which was higher in values on both sides and in both gender when compared to Ahmad Azhar et al [11] studies and Karakas S et al [4] studies.

Sahlstrand-Johnson et al [10] studied dimensions of 120 maxillary and frontal sinuses from head CT images showed that there was no statistically significant correlation between the volume of maxillary sinuses with age or side. Mehmet Emirzeoglu et al [6] examined coronal CT scan images taken from 77 Turkish patients reported significant difference of maxillary sinus volume between males and females and also on both sides but there was no statistically difference between the different age groups. Mohammad Azhar et al [11] studied 3 dimensional computed tomography (3D CT) images of 144 Malays (288 maxillary sinuses aged from 0.4 to 30 years, found Females have significantly larger maxillary sinus width, height and depth than males in 0-6 years age category. Sanchez Fernandez JM et al [14] reported that there were no statistically significant differences regarding asymmetry and gender. Arij Y et al [15] observed that there was no significant sex differences and reported a correlation in maxillary sinus volume between the two sides. Nowak R et al [16] reported that the sinus maxillaries of the left side were greater than that of the right side in both male and female patients and that the sinus maxillaries were greater in female patients than in male patients. Study done by Karakas S et al [5] showed that males tended to have larger maxillary sinus volume than females though not statistically significant. In the present study the mean value in males in both sides have higher values in height, width, depth and volume than females except right side width which was lesser in value than females. There is a significant difference in mean height of right and left maxillary sinus between male and female. All the parameters were more on right side in females, whereas width, depth, volume was more on left sinus in males except height of right sinus was more, there is a significant difference between right and left maxillary sinus in males

and also in females. There is a significant difference in width of right and left side between male and female in the age group 51-60 and 61-70 yrs.

We found a higher mean values in all dimension of maxillary sinus in males compared to female, in different age groups volume being more in males compared to females and right side being more than left side in different age groups and also our values were more compared to others authors. This study showed variations in the volumes of the maxillary sinus in different age groups and between males and females. For this two explanations can be offered. First, according to Enlow DH [17] study, males need to have correspondingly bigger lungs to support their relatively more massive muscles and body organs. Second, males need a larger airway, which begins with the nose and nasopharynx. In other words, physiological changes in nasal cavity size and shape occur as a direct result of respiration-related needs, such as warming and humidifying inhaled air. As the maxillary sinus occupies the remaining space within the naso-maxillary complex, it also increases in size. These differences are also attributed to multiple global factors among various ethnic and racial groups, these including special body stature, skeletal size, height and physique of an individual, environmental conditions and pneumatization process of sinus in varying age and sex groups [18].

CONCLUSION

The maxillary sinus sizes and volume showed sexual dimorphism at most age categories. It is not always possible to measure the sinus volume in the clinic. The volumetric value is the key to establishing an objective definition of hypoplasia or sinus atelectasis. It is useful to consider normal values and clinical indices in the diagnostic approach to sinus pathologies such as sinusitis or sinus dysmorphism. The normative size rather than the comparison with the opposite side can be used for treatment planning and evaluation of the outcome. A detailed knowledge of the anatomy of the sinuses and its morphometric comparison of both sides with gender and age consideration is essential in performing procedures such as functional endoscopic sinus surgery.

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