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Research Article

Study of age related changes of maxillary air sinus from its anteroposterior, transverse and vertical dimensions using Computerized Tomographic (CT) scan

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Abstract

The maxillary sinuses are largest of the paranasal sinuses and contained within the body of maxilla. After birth, the maxillary sinus enlarges with the growing maxilla, though it is only full developed following eruption of the permanent dentition. When teeth are lost, the maxilla reverts towards its infantile shape. Thus, its height diminishes and the alveolar process is reabsorbed. In the present study, anteroposterior, transverse and dimensions of maxillary air sinus of 90 subjects divided into 9 age groups were measured by CT scan. The study concluded that there was gradual increase in all three dimension from age groups 0-25 years and thereafter, a decrease in dimensions was observed.

Keywords: Paranasal sinuses, pneumatic, alveolar process, coronal plane

1. Introduction

The anatomy of paranasal sinus is complex and variable from person to person. The main characteristics of these structures are pneumatic and initiation and pneumatization differs from person to person[1].

The maxillary sinus is the first of paranasal sinus to begin development in human fetus. It appears as a shallow groove on the nasal aspect at about the fourth month in utero. Though, small at birth, the sinus is identifiable radiologically. After birth, the maxillary sinus enlarges with the growing maxilla, though it is fully developed following the eruption of permanent dentition. At birth, the transverse and sagittal dimensions of maxillary sinus are greater than vertical. This is because the body of maxillae is little more than an alveolar process and the alveoli reach almost to the orbital floor. In adults, the vertical dimension is greatest, reflecting the development of the alveolar process and enlargement of the sinus. When teeth are lost, the bone reverts to its infantile shape. Thus, its height diminishes, the alveolar process is absorbed and the lower parts of the bone contracts and become reduced in thickness at the expense of the labial wall[2].

The volume of the normal maxillary sinus increases upto twenty years and then decreases[3]. There is no significant difference in the size of maxillary sinus between 50-79 years. In inflammatory changes like chronic maxillary sinusitis etc. the volume of maxillary sinus decreases[4]. Until the use of computed tomography (CT) by Haunsfield for diagnosis in 1972,

x-rays were used for the measurement of area, volume and shape of paranasal sinuses ,since then the use of CT has been common in studies since CT provides infinitely clearer images of the air sinuses. Each maxillary sinus is a pyramidal radiolucent area below the orbit and lateral to the lower part of the nasal cavity, extending inferiorly into the alveolar process of the maxilla. The present study was done to find out the average maximum dimensions (anteroposterior, transverse and vertical) of maxillary air sinus in males and females using CT scan and study the age related changes of maxillary sinus with these dimensions.

2. Materials and Method

The study was carried out in the Department of Anatomy, Gandhi Medical College in association with Jawahar Lal Nehru Cancer Hospital and Research Centre, Bhopal (M.P.). The study included CT scans of paranasal sinuses of 90 subjects having normal air sinuses. All CT scans were done on CT/e spiral CT machine (GE) in both axial and coronal planes. The scan mode was helical. After lateral topogram, examination consisted of 5mm axial crossections using 125Kvp and 80-160mAS. The section of maxillary sinus having maximum dimension was recorded.

For axial scans, subject lies supine with hard palate perpendicular to the table top. Scanning plane was parallel to inferior orbitomeatal line and scanning was done from top of frontal sinus to bottom of maxillary teeth. Anteroposterior and transverse dimension were calculated in this plane. For coronal section, subject lies prone, scanner is angled perpendicular to hard palate and scanning was done from anterior wall of frontal sinus to posterior wall of sphenoid sinus. The vertical dimension was obtained from this section (Fig. 1-4).

3. Result

In the present study, there was gradual increase in all the 3 dimensions from age group zero to 25 years and thereafter a decrease in dimensions was observed. Maximum dimension in males was observed in age group 21-25 years. Highest Dimension in females was observed in age group 21-25 years. Average of AP, transverse and vertical dimensions in 90 subjects were 3.35 $\pm$ 0.53cm, 2.17 $\pm$0.35cm and 3.71$\pm$0.74cm, respectively. Vertical dimension in adults is larger than AP, which is larger than transverse dimension (Table 1-4).

4. Discussion

The paranasal sinus anatomy varies from person to person. The main characteristics of these structures are pneumatic. Genetic diseases, environmental conditions and past infections can affect the process of pneumatization of paranasal sinuses. The size of maxillary air sinuses are reported to increase with age. Our results also showed that all the three dimensions of maxillary air sinus increase from age group 0 to 25 years.

The change of maxillary sinus volume according to subjects age and gender and concluded that the highest average for maxillary sinus size in males was observed in 3rd decade (21-25years) while, in females the highest average was observed in 2nd decade (16-20years). In our study, the highest average dimensions of maxillary sinus for both males and females was observed in age group 21-25years. Thus, the present study is comparable to the study done by them in case of males however it differs in case of females. This difference can be attributed to environmental conditions and genetic contributions to pneumatization[1,5].

Our study is comparable to the study done by *Ariji et al*.[1], who reported the normal transverse and anteroposterior dimensions to be 2.70 (SD+0.60) cm and 3.56 (SD+0.47) cm respectively. In our study the average transverse and anteroposterior width came to be 2.17 (SD-0.35) cm and 3.35 (SD+0.53) cm respectively.

The transverse and sagittal maxillary dimensions are greater than the vertical however in adults the vertical dimension is greatest[3]. Our study corresponds to this and anteroposterior dimension was more than vertical in age group 0-10 years and then onwards vertical dimension was observed to be greater than anteroposterior and transverse dimension.

5. Conclusion

The size of maxillary air sinus is decreased in inflammatory changes of bone (maxilla). Moreover, the small sinuses have a tendency to develop chronic inflammatory changes. The results obtained in the present study can be helpful in understanding the normal and pathological conditions of maxillary sinus.

Reference

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Table 1: Anteroposterior Dimension

Age Group	Males Mean + SD	Females Mean + SD	Average Mean
0-10	2.44+0.82	2.48 + 0.58	2.46
11-15	3.53+0.50	3.33 + 0.62	3.45
16-20	3.55 + 0.45	3.63 + 0.14	3.58
21-26	3.74 + 0.25	3.72 + 0.30	3.73
26-30	3.64 + 0.48	3.30 + 0.43	3.47
31-40	3.73 + 0.35	3.18 + 0.33	3.46
41-50	3.40 + 0.37	3.23 + 0.35	3.32
51-60	3.25 + 0.35	3.33 + 0.22	3.29
61 & above	3.40 + 0.25	3.46 + 0.38	3.42

Table 2: Transverse Dimension

Age Group	Males Mean + SD	Females Mean + SD	Average Mean
0-10	1.58 + 0.99	1.66 + 0.39	1.62
11-15	2.20 + 0.18	2.05 + 0.50	2.14
16-20	2.23 + 0.31	2.45 + 0.20	2.32
21-26	2.56 + 0.13	2.52 + 0.17	2.54
26-30	2.26 + 0.17	2.32 + 0.40	2.29
31-40	2.23 + 0.34	2.15 + 0.05	2.19
41-50	2.20 + 0.28	2.03 + 0.50	2.12
51-60	2.25 + 0.18	2.20 + 0.16	2.23
61 & above	2.15 + 0.36	2.03 + 0.15	2.12

Table 3: Vertical Dimension

Age Group	Males Mean + SD	Females Mean + SD	Average Mean
0-10	2.06 + 0.58	2.42 + 0.61	2.24
11-15	3.78 + 0.54	3.83 + 0.34	3.80
16-20	3.95 + 0.55	4.07 + 0.29	4.00
21-26	4.46 + 0.60	4.36 + 0.70	4.41
26-30	3.84 + 0.52	3.84 + 0.57	3.84
31-40	4.23 + 0.33	3.63 + 0.33	3.93
41-50	3.83 + 0.55	3.75 + 0.50	3.79
51-60	3.50 + 0.65	3.58 + 0.39	3.54
61 & above	3.88 + 0.60	3.76 + 0.06	3.85

Table 4: Average of different dimensions from age group zero to 61 years and above

Dimensions	Total Avg. (M+F) n = 90	Males (Mean + SD) n = 52	Females (Mean + SD) n = 38
Anteroposterior	3.35 + 0.53	3.41 + 0.51	3.30 + 0.56
Transverse	2.17 + 0.35	2.18 + 0.34	2.16 + 0.37
Vertical	3.71 + 0.74	3.73 + 0.80	3.69 + 0.70

n= no. of subject
M= Male
F= Female

Figure 1: Axial section of maxillary sinus in 25 year male for measurement of posterior diameter

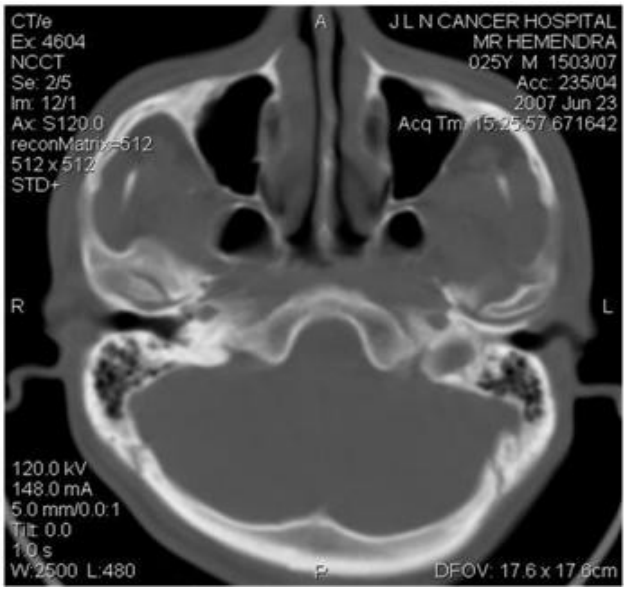

Figure 2: Axial section of maxillary sinus in 14 year female for measurement of anteroposterior diameter.

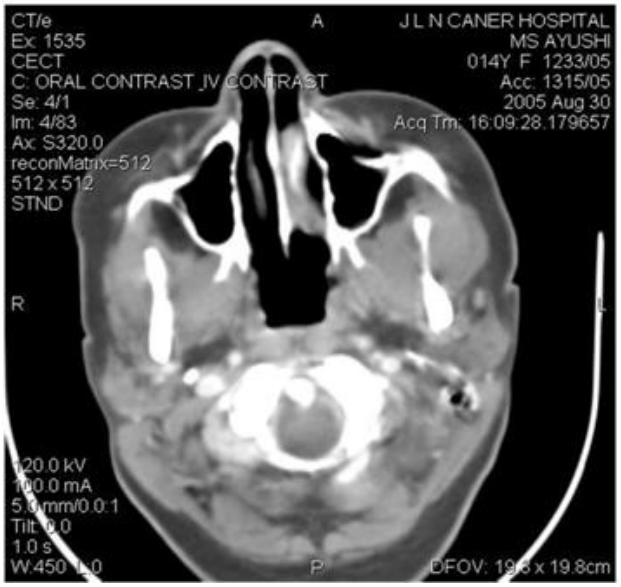

Figure 3: Axial image in 40 year male of maxillary sinus for measurement of anteroposterior diameter

Figure 4: Coronal image of maxillary sinus for measurement of vertical diameter