

Morphometry of frontal sinus in correlation to age and gender by Computed TomoFig.y**P. Moula Akbar Basha¹, Pawan Kumar Mahato^{2*}**¹*PhD Research Scholar, Department of Anatomy, Index Medical College, Indore, Madhya Pradesh, India*²*Associate Professor, Department of Anatomy, Index Medical College, Indore, Madhya Pradesh, India***Received: 09-10-2021 / Revised: 28-11-2021 / Accepted: 21-12-2021****Abstract**

Introduction: Frontal sinuses are paired irregularly shaped pneumatized cavities that are located in the frontal bone, posterior to the superciliary arch and superior to each eye and extends between the anterior and posterior tables of the ascending portion of the frontal bone. The uniqueness of the frontal sinus continues with the absence, or presence of a septum which typically deviates from the midline of the left and right frontal sinus. **Materials and Methods:** This is a prospective study conducted at Department of Anatomy and Radiology, Index Medical College, Indore with included 90 Sample sizes over a period of 2 years. Either gender of Age group between 1 to 70 years were included. They were included in the study after recording demoFig.ic data, brief history of the present illness and past medical/surgical history. The various parameters like height, width and depth of the frontal sinus were measured using Computed tomoFig.y scans in the Osirix software. **Result:** A total of 90 patients who fulfilled the selection criteria during the study were enrolled, 49 were males and 41 females, which correspond to 54.5% of male and the rest female. In our study, differences were found between male was 3.83 cm and female was 2.92 cm of right height of frontal sinus. There is statistically significant difference between the male and female measurements allowed the observer to perform the comparison between sexes utilizing just one sinus' parameters. In our study, the frontal sinus of right width in males was 2.74 cm and in females it was 2.23 cm. The width of the frontal sinus was not found to be significant in relation to gender in our study. **Conclusion:** It was found that the length and width of the frontal sinus area, increase with age because of hormonal and mechanical stresses of mastication. In addition, the size was increasing due to bone resorption of sinus.

Keywords: Frontal sinus, Frontal bone, Computed TomoFig.y.

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Introduction

Frontal sinuses are paired irregularly shaped pneumatized cavities that are located in the frontal bone, posterior to the superciliary arch and superior to each eye and extends between the anterior and posterior tables of the ascending portion of the frontal bone[1]. The uniqueness of the frontal sinus continues with the absence, or presence of a septum which typically deviates from the midline of the left and right frontal sinus[2]. Each frontal sinus communicates with the nasal fossa, specifically the middle meatus, via the infundibulum and are triangular, or pyramidal shaped, with the apex superior to its base[3]. The frontal sinus develops from an ethmoidal cell as diverticula that originates from the lateral aspect of the nasal wall approximately during the fourth intrauterine month, following the development of a sinus[4]. The asymmetrical configuration of the frontal sinuses can be contributed to unequal reabsorption of the diploe during the development of the sinuses[5]. Although the frontal sinus begins to develop during utero, it is not actually visible at birth, but appears at the second year of life and is well developed by the seventh or eighth year [6]. The frontal sinus completes its development by age 20 and does not typically change during adulthood due to the sinus' strong walls [7]. The frontal sinus can experience changes in old age due to several reasons. The sinus may become larger due to bone reabsorption causing the walls to thin as the individual ages [8]. Contrarily, the frontal sinus may also appear atrophic, or become smaller, due to pathological events such as fractures, tumors or severe infections, as well as gradual pneumatisation [9].

The absence of a paranasal sinus is uncommon and typically only occurs in the frontal sinus. Absence of the frontal sinus occurs in only 2.00-4.00% of the sample with bilateral absence occurring in only 5.00% and unilateral 4.00%[10]. These percentages are known to differ to an extent, dependent on ethnic sample, of which the Eskimo sample has the highest occurrence, which is believed to have developed as an adaption to their climate conditions [11].

Materials and methods

This is a prospective study conducted at Department of Anatomy and Radiology, Index Medical College, Indore with included 90 Sample sizes from January 2020 December 2021. Either gender of Age group between 1 to 70 years were included.

Exclusion criteria

- History of sinus pathology issues could be excluded as possible outliers before measurements.
- History of maxillofacial trauma and history or clinical characteristics of any type of systemic disorders like bone diseases; nutritional and endocrinal diseases were excluded.

They were included in the study after recording demoFig.ic data, brief history of the present illness and past medical/surgical history. The various parameters like height, width, depth & volume of the frontal sinus were measured using Computed tomoFig.y scans in the Osirix software. CT image files, with a slice thickness of 0.625, were then uploaded to the Osirix software database for examination. The CT slice thickness was 0.625. The study was designed to measure volume of the frontal sinus used for sex identification. This was done in an effort to identify a preferential sinus for sex identification.

Statistical Analysis

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

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Result : A total of 90 patients who fulfilled the selection criteria observations were tabulated as below. during the study were enrolled. The data were analysed, and the final

Table 1: Distribution of Gender

Sex	No. of patients	Percentage
Male	49	54.5
Female	41	45.5
Total	90	100

In table 1, of the 90 samples, 49 were males and 41 females, which correspond to 54.5% of male and the rest female in table 1.

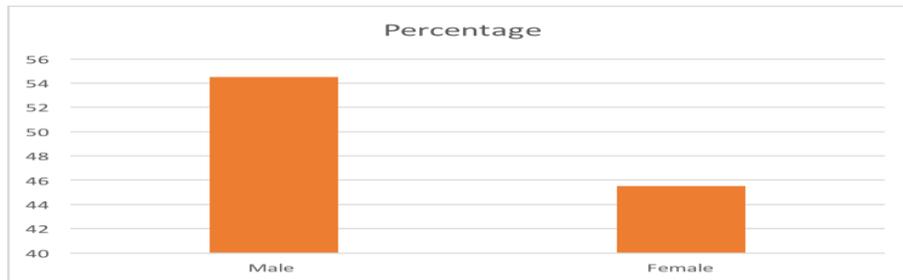


Fig 1: Distribution of Gender

In Fig. 1, of the 90 samples, 49 were males and 41 females, which correspond to 54.5% of male and the rest female in table 1.

Table 2: Distribution of the number of subjects according to age group

Age group	No. of patients	Percentage
18-30 years	37	41.1
31-50 years	31	34.4
51-70 years	22	23.3
Total	90	100

In this study, the maximum number of patients were in the age group of 18-30 years which were 41.1% (n =37) of total followed by age group 31–50 years having 34.4% (n = 31) in this group and 23.3% were 51-70 years in table 2.

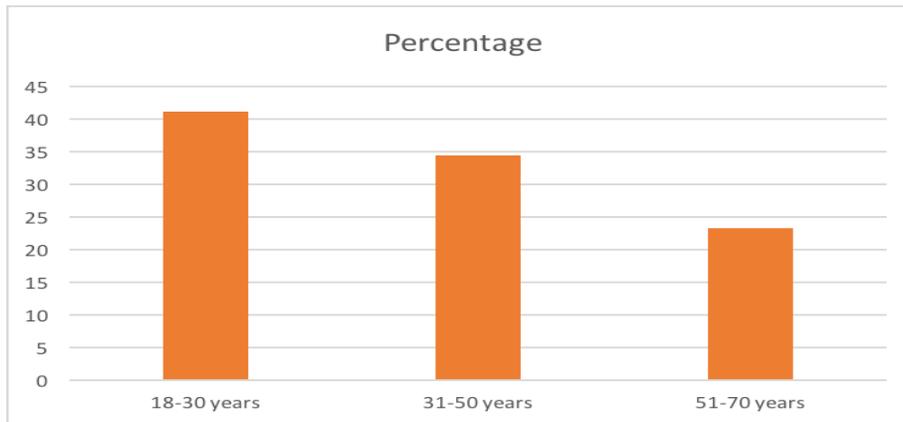


Fig 2: Distribution of the number of subjects according to age group

In this study, the maximum number of patients were in the age group of 18-30 years which were 41.1% (n =37) of total followed by age group 31–50 years having 34.4% (n = 31) in this group and 23.3% were 51-70 years in Fig. 2.

Table 3: Descriptive Statistics of right height (cm) of frontal sinus in males and females

Sex	18-30 years	31-50 years	51-70 years
Male	2.11	4.21	3.83±1.12
Female	1.93	3.74	2.92±0.98
p-value			0.0001

In our study, differences were found between male was 3.83 cm and female was 2.92 cm of right height of frontal sinus. There is statistically significant difference between the male and female measurements allowed the observer to perform the comparison between sexes utilizing just one sinus' parameters in table 3.

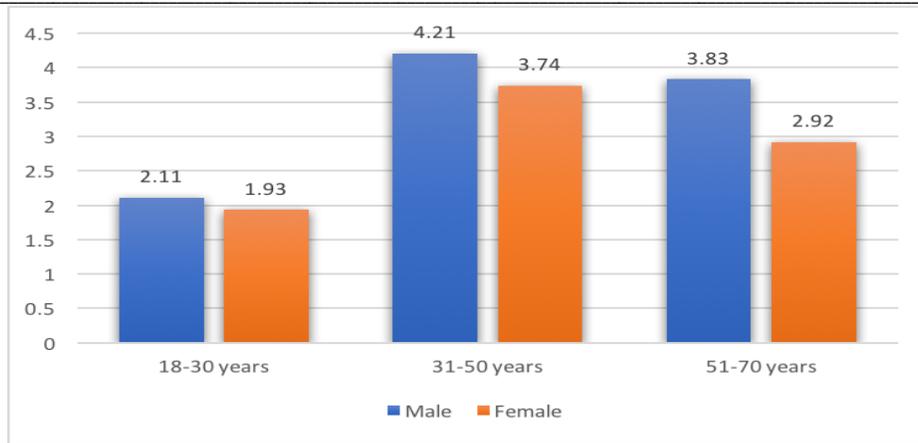


Fig 3: Descriptive Statistics of right height (cm) of frontal sinus in males and females

In our study, differences were found between male was 3.83 cm and female was 2.92 cm of right height of frontal sinus. There is statistically significant difference between the male and female measurements allowed the observer to perform the comparison between sexes utilizing just one sinus' parameters in Fig. 3.

Table 4: Descriptive Statistics of Left height (cm) of frontal sinus in males and females

Sex	18-30 years	31-50 years	51-70 years
Male	2.03	4.13	3.74±1.23
Female	1.98	3.87	3.23±1.93
p-value			0.112

However, the statistically significant differences were weak in left height (cm) of frontal sinus between male was 3.74 cm and female was 3.23 cm in table 4.

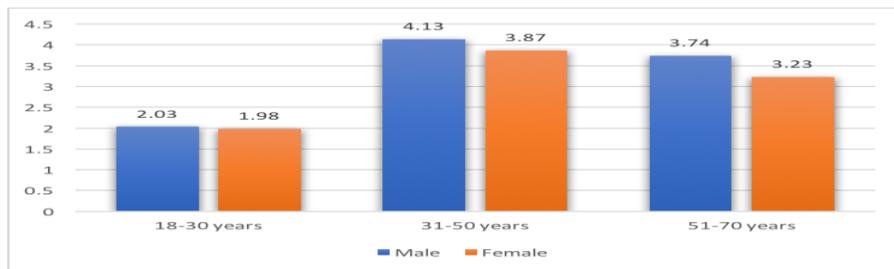


Fig 4: Descriptive Statistics of Left height (cm) of frontal sinus in males and females

However, the statistically significant differences were weak in left height (cm) of frontal sinus between male was 3.74 cm and female was 3.23 cm in Fig. 4.

Table 5: Descriptive Statistics of right width (cm) of frontal sinus in males and females

Sex	18-30 years	31-50 years	51-70 years
Male	2.21	4.02	2.74±0.98
Female	1.88	3.74	2.23±0.83
p-value			0.072

In our study, the frontal sinus of right width in males was 2.74 cm and in females it was 2.23 cm. The width of the frontal sinus was not found to be significant in relation to gender in our study in table 5.

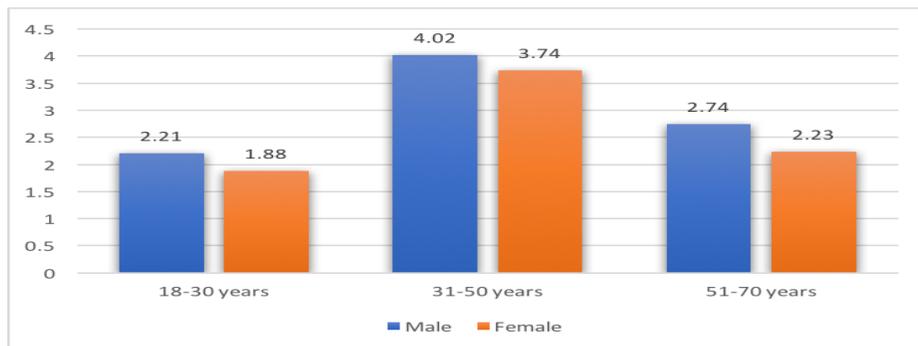


Fig 5: Descriptive Statistics of right width (cm) of frontal sinus in males and females

In our study, the frontal sinus of right width in males was 2.74 cm and in females it was 2.23 cm. The width of the frontal sinus was not found to be significant in relation to gender in our study in Fig. 5.

Table 6: Descriptive Statistics of left width (cm) of frontal sinus in males and females

Sex	18-30 years	31-50 years	51-70 years
Male	2.02	4.22	2.93±0.97
Female	1.86	3.77	2.27±0.89
p-value			0.042

On the other hand, frontal sinuses of left width males was found to be larger than that of females 2.93 cm and 2.27 cm respectively; the statistical difference of means between them was significant in table 6.

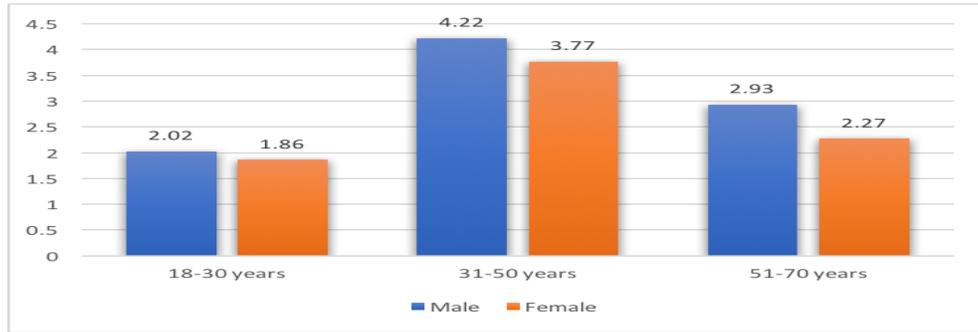


Fig 6: Descriptive Statistics of left width (cm) of frontal sinus in males and females

On the other hand, frontal sinuses of left width males was found to be larger than that of females 2.93 cm and 2.27 cm respectively; the statistical difference of means between them was significant in Fig. 6.

Table 7: Descriptive Statistics of right depth (cm) of frontal sinus in males and females

Sex	18-30 years	31-50 years	51-70 years
Male	1.13	3.98	2.02±0.83
Female	1.08	2.87	1.93±0.73
p-value			0.074

When compared between gender, sinus depth size was more in values in males was 2.02 cm than females 1.93 cm. When compare to other authors the depth of frontal sinus on right side was being more than left side both in males & females, in the present study which was similar to other study in table 7.

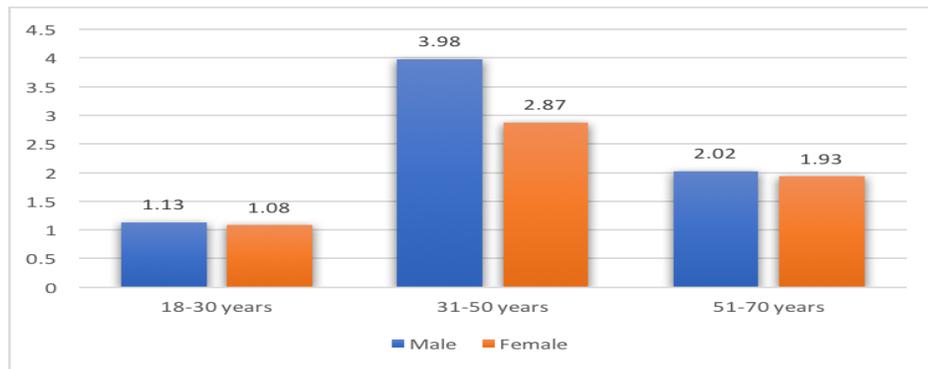


Fig 7: Descriptive Statistics of right depth (cm) of frontal sinus in males and females

When compared between gender, sinus depth size was more in values in males was 2.02 cm than females 1.93 cm. When compare to other authors the depth of frontal sinus on right side was being more than left side both in males & females, in the present study which was similar to other study in Fig. 7.

Table 8: Descriptive Statistics of left depth (cm) of frontal sinus in males and females

Sex	18-30 years	31-50 years	51-70 years
Male	1.03	3.13	2.34±0.94
Female	0.93	2.53	1.83±0.87
p-value			0.064

The Left side depth of sinus was being more in male 2.34 cm than females 1.83 cm. In the male sinus size was more in values than females in table 8.

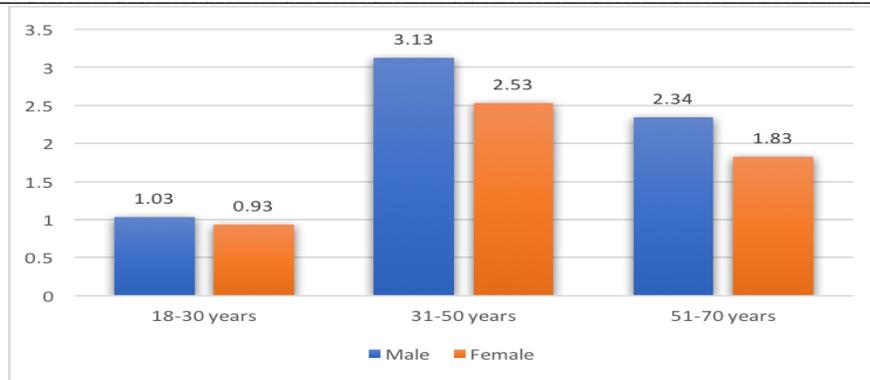


Fig 8: Descriptive Statistics of left depth (cm) of frontal sinus in males and females

The Left side depth of sinus was being more in male 2.34 cm than females 1.83 cm. In the male sinus size was more in values than females in Fig. 8.

Discussion

The frontal sinuses are one of the four pairs of paranasal sinuses that are situated behind the brow ridges. Sinuses are mucosa-lined airspaces within the bones of the face and skull[12]. Each opens into the anterior part of the corresponding middle nasal meatus of the nose through the frontonasal duct which traverses the anterior part of the labyrinth of the ethmoid. These structures then open into the semilunar hiatus in the middle meatus[13]. In our study, differences were found between male was 3.83 cm and female was 2.92 cm of right height of frontal sinus. There is statistically significant difference between the male and female measurements allowed the observer to perform the comparison between sexes utilizing just one sinus' parameters. When comparing the frontal sinus parameters between the sexes, statistically significant differences were found in every parameter except in few parameters. This suggests that using linear dimensions of the frontal sinus would be more appropriate in the process of sex determination than volumetric parameters. However, the statistically significant differences were weak in left height (cm) of frontal sinus between male was 3.74 cm and female was 3.23 cm. Similarly, study by Patil N et al the height of sinus being more on right side than right both in males & females, males size more in value than female sinus size[14].

In our study, the frontal sinus of right width in males was 2.74 cm and in females it was 2.23 cm. The width of the frontal sinus was not found to be significant in relation to gender in our study, which was to the findings reported by Rubiera et al.[15]. On the other hand, frontal sinuses of left width males was found to be larger than that of females 2.93 cm and 2.27 cm respectively; the statistical difference of means between them was significant, a similar finding noted in another study Fatu C et al. (2016), identified 7 parameters in an attempt to accurately identify the sex of an unknown individual[16].

According to Fatu et al. was found that the length and width of the frontal sinus area, increase with age. It also found to decrease in males in the age group of 45 years and above in accordance with the study conducted by Gulisano M et al.,[17] who suggested that the frontal sinus continued to expand until the age of 40 years because of hormonal and mechanical stresses of mastication. The tendency of the right side to be larger than the left side was seen in agreement with the results from other studies Gulisano[18]. This discrepancy in the sides can be attributed to their independent development (Nambiar, Naidu (1999))[19]. When compared between gender, sinus depth size was more in values in males was 2.02 cm than females 1.93 cm. When compare to other authors the depth of frontal sinus on right side was being more than left side both in males & females, in the present study which was similar to other study. The Left side depth of sinus was being more in male 2.93 cm than females 2.27 cm. In the male sinus size was more in values than females except in Quatrehomme G et al studies & in the present study in male right side being more in value than left[20].

Conclusion

The present study coincides with the growth pattern of frontal sinus with other authors. It was found that the length and width of the frontal sinus area, increase with age because of hormonal and mechanical stresses of mastication. In addition, the size was increasing due to bone resorption of sinus. This difference could have been due to morphological differences seen in various ethnic groups and various other radioFig.ic techniques used for the morphological evaluation of the frontal sinuses.

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