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A PROSPECTIVE / CROSS-SECTIONAL STUDY OF MEASUREMENTS OF DIMENSIONS OF FRONTAL SINUSES AND MAXILLARY SINUSES BY USING OF 128 SLICE MULTI-DETECTOR COMPUTED TOMOGRAPHY(MDCT) SCAN ON SOUTH-CENTRAL GUJARAT POPULATIONS FOR GENDER DIMORPHISMS.

Radiology

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ABSTRACT

Context: The Multi-detector Computed Tomography (MDCT) Scan is a Non-Invasive, Advanced Imaging Technique, which is a used in Forensic Radiology for the Identification of humans, especially in cases where the body is decomposed, fragmented, or burned. In such conditions Frontal Sinus and Maxillary Sinus also considered by different researchers for Sex identification. **Aims:** To compares the Frontal and Maxillary sinus dimensions for to assess, it's reliability and accuracy for gender determination. **Settings And Design:** Prospective, Cross-sectional study. **Material And Methods:** A total of 201 patients (109 males, 92 females) were selected as a participant. **Statistical Analysis:** The data were analyzed by using of STATA program 14.2 version and independent sample test were performed for Both Male and Female Groups. **Results:** The Frontal Sinus Antero-posterior diameters, Transverse diameters, Supero-inferior diameters and Volumes are being a more accurate Predictor for gender Dimorphism. As well as Maxillary Sinus Antero-posterior diameters, Supero-inferior diameters and volumes are being a more accurate predictor for gender Dimorphism. **Conclusion:** The Computed Tomography dimensions of the Frontal and Maxillary Sinus can be successfully used as an adjunct tool for racial and sexual Dimorphism in forensic radiology.

KEYWORDS

Multi-Detector Computed Tomography, Frontal sinus & Maxillary Sinus Dimensions, Sex Dimorphism.

INTRODUCTION

Identity verification is commonly observed as the need for unknown remains after natural disasters such as tsunamis, earthquakes, floods, and landslides, and is defined as the process of verifying the identity of an individual. Personal identification may also be required in the event of a man-made disaster such as a terrorist attack, mass murder, or bombing, or in the deliberate dismemberment of a corpse in a manner that may obscure the identification.[1]

The process of identifying a person from dismembered body parts and skeletal remains is one of the most challenging aspects of forensics, but the variety of diagnostic methods for determining the sex is advancing rapidly. Age and ethnicity play an important role in identifying a person. Gender identification in particular, is an important aspect of identifying unknown human remains in forensics, especially when complete skeletons and cadavers are not available for analysis. Skeletal-based identification is important because forensic anthropologists often obtain incomplete skeletons, and remains skeletal can be preserved for centuries. some alternative identification methods for sex estimation are emerging. [2,3,4]

There are a number of techniques that can be used to identify unknown human remains, including fingerprint analysis, DNA matching, anthropological methods, and radiological methods. Gender was determined by Cranio-facial height, mastoid height, bi-condyle width, mandibular width, pelvis, skull, long bones with assessment of epiphysis & metaphysis, between basion and prosthion distance, head circumference, orbital crest length, mastoid process, mandibular ramus, shape and length of plate , occipital condyle circumference, tooth size, head length and height, distance between the basion and nasion, height of mandibular symphysis, foramen magnum, sphenoid sinus, Sella turcica, mastoid air cells, and frontal and maxillary sinuses. [5,6]

When certain postmortem changes occur, it becomes increasingly difficult to identify postmortem individuals as a forensic procedure. These changes may include degradation and skeletonization due to environmental factors such as humidity, temperature, and microbial exposure. Occasionally, there are extreme postmortem changes due to explosions, warfare, plane crashes, and other mass disasters which also making the sex determination increasingly difficult. [2,5]

Both the frontal and maxillary sinuses have distinct features that aid in human identification. Frontal and Maxillary sinuses of different species show sexual dimorphism. This refers to systemic differences in shape or size between different sexes within the same species. The morphology of the frontal sinuses allows their configuration to exhibit highly individualistic markers due to their unique characteristics related to shape, size, and position, allowing the frontal sinuses to serve as a personal identification tool. Because the uniqueness of the frontal sinus has been scientifically proven by several studies in the literature. [1,5,7,8]

Because of less literature to assess and compares the frontal sinus and maxillary sinus dimensions for gender dimorphism by using of Computed Tomography (CT) Scan. The, present study is aim to evaluate reliability and accuracy of frontal sinus and maxillary sinus dimensions and volumes for gender recognition by using MDCT Scan.

MATERIAL & METHODS

Study Design: -

A prospective / Cross-sectional study was a performed on 201 Patients (109 Males & 92 Females groups), **after approval of research proposal by Institutional Ethics Committee (I.E.C.).**

The main source of data for this research study is collected from patients those who referred to the Department of Radiodiagnosis, Shree Krishna Imaging center, Karamsad; for Plain and contrast CT scan of Head, PNS, Facial bones and Neck will be taken as participant.

Antero-posterior (AP), and Transverse (TX) dimensions of right and left frontal sinus and maxillary sinuses were taken on axial image orientation and Supero-inferior (SI) dimensions on coronal orientation.

And, Formula for volumes of the frontal sinuses and maxillary sinuses is: - *AP* **X** *TX* **X** *SI* Dimensions **X** 0.52.

Figure-1a). Both Frontal Sinus AP, TX Dimensions.

Figure-1b). Both Frontal Sinus SI Dimensions.

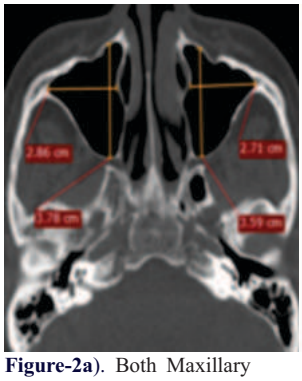


Figure-2a). Both Maxillary Sinus AP, TX Dimensions.

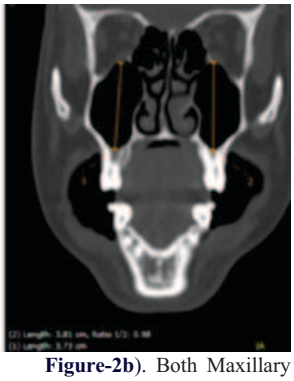


Figure-2b). Both Maxillary Sinus SI Dimensions.

RESULTS

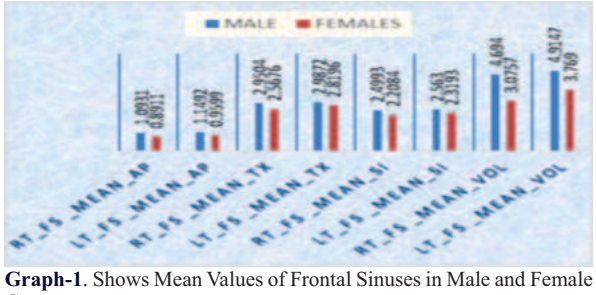
Statisical Analysis Of Measurements Of Ap, Tx, Si Diameters & Voumes Of Right And Left Frontal Sinuses. [Table: -1]

Parameters- Dimensions	Sex	Mean (cm)	SD (cm)	P Value
FS_AP_ RT_ Side.	M	1.09	0.28	< 0.000*
	F	0.89	0.27	
FS_AP_ LT_ Side.	M	1.14	0.28	< 0.000*
	F	0.95	0.31	
FS_TX_ RT_ Side.	M	2.95	0.88	0.04*
	F	2.56	0.98	
FS _TX_ LT_ Side.	M	2.98	0.80	1.99
	F	2.81	1.03	
FS_SI_ RT_ Side.	M	2.49	0.61	0.02*
	F	2.20	0.71	
FS_SI_ LT_ Side.	M	2.5 2.56	0.61	0.01*
	F	2.31	0.75	
FS_ Vol_ RT_ Side.	M	4.69	3.27	< 0.000*
	F	3.07	2.81	
FS_ Vol_ LT _Side.	M	4.92	3.09	0.008*
	F	3.76	2.94	

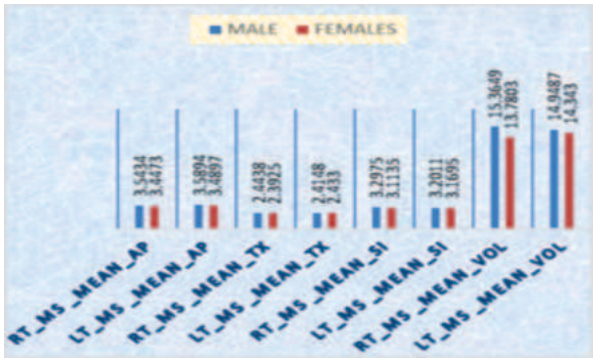
[**Abbreviations**: - FS (Frontal sinus), MS (Maxillary sinus), AP (Antero-posterior), TX (Transverse), SI (Supero-inferior), & VOL (Volume).]

Statisical Analysis Of Measurements Of Ap, Tx, Si Diameters & Voumes Of Right And Left Maxillary Sinuses. [Table: -2]

Parameters Dimensions	Sex	Mean (cm)	SD (cm)	P Value
MS _AP_ RT_ Side.	M	3.54	0.37	0.06
	F	3.44	0.35	
MS_AP_ LT_ Side.	M	3.58	0.35	0.05*
	F	3.48	0.37	
MS _TX_ RT_ Side.	M	2.44	0.47	0.44
	F	2.39	0.46	
MS_TX_ LT_ Side.	M	2.41	0.47	0.78
	F	2.43	0.45	
MS_SI_ RT_ Side.	M	3.29	0.48	0.00*
	F	3.11	0.45	
MS_SI_ LT_ Side.	M	3.20	0.51	0.65
	F	3.16	0.47	
MS_ Vol_ RT_ Side.	M	15.36	5.42	0.03*
	F	13.78	4.79	
MS_ Vol_ LT_ Side.	M	14.94	5.30	0.40
	F	14.34	4.86	



Graph-1. Shows Mean Values of Frontal Sinuses in Male and Female Groups.



Graph-2. Shows Mean Values of Maxillary Sinuses in Male and Female groups.

DISCUSSION

The Mean and standard deviation values of Antero-posterior diameter of right and left side of frontal sinuses for male groups were (1.09 ± 0.28 cm) and (1.14 ± 0.28 cm), when it compared with the female groups of right side and left side (0.89 ± 0.27 cm) and (0.95 ± 0.31 cm); which, showed statistical significance. (P value is < 0.05*).

The Mean and Standard Deviation Values of the transverse diameter of right of frontal sinuses for male groups were (2.95 ± 0.88 cm), when, it compared with the female groups of right side (2.56 ± 0.98 cm); which showed statistical significance. (P Value is < 0.05*).

The Mean and Standard Deviation Values of Supero-inferior diameter of right and left side of frontal sinuses for male groups were (2.49 ± 0.61 cm) and 2.56 ± 0.61 cm); when, it compared with the female groups of right side and left side (2.20 ± 0.71 cm) and (2.31 ± 0.75 cm); which, showed statistical significance. (P value is < 0.05* for both sides).

The Mean and Standard Deviation Values of Volumes of right and left side of frontal sinuses for male groups were (4.69 ± 3.27 cm^3) and (4.92 ± 3.09 cm^3); when, it compared with the female groups of right side and left side (3.07 ± 2.81 cm^3) and (3.76 ± 2.94 cm^3), which, showed statistical significance. (P value is < 0.05* for both sides).

The Mean and Standard Deviation Values of Antero-posterior diameter of left maxillary sinuses for male groups were and (3.58 ± 0.35 cm); when, it compared with the female groups of left side (3.48 ± 0.37 cm) which, showed statistical significance. (P value ≤ 0.05*).

The Mean and Standard Deviation Values of the Supero-inferior diameter diameters of right maxillary sinuses for male groups were (3.29 ± 0.48 cm); when, it compared with the female groups of right side (3.11 ± 0.45 cm); which, showed statistical significance. (P value is < 0.05*).

The Mean and Standard Deviation Values of the Volumes of right maxillary sinuses for male groups were (15.36 ± 5.42 cm^3); when, it compared with the female groups of right side (13.78 ± 4.79 cm^3); which, showed statistical significance (P value is < 0.05*).

In our 201 patients research study, overall accuracy of for gender differentiation between males and females is 70.5 %.

CONCLUSIONS

The Present Study showed the frontal sinus Antero-posterior diameters, transverse diameters, Supero-inferior diameters and volumes are being a more accurate predictor for sex determination in forensic radiology.

The Present study showed the maxillary sinus Antero-posterior diameters, Supero-inferior diameters and volumes are being a more accurate predictor for sex determination in forensic radiology.

So, according to Present study computed tomographic dimensions of the frontal and maxillary sinus can be successfully used as an adjunct tool for racial and sexual identification in forensic radiology.

Main limitation of this research study is small sample size and single center study.

However, in this research study environmental factors, genetic factors, ethnic, racial groups which can also cause variations in dimension and volumes of frontal sinuses and maxillary sinuses.

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