

Identification of Sex from Maxillary Sinus in Western Maharashtra Population

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Abstract

Background: As Maxillary Sinus are pneumatic bones delicate in cadavers, Morphological study has anatomical anthropological and medico legal important. Hence Morpho metric parameters of MXS in CT scan of both sexes were studied.

Methods: 23 male 23 female adult aged between 20-50 year healthy people were studied with CT images to measure medio-lateral, superoinferior and antero posterior dimensions and volumes of MXS in both sexes and results were analysed statistically.

Results: In ML Right mean values Males was 29.30 (SD±3.17), female 27.12 (SD±5.16 t test was 1.72 and p<0.001. SIR Right – Mean value of male was 40.02 (SD±3.66), female 35.11 (SD±4.40) t test 4.11 and p<0.001. AP (right side) Mean value of male was 44.23 (SD±3.21), female 38.03 (SD±2.30) t test 7.53 p<0.00. MLC (left side) mean value of male was 29.04 (SD±2.30), female 25.06 (SD±4.20) t test 3.98 p<0.004. SIL left side mean value of male 38.41 (SD±4.12), female 35.07 (SD±3.60) t test 2.92 p<0.005. APL (left side) mean value of male 42.36 (SD±2.60), female 39.05 (SD±2.45) t test value 4.44 p<0.001. The volumes study of MXS had VR – mean value of male 18.25 (SD±2.53), female 13.30 (SD±3.14) t test 5.88 p<0.041. In VL study mean value of male was 17.09 (SD±2.75), female was 12.44 (SD±3.42) p<0.001.

Conclusion: This pragmatic study of sexual dimorphism will be quite useful to medico-legal expert, anthropologist and anatomist

Keywords: MXS=Maxillary Sinus, CT Scan, computerised tomographic scan, adults, Maharashtra VR = Volumes of Right MXS. Sinus, VL=volume of left MXS sinus.

Introduction

Maxillary sinus is pneumatic bones present on either side of Norma frontals forming the floor of orbital cavity. Being pneumatic bones they are delicate and more prone to get broken. They lighten the skull and helps in the resonance of voice⁽¹⁾. It is difficult to study the morphometric values of cadaveric Maxillary sinuses (MXS) as they break easily. Hence attempt was made

to study computerised tomographic morpho-metric values in living subjects of both sexes to know the exact measurements.

The MXS is first PNS to develop and is located in the right and left maxillary bones and consists of two pyramidal shaped air filled cavities lined by mucosa. The MXS tend to appear at the end of second month of embryonic life and complete by the age between 18 to 20 years of life (2)(3), but size and shape of MXs varies amongst individuals between genders and different populations and/or ethnic groups. However the size and shape of MXS will be stabilized after second decade of life thus reliable measurements can be achieved by radiographic images after 20th year of age will be an ideal

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study⁽⁴⁾. Apart from this nutritional, generic hormonal environmental factors do contribute in the morphometry of MXS. Hence CT scan images of western Maharashtra were studied.

Material and Method

23 Male and 23 Female adults aged between 23-50 visiting to Vedantaa institute of Medical sciences Dhundalwadi, Dahanu, Palghar (dist)-401610, Maharashtra were studied.

Inclusive Criteria: These volunteers did not have any pathology of PNS and majority of healthy volunteers were selected for study.

Exclusion Criteria: The persons who had undergone surgery of PNS or Norma frontalis. History of fracture of Norma frontails, Immune compromised patients, and patients with pathology of PNS was excluded from study.

Methods: Non-contrast CT scan was performed to study the morphometry of Maxillary sinuses in both sexes using GECT/e dual slice CT scanner (GE health care technologies, Waukesha, WI, USA). Prior to the scan every patient was instructed to remove the metallic objects, jewellery, hairpins etc, from the head, to neck region and positioned on the CT table in prone position. The patient's neck was hyper-extended with the chin resting on pad for stabilization. Pads were inserted on both sides of head. The gantry was angulated to make it par perpendicular to the hard palate 3mm thickness were used on preliminary. Scout view extending form

anterior margin frontal sinus to the posterior margin of spheroid sinus with a reconstruction matrix zone of 512X512 at 120 KV, 100MA coronal CT was performed after instructing the volunteers to remain steady during the entire procedure.

The measurements like ML and SI were made, maxillary sinus were in the widest position with the help of on screen linear on screen (fig-A). To measure the AP dimensions of the maxillary sinus, the first and last appearance of the sinus was noted in the sequential coronal CT sections and number of sections between, them were selected finally selected section were multiplied by 3 (thickness of single section to find out the AP of the sinus. Maxillary sinus volume (MSV) was calculated by using the paint on slice tool on the work station. To define a volume outline of the sinus was traced manually on each slice of the image stack using on the screen mouse pointer in the coronal plane (fig-B). Once the tracing was complete, the work station automatically segmented the entire volume of the sinus form the surrounding structure and the segmented portion could be visualized and manipulated in 3D.

At this point switching to the histogram view on the work station (fig-C) automatically reflected the volume of the sinus in the cubic centimetres (CC) of both right and left maxillary sinus. The duration of study was 2017 to 2019.

Statistical analysis: The obtained results from different parameters were studied in SPSS software computer.



Fig A – Linear measurement of medio-sinus and super inferior dimension of maxillary sinus

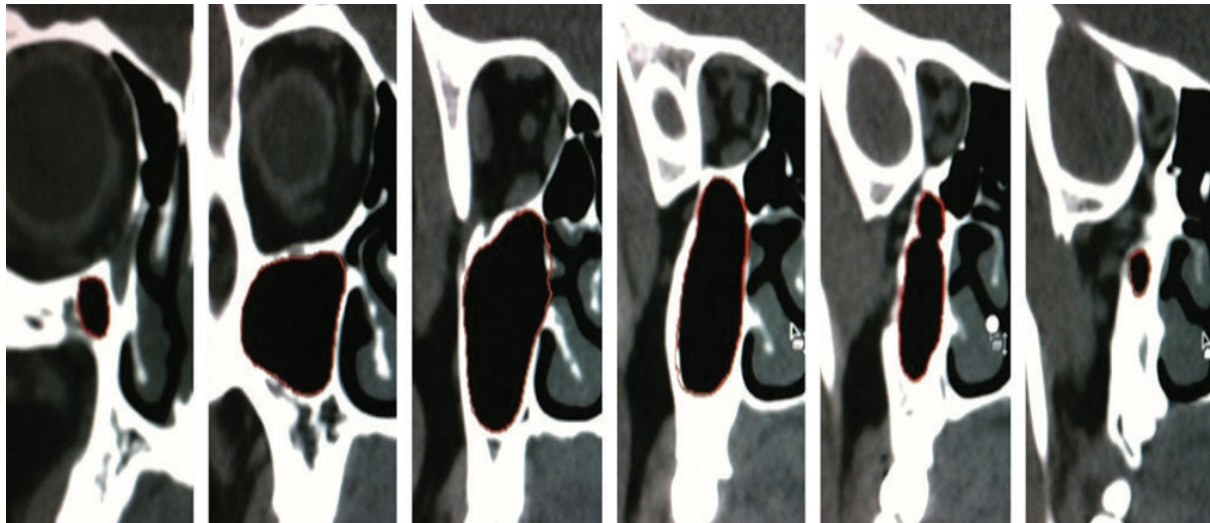


Fig B – point on slice tool



Fig C – workstation showing maxillary sinus.

Observation and Results

Table-1: Comparison of various dimensions of maxillary sinus measured on CT scan studies in both sexes. In ML Right mean values male was 29.30 (SD±3.17), female was 27.12 (SD±5.16) t test value was 1.72 and p<0.001. In the SIR (Right) mean value of male was 40.02 (SD±3.66), female was 35.11 (SD±4.40) t test value 4.11 and p value p<0.001. In AP (Right side) mean value of male was 44.23 (SD±3.21) in female 38.03 (SD±2.30) t test 7.53 p<0.001. In ML (left side) female 25.06 ((SD±4.20) t test 3.98 and p<0.01.

SIL (left side) mean value male 38.40 (SD±4.12) and female was 35.07 (SD±3.60) t test value 2.92 p<0.005.

In APL (left side) main value, male was 42.36 (SD±2.60), female 39.05 (SD±2.45) t test was 4.44 p<0.01.

Table-2: Comparison of maxillary sinus volume measured on CT in both sexes. In VR study mean value of male 18.25 (SD±2.53), female 13.30 (SD±3.14) t test value was 5.88 p<0.01. In VL study mean value of male was 17.09 (SD±2.75), female 12.49 (SD±3.42) t test 5.08 and p<0.001.

Table-1: Comparison of various dimensions of Maxillary Sinuses measured on CT scan studies in both sexes.

Sl. No	Particulars	Male (23)	Female (23)	T test value	P value
1	ML Right	29.30 (±3.17)	27.12 (±5.16)	1.72	P<0.01
2	SIR (Right)	40.02 (±3.66)	35.11 (±4.40)	4.11	P<0.01
3	AP (Right side)	44.23 (±3.21)	38.03 (±2.30)	7.53	P<0.00
4	ML (Left side)	29.04 (±2.30)	25.06 (±4.20)	3.98	P<0.04
5	SIL (Left side)	38.41 (±4.12)	35.07 (±3.60)	2.92	P<0.005
6	APL (Left side)	42.36 (±2.60)	39.05 (±2.45)	4.44	P<0.00

(MLR Right = Right Medio lateral dimension of right side. SIR (Right) = Supero inferior Dimension of right side. AP right side = Antero posterior dimension of side right. ML Left side = Medio lateral dimension of left sinus Maxillary sinus. SIL = superior-Inferior dimension of left maxillary. AP (left side)= left Antero-posterior dimension of left Maxillary sinus.

Table – 2: Comparison of Maxillary sinus volume measured an in both sexes

Sl. No	Particular	Male (23)	Female (23)	T test value	P value
1	VR	18.25 (±2.53)	13.30 (±3.14)	5.88	P<0.001
2	VL	17.09 (±2.75)	12.44 (±3.42)	5.08	P<0.001

VR = Volumes of Right Maxillary sinus

VL = Volumes of Left Maxillary sinus

Discussion

In the present study of Identification of sex from maxillary sinus in western Maharashtra of ML right study mean value of male was 29.30 (SD±3.17), female 27.12 (SD±5.16) t test was 1.72 p<0.001. AP right the mean value of male was 40.02 (SD±3.66), female 35.11 (SD±4.40) t test value was 4.11 p<0.001. In AP

(Right side) mean value of male was 44.23 (SD±3.21), female 38.03 (SD±2.30) t test was 7.3 p<0.000. In ML (left side) the mean value of male was 29.04 (SD±2.30), female 25.06 (SD±4.20) t test value was 3.98 p<0.004. In SIL (left side) mean value of male was 38.41 (SD±4.12), female was 35.07 (SD±3.60) t test was 2.92 p<0.005. In APL (left side) mean value of male was 42.3 (SD±2.60), female 39.05 (SD±2.43) t test was 4.44 and p<0.00 (Table-1). In the comparison of volume of maxillary

sinus on CT in both sexes. VR mean value of male was 18.25 (SD±2.53), female 13.30 (SD±3.14) t test was 5.88 p<0.001. In VL study mean value of male was 17.09 (SD±2.75), female 12.44 (SD±3.42) t test value was 5.08 p<0.001 (Table-2). These findings were more or less in agreement with previous studies⁽⁵⁾⁽⁶⁾⁽⁷⁾.

It was interesting to note that left MXS width was more discriminate than right MXS for sexual dimorphism in various studies of north and south Indian studies⁽⁸⁾⁽⁹⁾. Because it is well established fact that, foramina or sinus/space in the bone tends to start at surface irregularities because strain energy tends to concentrate such points. It was also noted that right MXS was larger and wider in abroad studies⁽¹⁰⁾⁽¹¹⁾. This anatomical variability between genders could be environment or nutritional adaptations because skeleton of a particular individual is able to adapt to its owner's way of life.

It was also mentioned that till puberty sexual dimorphism is insignificant in crania but after puberty hormonal, nutritional environmental factors play vital role in the gender determination in India and abroad crania.

It can't be denied that, males need to have correspondingly bigger lungs to support their relatively more massive muscles and body organs. Secondly males need a large air way, which begins with nose and nasopharynx. In other words, physiological changes in nasal cavity size and shape occur as direct result of respiration related needs, such as warming and humidifying inhaled air. As the MXS occupies the remaining space within the naso-maxillary complex, it also increase in size hence morpho-metric values is higher in males than females.

Summary and Conclusion

The present study of gender determination of MXS by CT scan study is an important step in identification in Medico-legal practice. It has to be borne in mind that MXS tend to stabilize morpho-metrically after second decade of life. Hence radiographic images will prove ideal in sexual dimorphism after second decade of life but this study further demands genetic, nutritional hormonal embryological study because the factors which determine the time of ossification are still obscure.

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