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Identification of Sex from Maxillary Sinus in Northern Maharashtra

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ABSTRACT

Background: Maxillary Sinus are delicate spaces between maxillary bones and floor of orbital cavities, helps to lightened the skull and resonance of voice after puberty.Variations in size and shape were observed, owingto their delicacy they get break hence CT scan study was carried out both sexes.

Methods: 25 male 25 female aged between 25-55 year healthy adults were studied, with CT images, medio-lateral, supero-inferior and antero-posterior dimensions and volumes of MXS were measured in both sexes and results were analysed statistically.

Results: ML Right SIR right, AP right ML (left) APC (left) volumes of MXS were compared and there was highly significant p value.

Conclusion: This radiological study (CT scan) of sexual dimorphism of MXS will be useful to medico-legal expert, anthropologist and anatomist

Keywords: Maxillary Sinus, CT Scan, Morphometric Volumes,Adults.

INTRODUCTION

Many criteria are available for sexual dimorphism of crania but least data is available regarding maxillary sinus because maxillary bones are delicate hence they are called pnuematic bones and more prone to get destructed after burial in the soil, as they are delicate, hence their marphometric study was done radiologically.

Maxillary sinus lightens the skull and help in resonance of voice.[1] Maxillary sinus (MXS) is first paranasal sinus (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 second month of embryonic life and complete its development by the age between 18 to 20 years of life [(2)(3)] but the size and shape of MXs varies amongst individuals between genders and different ethnic groups. However the size and shape of MXS will be stabilized after second decade of life thus reliable measurements can be achieved after 20th year of age;will be an ideal study [(4)]. The variations of MXS in both genders are also contributed by nutritional, genetic, hormonal, environmental factors. Hence present study also represents northern Maharashtra population.

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Material and Method

25 Male and 25 Female aged between 25-55years visiting to ACPM Medical college hospital Dhule-424002 (Maharashtra)were studied.

Inclusive Criteria: Volunteers did not have any pathology of para-nasal sinuses were selected for study.

Exclusion Criteria: The persons who had undergone surgery of PNS or Norma frontalis History of fracture of Norma frontails. The person who had any pathologyin PNS, and immune compromised patients were 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 CT scan 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 the 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 wasstudied, maxillary sinus was in the widest position with the help of on screen(figure-1). 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 of the sinus was tracedmanually on each slice of the image stack using on the screen mouse pointer in the coronal plane (figure-2). 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.

Duration of study was from April-2021 to March-2022

Fig. 1: Linear measurement of medio-sinus and super inferior dimension of maxillary sinus

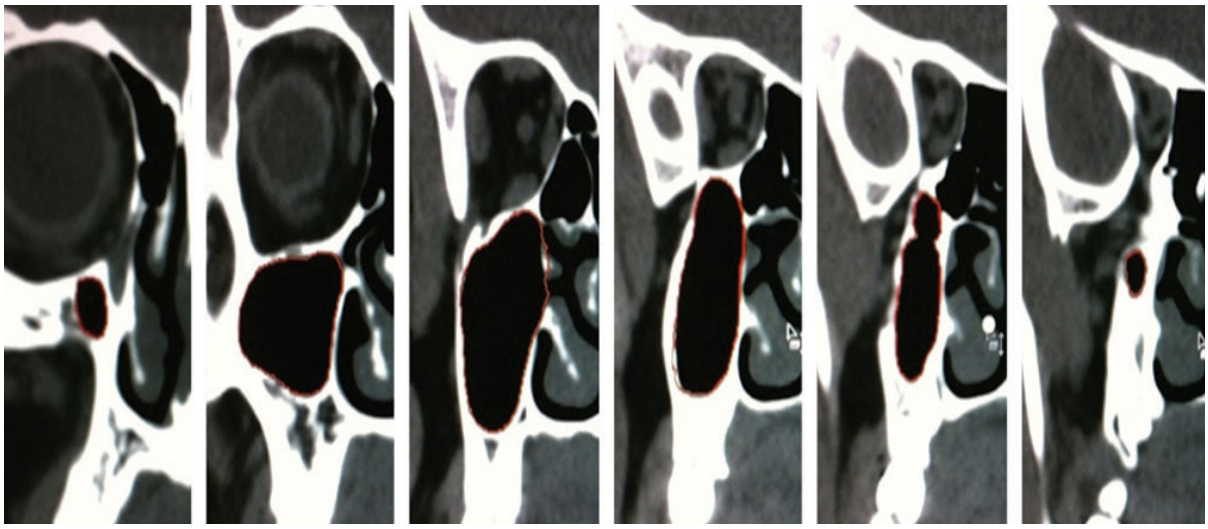

Fig. 2: Point on slice tool

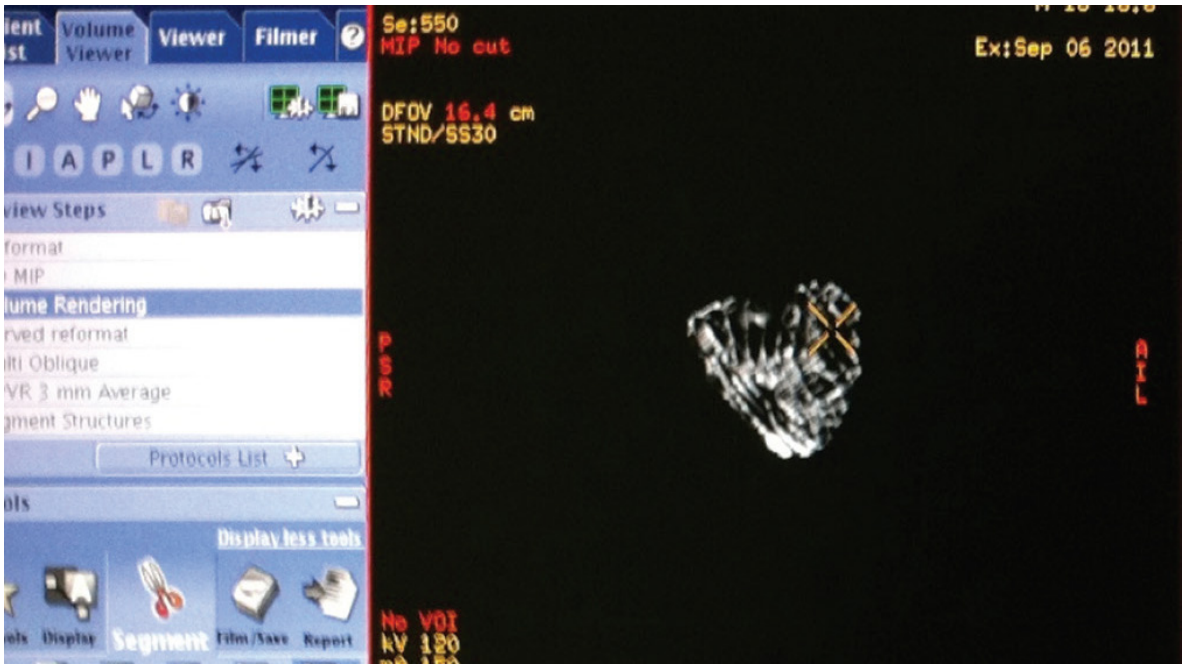

Fig. 3: Workstation showing maxillary sinus

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

- ML Right 28.32 (SD±3.15) in males, 26.92 (SD±4.15) in female, t test value was 1.34 and p value significant ($p<0.001$).
- SIR (Right) 39.05 (SD± 3.60) in males, 34.21 (SD±4.30) in females, t test value 4.25 and p value $p<0.001$. (p value was highly significant)
- AP (Right side) 43.42 (SD±3.30) in males, 37.06 (SD±2.28) in females, t test 7.90 and $p<0.001$(p value was highly significant).
- ML (left side) 28.09(SD±2.38) in male, 24.08 (SD±4.30) in females, t test 4.08 and $p<0.004$ (p value was highly significant).
- SIL (left side) 37.20 (SD±4.18) in males, 34.09 (SD±3.58), t test value 2.82 and $p<0.005$ (p value was highly significant).
- APL (left side) 41.38 (SD±2.62) in males, 38.08 (SD±2.50) in females, t test was 4.44 $p<0.001$ (p value was highly significant).

Statistical analysis: Comparisons of various dimensions of MVS measured in CT scan studies were studied with t test analysis. The statistical study was carried out SPSS software.

OBSERVATION AND RESULTS

Table-2: Comparison maxillary sinus volume measured in both sexes in CT scan study

- VR - 18.22 (SD±2.50) in males, 13.28 (SD±3.12) in females, t test value was 6.17 and p<0.01 (p value was highly significant).
- VL - 17.07 (SD±2.70) in males, 12.42 (SD±3.40) in females, t test 5.35 and p<0.001 (p value was highly significant).

DISCUSSION

Present study of Identification of sex from MXS in northern Maharashtra population. ML (right)26.92 (SD±3.2) in males, 26.92 (SD±4.15) in females, t test was 1.84 p<0.001. SIR (right)39.63 (SD±3.60) in males, 34.21 (SD±4.30) in females, t test value was 4.29 and p<0.001. AP (Right side) 43.42 (SD±3.30) in males, 37.06 (SD±2.28) in females, t test was 7.90 and p<0.001. ML (left side) 28.09 (SD±2.38) in males, 24.08 (SD±4.30) in females, t test value was 4.08 and p<0.004. SIL (left side) 37.28 (SD±4.18) in males, 34.09 (SD±3.55) in females, t test was 2.82 and p<0.005. APL (left side) 41.38 (SD±2.62) in males, 38.08 (SD±2.50) in females, t test was 4.55 and p<0.001 (Table-1). Compassion of MXS volume measured in both sexes in CT scan study. VR 18.22 (SD±2.50) in males, 13.28 (SD±3.10) in females, t test was 6.17 and p<0.001. VL study had 17.07 (SD±2.70) in males, 12.42 (SD±3.40) in females, t test value was 5.35 and 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 starts 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, male's needs 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.

Limitation of Study – Due to tertiary location of research centre, small number of patients, lack of latest techniques, we have limited findings and results.

- This research paper was approved by Ethical committee of ACPM Medical College hospital Dhule-424002 (Maharashtra)
- No **Conflict of Interest**
- No **Funding**

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

Sl. No	Particulars	Male (25) Mean value SD±	Female (25) Mean value SD±	T test value	P value
1	ML Right	28.32 (±3.15)	26.92 (±4.15)	1.34	P<0.001
2	SIR (Right)	39.03 (±3.60)	34.21 (±4.30)	4.29	P<0.001
3	AP (Right side)	43.42 (±3.30)	37.06 (±2.28)	7.90	P<0.001
4	ML (Left side)	28.09 (±2.38)	24.08 (±4.30)	4.08	P<0.004
5	SIL (Left side)	37.20 (±4.18)	34.09 (±3.58)	2.82	P<0.005
6	APL (Left side)	41.38 (±2.62)	38.08 (±2.50)	4.55	P<0.001

MLR = 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.
APL (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 (25)	Female (25)	t test	p value
1	VR	18.22 (±2.50)	13.28 (±3.12)	6.17	P<0.001
2	VL	17.07 (±2.70)	12.42 (±3.40)	5.35	P<0.001

VR = Volumes of Right Maxillary sinus
VL = Volumes of Left Maxillary sinus

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