Section: Anatomy

Original Research Article

IDENTIFICATION OF SEX FROM MAXILLARY SINUS IN ANDAMAN AND NICOBAR POPULATION

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Abstract

Background: Many criteria are available, to study the human skeleton, in standard text books, but least data is available, regarding morphometry of maxillary sinuses. **Materials and Methods:** 30 males and 30 females, who were healthy adults, aged between, 25-60 years were studied, with CT images. Medio-lateral, Supero-inferior, Antero-posterior dimensions and volumes of maxillary sinuses (MXS) were measured, in both sexes and results were noted. **Result:** ML (Right), ML (Left), AP (Right), AP (Left), SIR, SIL dimensions and volumes of MXS were compared in both sexes and 't' test and 'p' value were noted. **Conclusion:** The present radiological study of MXS, will be of great importance to, the anthropologists, anatomists, ENT surgeons and also from, the medico-legal point of view.

INTRODUCTION

Maxillary sinuses are pneumatic bones, present on either side of the norma frontalis, forming the floor of the orbital cavity. Being pneumatic bones, they are delicate and more prone to get broken. They lighten the skull and help in the resonance of voice.[1] It is difficult to study the morphometric values, of cadaveric maxillary sinuses, as they tend to break easily. Hence an attempt is made, to study computerised tomographic values, in living subjects of both sexes, to know the measurements.

The maxillary sinuses (MXS) are the first paranasal air sinuses (PNS) to develop and are located in the right and left maxillary bones and consist of two pyramidal shaped, air filled cavities, lined by mucosa. The MXS tend to appear, at the end of the second month of embryonic life and are completely formed, by the age of 18 to 20 years of life.[2,3] But the size and shape of MXS, varies amongst individuals between genders and different populations or/and ethnic groups. However the size and shape of MXS, will be stabilized, after second decade of life. Thus reliable measurements could be achieved, by radiographic images, after the 20th year of age, which would render it, to be an ideal study.[4] Apart from nutritional, genetic, hormonal and environmental factors, also do contribute, to the morphometry of MXS. Hence CT scan images were used, to study the adult MXS in both sexes.

MATERIALS AND METHODS

30 Male and 30 Female adults, aged between 25-60 years, regularly visiting Andaman and Nicobar Islands Institute of Medical Sciences Hospital, Port Blair-744104 were studied.

Inclusion Criteria

The volunteers, devoid of any pathology of para-nasal sinuses, were selected, for the study.

Exclusion Criteria

Those individuals, who underwent surgery on their Paranasal air sinuses (PNS) or Norma frontalis, history of fractures of Norma frontalis, any pathology of PNS, and immune compromised patients, were excluded from the 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 any metallic objects, jewellery, hairpins etc, from the head to the neck region and positioned on the CT scan table, in prone position. The patient's neck, was hyper-extended with the chin resting on the pad for stabilization. Pads were inserted on both sides of the head. The gantry was angulated, to make it perpendicular to the hard palate. 3mm thickness was used, in the preliminary. A Scout view, extending from the anterior margin of the frontal sinus, to the posterior margin of sphenoid sinus, with a reconstruction matrix zone of, 512 X 512 at 120

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KV, 100MA coronal CT was performed, after instructing the volunteers, to remain steady, during the entire procedure.

The measurements like, ML and SI were studied and the maxillary sinus was in the widest position with the help of on screen (figure-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. The finally selected sections were multiplied by 3 (thickness of single section to find out the AP dimensions of the sinus). Maxillary sinus volume (MSV) was calculated, by using the point on slice tool on the work station. To define the volume of the sinus, it was traced manually on each slice of the image stack, using the screen mouse pointer, in the coronal plane (figure-B). Once the tracing was complete, the work station automatically segmented the entire volume of the sinus, from 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 cubic centimetres (CC) of both right and left maxillary sinus.

The duration of the study was from January 2020 to January 2021.

Statistical Analysis

Comparison of various dimensions of MXS, measured by CT scan studies, were studied with 't' test analysis. The statistical study was carried out with SPSS software. The ratio of males to females was 1:1.

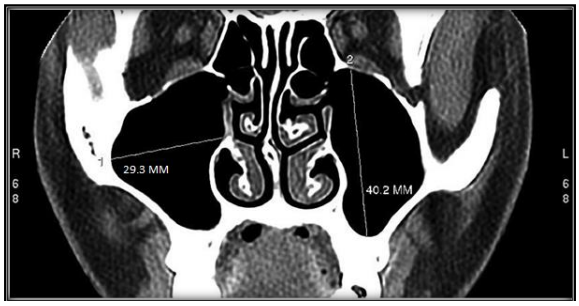

Image (A) – Linear measurements of medio-lateral and supero-inferior dimensions of maxillary sinus.

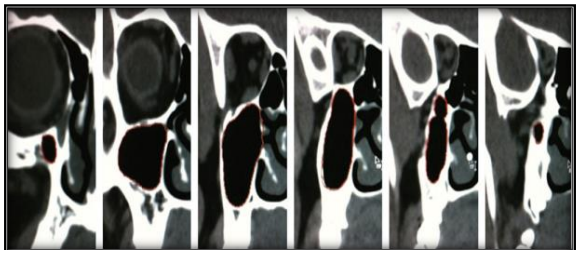

Image (B) – Point on slice tool.

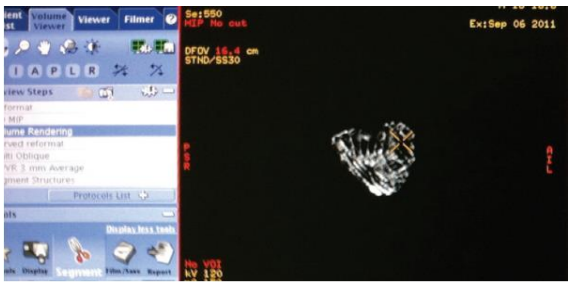

Image (C) – Workstation showing maxillary sinus.

RESULTS

[Table 1] Comparison of MXS measured by CT scan studies.

- ML Right 29.30 (SD±3.18) in males, 26.90 (SD±2.17) in female, t test value was 1.48 and p<0.002.
- SIR 38.04 (SD± 3.58) in males, 34.18 (SD±4.28) in females, t test value 3.78 and p value p<0.004.
- AP (Right side) 42.40 (SD±3.28) in males, 37.04 (SD±2.20) in females, t test 7.36 and p<0.001.
- ML (left side) 27.04 (SD±2.30) in males, 23.09 (SD±3.80) in females, t test 4.87 and p<0.001.
- SIL (left side) 36.19 (SD±4.16) in males, 33.07 (SD±3.38), t test 3.18, p<0.002.
- APL (left side) 40.62 (SD±3.38) in males, 37.10 (SD±2.30) in females, t test was 4.70 p<0.001.

[Table 2] Comparison of MXS volume, measured in both sexes.

- VR - 18.20 (SD±2.48) in males, 13.26 (SD±3.10) in females, t test value was 6.81 and p<0.01.
- VL - 17.05 (SD±2.68) in males, 12.40 (SD±3.36) in females, t test 5.90 and p<0.001.

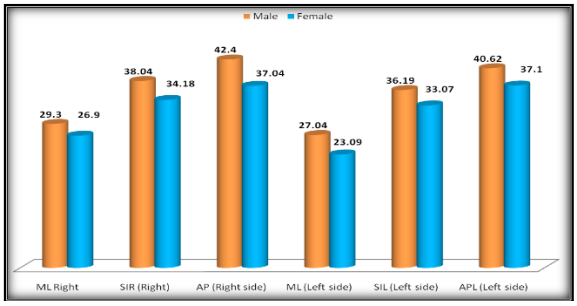

Figure 1: Comparison of various dimensions of Maxillary Sinuses measured on CT scan studies in both sexes.

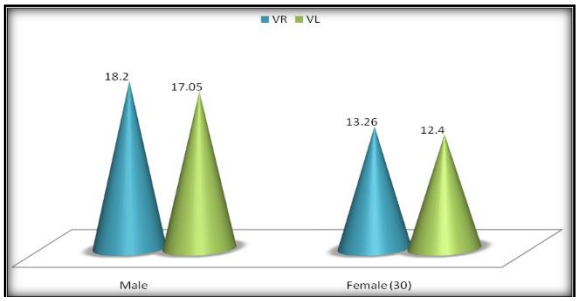

Figure 2: Comparison of Maxillary sinus volume measured in both sexes.

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

Sl. No	Particulars	Male (30) Mean value SD±	Female (30) Mean value SD±	t test value	p value
1	ML Right	29.30 (±3.13)	26.90 (±2.17)	1.48	P<0.002
2	SIR (Right)	38.04 (±3.58)	34.18 (±4.28)	3.78	P<0.004
3	AP (Right side)	42.40 (±3.28)	37.04 (±2.28)	7.36	P<0.001
4	ML (Left side)	27.04 (±2.30)	23.09 (±3.80)	4.87	P<0.001
5	SIL (Left side)	36.19 (±4.15)	33.07 (±3.38)	3.18	P<0.002
6	APL (Left side)	40.62 (±3.38)	37.10 (±2.30)	4.71	P<0.001

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

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

Sl. No	Particular	Male (30)	Female (30)	t test	p value
1	VR	18.20 (±2.48)	13.26 (±3.10)	6.81	P<0.001
2	VL	17.05 (±2.68)	12.40 (±3.38)	5.90	P<0.001

DISCUSSION

The present study was of Identification of sex, from MXS in Andaman and Nicobar population. The various dimensions of MXS were studied through CT scan images – ML (right) 29.30 (SD±3.13) in males, 26.90 (SD±2.12) in females, t test was 1.48 and p<0.002. SIR 38.04 (SD±3.58) in males, 34.18 (SD±4.28) in females, t test value was 3.78 and p<0.004. AP (Right side) 42.40 (SD±3.28) in males, 37.04 (SD±2.20) in females, t test was 7.36 and p<0.001. ML (left side) 27.04 (SD±2.30) in males, 23.09 (SD±3.80) in females, t test value was 4.87 and p<0.001. SIL (left side) 36.19 (SD±4.16) in males, 33.07 (SD±3.38) in females, t test was 3.18 and p<0.001. APL (left side) 40.62 (SD±3.38) in males, 37.10 (SD±2.30) in females, t test was 4.71 and p<0.001 (Table-1). Comparison of MXS volume, measured in both sexes – VR 18.20 (SD±2.48) in males, 13.26 (SD±3.10) in females, t test was 6.81 and p<0.001. VL study had 17.05 (SD±2.68) in males, 12.40 (SD±3.38) in females, t test 5.90 and p<0.001 (Table-2) (Figure- A, B and C). These findings were more or less in agreement with previous studies.[5-7]

It was interesting to note, that the left MXS width was more discriminate than the right MXS for sexual dimorphism, in various studies of North and South Indian studies.[8,9] It is a well established fact, that foramina or sinus/space in the bone, tends to start at surface irregularities, because strain energy tends to concentrate at such points. It was also noted, that the right MXS was larger and wider in studies done abroad.[10,11] This anatomical variability between genders could be environmental 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 and environmental factors, play a vital role in gender determination in India and abroad crania.

It cannot be denied that, males' need correspondingly bigger lungs, to support their relatively more massive muscles and body organs. Secondly, males need a larger air way, which begins with, the nose and naso-pharynx. In other words, physiological changes in nasal cavity size and shape occur, as a 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 increases in size, hence morpho-metric values are higher in males than females.

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 the second decade of life. Hence radiographic images will prove ideal in sexual dimorphism, after the second decade of life. But this study further demands, genetic, nutritional, hormonal and embryological studies, because the factors which determine the time of ossification, are still obscure.

Limitation of Study

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

- This research paper was approved by, the Ethical committee of Andaman and Nicobar Islands of Medical Sciences, Port Blair-744104.
- No Conflict of Interest.
- Self-Funded.

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