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ORIGINAL ARTICLE

Anthropological assessment of mastoid process using multidetector computed tomography in Indian population

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ABSTRACT:
Introduction: In these cases, the human mastoid process has also been utilized. Gender identification using the mastoid process is performed using both metric and non-metric methods. Gender identification is performed using manual techniques including Vernier caliper, xerographic copies, and CT images.**Materials and Methods:**The CT scans were not solely conducted for research purposes. Patients with damage or injury to the mastoid bone, children, expectant mothers, CT scans with abnormalities blocking the identifiable features of the mastoid bone were not included in the study.**Results:**Out of a total of 114 patients, 43 (37.7%) were male and 71 (62.2%) were female. The average age of patients was 52.9 years. The distribution of various diameters of the mastoid process on both the left and right side, categorized by gender. Males exhibited higher measurements in all dimensions, except for the anterior inclination angle, which was greater in females.**Conclusion:**By doing so, the likelihood of complications during the surgery can be decreased and the percentage of success will improve.
Keywords: Body measurements, bony protrusion behind the ear, advanced imaging technology.

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INTRODUCTION

The mastoid process is a cone-shaped bony protrusion located in the back part of the temporal bone. The mastoid process also serves as a point of attachment for several muscles, including the occipitofrontalis, auricularis posterior, sternocleidomastoid, splenius capitis, and longissimus capitis.[1]The mastoid process has also been used to determine the gender of the human skeleton.[1-3] In these cases, the human mastoid process has also been utilized. Gender identification via the mastoid process can be done by both metric and non-metric methods. Gender identification is performed utilizing manual techniques including Vernier caliper, photocopies, and CT scans. Recently, a small number of investigations have been conducted using CT scans.[1,3,4-6]CT scan is a quick method for studying cross-sectional images. Progress in CT scan imaging is highly beneficial for multi-directional and three-dimensional imaging and evaluation of many characteristics of the mastoid process. MRI scanning is also helpful for measuring the mastoid process in cross-section, although it is costly and takes more time compared to CT scan imaging. The mastoid process of the skull has caught the interest of several researchers due to its secure location at the base of the skull and its relatively compact construction. As a result, the mastoid process typically remains intact.[7,8]The mastoid bone is usually stronger in males. Sex variations in the shape and size of the mastoid process are explored using classic morphological and metric approaches. Progress in technology like CT scanning, MRI, and computer based anthropometry, and biochemical tests are greatly enhancing the precision of skeletal examinations, particularly in sex estimation.[9]Virtual anthropology (VA) can be described as a multidisciplinary method for examining anatomical data representations in three dimensions. It is a basic instrument for anthropological analysis that enables researchers to address issues that could not be resolved using conventional anthropological methods. In these situations, the anatomical characteristics of the mastoid bone and nearby tissues play an important role in planning retrolabyrinthinemastoidectomies, which are a type of surgical surgery.[10]Furthermore, there have been reports suggesting that the presence of air cells and the dimensions of the mastoid bone could potentially be linked to other conditions including otitis media.[11]In addition, numerous studies assess the capacity to identify gender, particularly from skeletal remains, using the anthropometric characteristics of the mastoid bone.[12,13]

MATERIALS AND METHODS

The patients who were scheduled to get a CT scan of their head for reasons other than the mastoid process, and who provided written agreement to participate in the study, were included in the study. These individuals were between the ages of 19 and 70, of both genders, and had no abnormalities connected to the mastoid process. The CT scans were not solely conducted for research purposes. Patients with damage or injury to the mastoid bone, children, expectant mothers, CT scans with obstructions that

hinder the identification of the mastoid bone's anatomical features were not included in the study. Information about the patients' demographics was gathered using a pre-designed questionnaire. The measurement of the mastoid process was taken according to the description by Allam FA.Eight Both the right and left sides were measured. The following measurements were recorded: Conventional mastoid height (cMH), True mastoid height (tMH), Oblique sagittal diameter (OSD), Oblique coronal diameter (OCD), Maximal oblique sagittal diameter (OSD max), Maximal oblique coronal diameter (OCD max), Mastoid volume, Anterior inclination angle, and Medio-lateral inclination angle.The data was examined using Statistical Package for the Social Sciences (SPSS) version 16 (SPSS, Inc., an IBM Company, Chicago, IL).

Statistical analysis

The statistical analyses were conducted using the SPSS Statistics program version 25.0 (IBM, Armonk, NY). The threshold value (p-value) was set at 0.05 for the comparison tests. The data's adherence to the normal distribution was assessed using the Kolmogorov-Smirnov test. Comparisons were made between separate pairs; assuming normality, group comparisons were conducted using the significance test (t-test) to assess the difference between the two means.

RESULTS

Out of total 114 patient 43 (37.7%) were male and 71 (62.2%) patients were female. The mean age of patients was 52.9 years (Table 1).

Table 1: Age and gender wise distribution of patients

Characteristics	Category	Frequency (%)
Gender	Male	43 (37.7)
	Female	71 (62.2)
Age (Mean ± SD) yrs		52.91±16.61

Table 2 showed the gender wise distribution of various dimensions of mastoid process on both left and right side. Male showed increased measurement of all dimensions except the anterior inclination angle which was more in females.

Table 2: Gender wise distribution of the various measurement of the mastoid process.

Variables	Male (n=43)		Female (n=71)	
	Right Mean ± SD	Left Mean ± SD	Right Mean ± SD	Left Mean ± SD
Conventional mastoid height (cm)	4.31±0.38	4.21±0.33	3.91±0.38	3.91±0.44
True mastoid height (cm)	4.72±0.50	4.71±0.57	4.31±0.45	4.21±0.53
Oblique sagittal diameter (cm)	3.42±0.39	3.21±0.54	3.11±0.50	2.94±0.63
Oblique coronal diameter (cm)	2.73±0.46	2.81±0.40	2.54±0.46	2.51±0.47
Maximal oblique sagittal diameter (cm)	4.41±0.69	4.41±0.69	4.21±0.68	4.02±0.80
Maximal oblique coronal diameter (cm)	3.02±0.35	3.10±0.46	3.02±0.36	2.91±0.36
Mastoid volume (cm^3)	15.12±6.1	15.70±7.1	12.90±6.70	11.71±7.04
Anterior inclination angle	74.61±9.32	75.31±8.61	76.21±10.11	75.81±10.11
Medio-lateral inclination angle	76.72±17.31	82.62±17.53	77.71±14.90	77.49±14.41

DISCUSSION

The mastoid process has attracted particular attention in forensic medicine because of its gradual growth and its resistance to physical harm due to its position.[14]This structure shows morphological differences between males and females. The increased muscular activity of sternocleidomastoid and other neck muscles is indicated as a possible cause for the variance.[5,14]Despite experiencing acute starvation, there is still a noticeable variation in the size of the mastoid process between males and girls.[15]The mastoid process has been examined using computed tomography (CT) scanning, Magnetic Resonance Imaging (MRI), computer-based anthropometry, and other methods. In this investigation, we also utilized the CT scanning approach. A recent study with 104 patients found that the average age was 51.9, with a standard deviation of 15.6. Out of the total, 38 patients (36.5%) were male, while 66 patients (63.5%) were female. cranial height, trunk height, occipital-synostosis distance, obsessive-compulsive disorder, occipital-synostosis distance (maximum), anterior inclination angle, and medio-lateral inclination angles in males were higher when compared to females. Overall volume of mastoid process was larger in males measuring 14.15 cm^3 and 14.68 cm^3 of right and left mastoid process respectively and in females it was 11.91 cm^3 and 10.74 cm^3 respectively. Allam et al,[14] in their study done among 80 Egyptian population found that conventional mastoid height, oblique sagittal diameter, and mastoid volume were precise and dependable for determining the sex of the tested population. Another study conducted by Yilmaz et al found that males have larger dimensions than

females.[5] This was similar to our study which showed males have greater dimension of the mastoid process. Saini et al[16]A study was carried out on the population in South India, which revealed a noticeable difference in the size of the mastoid process between males and females. Males had a larger mastoid process, which aligns with the findings of our current study. In comparison to the significant historical studies on skull sex determination, our study demonstrates improved results. These findings are derived from anthropological and body measurement methods, and they provide opportunities for more statistical research, which could be helpful in medico-legal investigations. The necessary equipment for performing this approach is easily accessible to most medical examiner's offices. Any type of photocopier can be utilized. This method is simple to do, provides fast outcomes, and doesn't require any specific training for the medical examiner. The approach for determining the sex of skulls reported in this study provides a practical option compared to other techniques. This method satisfies the requirements and practicalities of the forensic investigation in our country at now. The current study also includes constraints. The first constraint was the limited number of participants and the utilization of data from only one location. Because of this, the results of the study cannot be applied to other populations; hence a study with many centers needs to be undertaken in the future.

CONCLUSION

In this study, the different measurements of the mastoid process indicate a distinction between males and females. By doing so, the likelihood of difficulties during the surgery can be decreased and the rate of success will go up. We believe that the findings from this study could help reduce the rate of complications and improve outcomes, particularly when dealing with the back part of the skull and the side of the skull base. The majority of the measurements were higher in males compared to females on both the right and left sides.

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