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MORPHOMETRIC ANALYSIS OF MACEWEN'S TRIANGLE AND ITS CLINICAL IMPLICATIONS

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ABSTRACT

Introduction: In case of mastoiditis, otitis, and other neurovascular conditions related to the auricular region, it is important to approach through surgical methods. The infectious condition of mastoid antrum i.e., mastoiditis is a highly risky clinical condition which may spread into the cranial cavity and/or head and neck regions. The reasons for this mastoiditis condition are chronic suppurative conditions of otitis media. Hence, the drainage of the infected mastoid is very important. The drainage is achieved through a suprameatal triangle.

Materials and Methods: 15 died and processed skulls of human origin were procured from Anatomy Department, Basic Medical Science, Saveetha Dental College. Digital vernier caliper was used for the collection of data for

morphometric analysis of macewen's triangle. The study adopted the rank test of Wilcoxon for biostatistical investigation with $p < 0.005$ is fixed to be significant for current data analysis.

Results: On examining the right side and left side of the upper border and lateral anteroinferior boundary of the suprameatal triangle, there is no significant alteration. Also, there is a significant alteration in the posterior boundary of the suprameatal triangle.

Conclusion: The current study concludes that the information and understanding of the morphometry of the suprameatal triangle is most important for neurological, otological emergencies and surgical procedures.

Key Words: Morphometry, Macewen's triangle, Suprameatal triangle, otitis, mastoiditis, drainage.

Introduction

The temporal bone contains squamous, mastoid, petrous, tympanic, and styloid complexes. Among them the petrous part is highly complex which consists of inner and middle ear and related anatomical features (1). In the case of mastoiditis, otitis, and other neurovascular states related to the auricular region, it is important to proceed surgically. The infectious condition of the mastoid antrum i.e, mastoiditis is a highly risky clinical condition which may open up the cranial cavity or head and neck regions (2). Mastoid operation success rate depends on exposing the antrum, mostly as pointed out by Macewen's, anatomic features are more predominant on many Neolithic skulls and in certain apes (3). Hence the drainage of the infected mastoid is very peculiar.

Suprameatal triangle is triangular depression present on the posterior aspect of the eustachian tube of temporal bone (4). By note it is known that the suprameatal triangle is present at the center of entire other portions of the temporal bone so that proceeding towards various parts especially parts which are having cavity, can be easily outlook by suprameatal triangle the cavities present in temporal bone are mastoid and ear cavities (5). Mastoid antrum is an air space located in the petrous part of the temporal bone of cranium, interacting to mastoid cells in behind and in front to the epitympanic space of the middle ear cavity through the opening of mastoid antrum (6).

In a seriously infected condition the mastoid antrum must be drained through a suprameatal triangle surgically. Being a complex region it is important to know the temporal region thoroughly. In the present study, the suprameatal triangle was identified by drawing imaginary lines and the borders of the triangle were measured using vernier calipers on both the right and left side (7). Mastoidectomy is practiced frequently in the treatment of ear diseases as well chronic ear infections. As in many cases it is to identify the landmarks and proceed with the feature on the adjacent surface of mastoid process of temporal bone in a deep position (8). Suprameatal triangle is as its main drawback of this procedure was facial or chorda tympani nerve may get damaged (9). Our scientist experts with their encompassing information, research experience, data has transformed to several publications globally in well reputed indexed Journals (10–17),(18),(19),(20),(21,22),(23),(24),(25–29). The recent research work is aimed to assess boundaries of the suprameatal triangle by morphometry and to correlate their variations.

Materials and methods

In the current study, 45 South Indian skulls were procured from the Department of Anatomy, Basic Medical Science at Saveetha Dental College. The advantages are nominal sample size, no sampling bias and random sampling. The vernier caliper was used to take the measurement of the triangle which was used for the morphometric analysis. Abnomal and broken skulls were excluded from the analysis. Measurement was taken between the upper, antero-inferior and posterior borders of the suprameatal triangle. The data obtained were entered in a microsoft excel sheet and the data were imported to SPSS software (version 23.0). The study adopted the rank test of Wilcoxon for biostatistical investigation with $p < 0.005$ is fixed to be significant for current data analysis.

Results

The present study noted that the length of the upper border of suprameatal triangle of right and left side is 1.2060 ± 0.19570 and 1.3440 ± 0.32002, the lateral anteroinferior border on the right and left side is $1.1100 \pm$

0.44183 and 1.1000 ± 0.19243, the length of posterior border on the right and left is 1.1280 ± 0.08866 and 1.3960 ± 0.29659 (Table 1).

Table 1: Shows the morphometric measurement of the upper, lateral anteroinferior and posterior borders between the right and left side of the skull. All the values are expressed as Mean ± Standard Deviation.

Measurements	Minimum (cm)	Maximum (cm)	Mean (cm)	Std. Deviation
Right AB	0.94	1.46	1.2060	0.19570
Right BC	0.77	1.94	1.1100	0.44183
Right CA	1.01	1.27	1.1280	0.08866
Left AB	1.11	1.94	1.3440	0.32002
Left BC	0.91	1.33	1.1000	0.19423
Left CA	1.04	1.91	1.3960	0.29659

There is no significant difference between the right and left sides of the upper border of the Macewen's triangle as p=0.231 (p>0.05) and is considered statistically not significant between the two sides. Also there is no significant difference between the right and left sides of the anteroinferior border of the Macewen's triangle as p=0.305 (p>0.05) and considered statistically not significant between the two sides. But, there is a significant difference between the right and left sides of the posterior border of the Macewen's triangle as p=0.002 (p<0.05) and considered statistically significant between the two sides.

Table 2: Shows the significance of morphometric measurement of the upper (AB), lateral anteroinferior (BC) and posterior (CA) borders between the right and left side of the skull. The significance level is 0.05.

S.No.	Parameters Tested	Test	Significance
1	The median of difference between right AB and left AB equals 0	Related-samples Wilcoxon signed rank test	0.231
2	The median of differences between right BC and left BC equals 0	Related-samples Wilcoxon signed rank test	0.305
3	The median of differences between right CA and left CA equals 0	Related-samples Wilcoxon signed rank test	0.002

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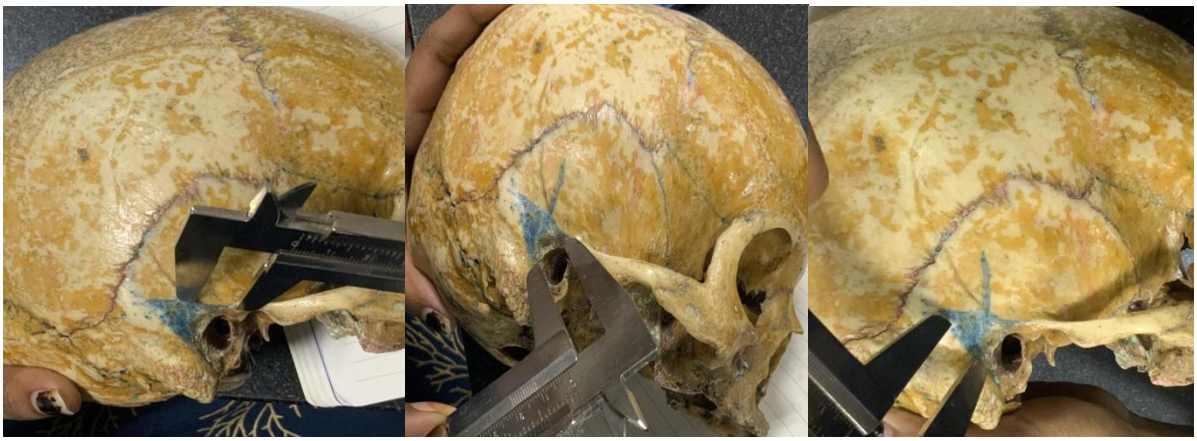

(i) (ii) (iii)

Figure 1: Photograph shows (i) upper border, (ii) anteroinferior border and (iii) posterior border of Suprameatal triangle. AB = upper border of suprameatal triangle; BC = anteroinferior border of suprameatal triangle; CA = posterior border of suprameatal triangle.

Discussion

Suprameatal triangle is an anatomically important landmark to approach the mastoid antrum. The study measured the lateral anteroinferior border right and left side is 1.1100 ± 0.44183 and 1.1000 ± 0.19243, the upper border of the suprameatal triangle of right and left side is 1.2060 ± 0.19570 and 1.3440 ± 0.32002, the length of posterior border on the right and left is 1.1280 ± 0.08866 and 1.3960 ± 0.29659.

Whereas research done by P. Titus (30) observed that the length of the upper border of the suprameatal triangle is 13.71 ± 1.86 mm and 13.76 ± 1.74 mm on the right and left sides, respectively (p=0.437358). The length of the anteroinferior border of suprameatal triangle was measured to be 14.46 ± 1.63 mm and 14.30 ± 1.46 mm on the right and left sides, respectively (p=0.310597) and also the length of the posterior border of the suprameatal triangle was measured to be 14.12 ± 2.02 mm and 17.73 ± 1.74 mm on the right and left sides, respectively (p=0.85613). There were no significant differences between the right and left sides which were observed in all the parameters.

The measurement of the suprameatal triangle plays a crucial role and it is important to know the types, dimensions and suprameatal spines and depressions (8). It was referred to that suprameatal depression or triangle was absent in male skulls (18.2%) and female skulls (35.7%) on the right sides, while on the left side 9.1% in male skulls and 28.6% in female skulls. Suprameatal region was chosen to approach the cerebellopontine region for the treatment of trigeminal neuralgia in vascular compression cases (31). The mucosal layer consists of air filled and mucosa lined cavities from anterior to posterior. The mucosal line is an oblique anteromedial direction extending along these structures and is used as anatomical landmarks (32).

Suprameatal trigone plays a crucial role in clinical aspects. It is a landmark used by surgeons to locate aditusadantrum of mastoid process which is located in temporal bone, superior to external acoustic meatus (33). It is a safest approach to the target region without damaging the chorda tympani and facial nerve (31).

In further research, adults have antrum lies approximately 1.5 to 2cm deep to the suprameatal triangle. This is an important landmark when performing a cortical mastoidectomy. The triangle lies deep to the lymba conchae (34). Using the macewen's triangle we can find sex of individual where forensic scientist, find gender by standard methods(35).The suprameatal depression is present less in female and more in male(36).

As only south indian skulls were taken into consideration and the sample size taken for the analysis was very minimal and only researches done in english language were considered as reference articles and those articles were only searched electronically no manual work was done.
More skulls will be considered in the future for more accurate results and many racial species will be considered.

Conclusion

The present study analysed the variations in the morphometry of the Macewen's triangle between the two sides and found that there is no difference in the upper and antero inferior borders of the triangle, but there was a significant difference in the posterior border. The current study concludes that the alterations in the triangle length might give a clue in the surgical approach of the area concerned and thus Macewen's triangle is most important for both neurological and otological emergencies.

Author contributions

Author 1: Priyanka R carried out the study by collecting data and drafted the manuscript after performing the necessary statistical analysis and in the preparation of the manuscript.
Author 2: Karthik Ganesh Mohanraj, aided in conception of the topic, designing the study and supervision of the study, correction and final approval of the manuscript.

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Conflicts of interest

None declared.

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