

MacEwen's Triangle- A Review

Dr. Bhaskaran Sathyapriya, Professor,

*Department of Anatomy,
Sree Balaji Dental College & Hospital,
Bharath Institute of Higher Education & Research,
Chennai*

*Chandrakala B¹, Govindarajan Sumathy², Syed Fazil Hasan³, Priyadharshini.M³, Srilakshmi.B³, Bhaskaran Sathyapriya**

- 1. Senior Lecturer, Department of Anatomy, Sree Balaji Dental College & Hospital, Bharath Institute of Higher Education & Research, Chennai.*
- 2. Professor and Head, Department of Anatomy, Sree Balaji Dental College & Hospital, Bharath Institute of Higher Education & Research, Chennai.*
- 3. Graduate student, Sree Balaji Dental College and Hospital, Bharath Institute of Higher Education and Research*

**Professor, Department of Anatomy, Sree Balaji Dental College & Hospital, Bharath Institute of Higher Education & Research, Chennai.*

Abstract

In the temporal bone, between the posterior wall of the external acoustic meatus and the posterior root of the zygomatic process is the area called the suprameatal triangle, suprameatal pit, mastoid fossa, foveolasuprameatica, or Mac Ewen's triangle, through which an instrument may be pushed into the mastoid antrum. In the adult, the antrum lies approximately 1.5 to 2 cm deep to the suprameatal triangle. This is an important landmark when performing a cortical mastoidectomy. The triangle lies deep to the cymba conchae. The sex determination of unknown human skulls can be evaluated by using the measurement of the area formed by the xerographic projection of 3 craniometric points related to the mastoid process: the porion, asterion, and mastoidale points.

Keywords: *MacEwen's triangle, mastoidectomy, suprameatal spine, Mastoid antrum, sex determination, zygomatic process, mastoid process.*

Introduction

MacEwen's triangle is a very important surgical landmark for the mastoid antrum or the largest mastoid air cell.^[9] It is also known as Suprameatal triangle or Mastoid fossa.^[4] The suprameatal trigone plays a big role in the aspect of clinics. It is used by surgeons as a landmark to locate the aditus ad antrum of the mastoid process. It's located in the temporal bone, just superior to the external acoustic meatus. The suprameatal spine is present just below the posterior root of the zygomatic process. It is situated at the upper and posterior part of the external acoustic meatus. The main function of the spine is to attach to the auricular cartilage. It appears almost crest shape among females and males. The suprameatal depression is present less in females and more in males^[1].

Anatomy of MacEwen's's Triangle

In the temporal bone, between the posterior wall of the external acoustic meatus and the posterior root of zygomatic process the sex determination is the area called the suprameatal triangle, suprameatal pit, mastoid fossa, foveolasuprameatica, or MacEwen's triangle, through which an instrument may be pushed into the mastoid antrum. In the adult, the antrum lies approximately 1.5 to 2 cm deep to the suprameatal triangle. This is an important landmark when performing a cortical mastoidectomy. The triangle lies deep to the cymba conchae.

Boundaries of MacEwen's Triangle

Superiorly: Suprameatal crest; Anterior-inferiorly: Posterior margin of external auditory canal; Posteriorly: A tangential line from the posterior canal wall cutting the suprameatal crest (Fig 1).

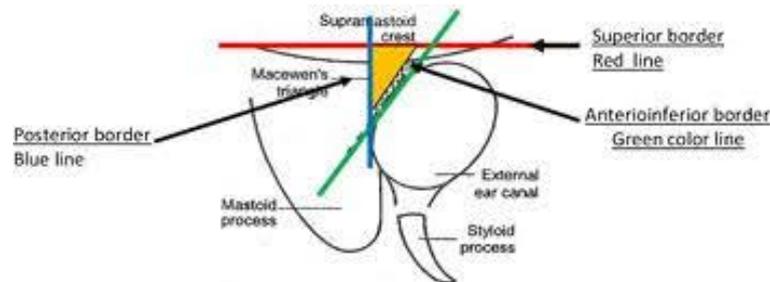


Figure 1: Boundaries Of MacEwen's Triangle

Mastoid Antrum

It is a large air containing space in the upper part of mastoid process. It communicates with tympanic cavity through aditus antrum. Its roof is formed by tegmen antri which is a continuation of tegmen tympani. It separates the antrum from middle cranial fossa. The lateral wall of the antrum is formed by a plate of bone, which is on average 1.5 cm thick in adult^[2].

Mastoid antrum in relation with MacEwen's Triangle: It is marked on the surface of mastoid by suprameatal triangle.

Mastoid antrum in relation with sigmoid sinuses: The floor of antrum receives the openings of mastoid air cells. Its posterior wall is related to sigmoid sinus whereas its medial wall presents bulging of the lateral semilunar canal.

Sex Determination Using MacEwen's Triangle

The sex determination of unknown human skulls can be evaluated by using the measurement of the area formed by the xerographic projection of 3 craniometric points related to the mastoid process: the porion, asterion, and mastoidale points. The area (mm²) of the demarcated triangle for each side of the skull was determined, and the total value of these measures was calculated. Nowadays, human identification is a universal process based on scientific principles, mainly involving fingerprinting, the objective of which is to identify and register individuals for both civil and criminal identification purposes.^[3-7] Adult skulls of mature individuals, 18 or more years old, that had no destruction of the mastoid region or absence of metopic bone in the region of the craniometric points were chosen for the study. The device used to obtain the xerographic copies was a xerox model 5334. A xerographic copy of each side of the skull was obtained through a standardized technique. The skull under study was kept on the copying surface supported by 2 points:

- a) the lateral surface of the mastoid process;
- b) the zygomatic arc.

On each xerographic copy, craniometric points will be marked:

- 1 - Porion – the uppermost lateral point of the external auditory meatus;
- 2 - Asterion – the meeting point of the lambdoid, occipitomastoid, and parietomastoid sutures;
- 3 - Mastoidale – the lowest point of the mastoid process.

Sex Determination Using Mastoid Process Length

The measurement was carried out with automatic Vernier calliper with a precision of 0.01mm and marker.

Mastoid length:

The distance between Porion-Mastoidale was measured as skull was kept with Norma lateralis position facing the observer.^[2]

Porion: It is the uppermost lateral point of the external auditory meatus;

Mastoidale: It is the mastoid process lowermost point

Area was calculated by using Heron's formula. With sides a,b and c;^[1]

$$\text{Area} = \sqrt{s(s-a)(s-b)(s-c)}$$

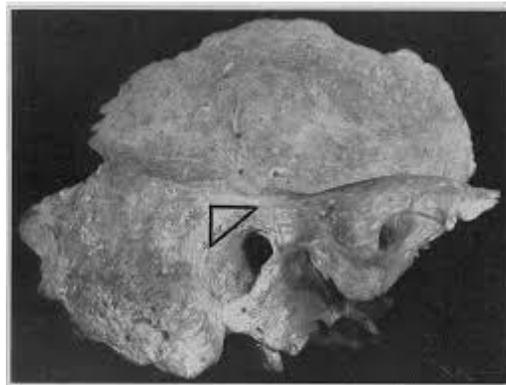


Figure 3: MacEwen's Triangle Area Is Marked By The Dark Black Lines

Thus using different standard methods we are able to find the sex of an individual due to The temporal bone which is highly resistant to physical damage can be used for sex determination. The accuracy of measurements depends heavily on the specific method used in measuring the distances in the sides of the mastoid triangle, particularly along the curved surface between the landmarks. Mastoid process length could be used to determine sex from the cranium. Knowledge of anthropometric dimensions of mastoid length can therefore be an invaluable tool to the forensic scientist with respect to identifying the sex of unknown individuals, craniometric prediction, and also relevant tool to craniofacial surgeons^[5].

Clinical Uses of Mastoid Triangle

Mastoid Abscess

It is a common condition. The antrum is approached surgically through its wall. Thus, it is important to assess the limits of the suprameatal triangle. This triangle is bounded above by the supramastoid crest, anteroinferiorly by the posterosuperior segment of the bony external auditory meatus and posteriorly by a line drawn as a tangent to the posterior margin of the bony meatal opening^[6].

Mastoiditis

The mastoid bone is the back part of the temporal bone of the skull located just behind the inner ear. Mastoiditis is infection of the mastoid bone. The mastoid bone is made up of a honeycomb-like structure, which is full of mastoid air cells. The mastoid air cells can become infected or inflamed, often as a result of an inner ear infection. If infection spreads outside the mastoid air cells into the mastoid bone (coalescent mastoiditis), serious health problems can arise. Mastoiditis is more common in children, but it can affect adults as well.^[8]

Mastoidectomy

A mastoidectomy is a surgical procedure that removes diseased mastoid air cells. The mastoid is the part of your skull located behind your ear. It's filled with air cells made of bone and looks like a honey comb. The diseased cells are often the result of an ear infection that has spread into your skull. The procedure can also be used to remove an abnormal growth of the ear known as a cholesteatoma. Mastoidectomy is a common procedure performed among children^[9, 10].

There are variations of mastoidectomy procedures, including:

Simple mastoidectomy, in which your surgeon opens your mastoid bone, removes the infected air cells, and drains your middle ear

Radical mastoidectomy, in which your surgeon may remove your mastoid air cells, your eardrum, most of your middle ear structures, and your ear canal. This procedure is reserved for complicated mastoid disease.^[9]

Modified radical mastoidectomy, which is a less severe form of radical mastoidectomy that involves removing mastoid air cells along with some, but not all, middle ear structures. Antibiotics usually treat infections, but surgery is an option if antibiotics fail.

Doctor usually performs a mastoidectomy using general anesthesia. This ensures that you're asleep and unable to feel pain. For a simple mastoidectomy, your surgeon will usually:

- Access your mastoid bone through a cut made behind your ear.
- Use a microscope and a small drill to open your mastoid bone.
- Use suction irrigation to keep the surgical area free of bone dust.
- Drill out the infected air cells.
- Stitch up the operative site.
- Cover the site with gauze to keep the wound clean and dry.
- Surgeon may also use a facial nerve monitor during surgery. This helps to limit injury to the facial nerve.

Suprameatal Spine and Suprameatal Depressions

Suprameatal spine and suprameatal depressions covers the lateral wall of the mastoid air system, the suprameatal triangle is of importance to otologic surgeons during mastoidectomy. Because of this clinical importance, topographic anatomy of the suprameatal spine and depression was studied on skulls^[10].

Conclusion

The MacEwen's triangle is an important surgical landmark of mastoid antrum. Using the MacEwen's triangle we can also find the sex of individual in the case where the forensic scientist were able to find the gender, by using the standard methods and materials that are needed. MacEwen's triangle is used in the surgical purposes to mark and remove the dead cells of mastoid antrum. MacEwen's triangle is also used for clinical importance, topographic anatomy of suprameatal spine and depression.

References

1. Kemkes A, Gobel T. Metric assessment of the “Mastoid Triangle” for sex determination: a validation study. *J Forensic Sci* 2006.
2. Rogers TL. Determining the sex of human remains through cranial morphology. *J Forensic Sci* 2005.
3. Deshmukh AG, Devershi DB. Comparison of cranial sex determination by univariate and multivariate analysis. *J Anat Soc India*. 2006.
4. Keen JA. A Study of the differences between male and female skulls. *Am J Phys Anthropol*. 1950;8(1):65–79.
4. Giles E, Elliot O. Sex determination by discriminant function analysis of crania. *Am J Phys Anthropol*. 1963.
5. Sumati VVG, Phatak A. Determination of sex from mastoid process by discriminant function analysis. *J Anat Soc India*. 2010.
6. Kranioti EF, Iscan AMY, Michalodimitrakis M. Craniometric analysis of the modern Cretan population. *Forensic Sci Int*. 2008.
7. Das Gupta A, Banerjee A, Kumar A, et al. Discriminant function analysis of mastoid measurements in sex determination. *J Life Sci*. 2012.
8. Wald ER, Conway JH. Mastoiditis. In: *Principles and Practice of Pediatric Infectious Diseases*. Philadelphia, PA: Elsevier; 2018.
9. Kronenberg J, Migirov L, Dagan T. Suprameatal approach: New surgical approach for cochlear implantation. *J Laryngol Otol* 2001.
10. Benito MB, Gorricho BP. Acute mastoiditis: Increase in the incidence and complications. *Int J Pediatr Otorhinolaryngol* 2007.