Section: Anatomy

Original Research Article

MORPHOMETRIC AND MORPHOLOGICAL EVALUATION OF MASTOID EMISSARY CANAL USING CONE-BEAM COMPUTED TOMOGRAPHY

Waqar Akram[1], Rakesh Kumar Tiwari[2], Naresh Kumar[3], Shailendra Singh[4]

[1]Assistant Professor, Department of Anatomy, Amar Shaheed Jodha Singh Attaiya Thakur Dariyav Singh Medical College, Fatehpur, Uttar Pradesh, India.
[2]Assistant Professor, Department of Anatomy, Naraina Medical. college. hospital and research center, Kanpur, Uttar Pradesh, India.
[3]Associate Professor, Department of Surgery, Amar Shaheed Jodha Singh Ataiya Thakur Dariyav Singh Medical College Fatehpur, Uttar Pradesh, India.
[4]Associate Professor, Department of Anatomy, Rani Durgavati Medical College, Banda, Uttar Pradesh, India

Received : 13/11/2023
Received in revised form : 17/12/2023
Accepted : 02/01/2024

Keywords:
Mastoid foramen, mastoid emissary canal, asterion.

Corresponding Author:
Dr. Shailendra Singh,
Email: shailendra.anatomy@gmail.com

DOI: 10.47009/jamp.2024.6.1.19

Source of Support: Nil,
Conflict of Interest: None declared

Int J Acad Med Pharm
2024; 6 (1); 96-98

Abstract

Background: The mastoid foramen is a hole in the temporal bone's posterior border. This hole transmits an emissary vein between the sigmoid sinus and the suboccipital venous plexus. A small branch of the occipital artery, the posterior meningeal artery, is also transmitted through this hole to the dura mater. The mastoid foramen opening is typically very narrow, with an average distance of 18 mm from the asterion and about 34 mm from the external auditory meatus. The cranial emissary veins connect the posterior cranial fossa's intracranial and extracranial venous systems. **Materials and Methods:** The study was conducted in the Narina Medical College, Kanpur and Amar Shaheed Jodha Singh Attaiya Thakur Dariyav Singh Medical College, Fatehpur at Department of Anatomy. A soft copy of the CBCT scans of 500 patients was collected from the radiology department; these scans were studied with the help of RadiAnt DICOM Viewer. **Result:** In our study, we took 500 patients with 1000 sides and detected Mastoid Foramen in 400 patients in 800 sides. Of these, 280 were male, and the rest, 120 were female. The average mean age group of males was 38.12±44 year and 36.25±19 year in female in which age were vary from 20 year to 60 year. we observed unilaterally in 253 (36%) and 147 (37%). The mean diameter of the mastoid foramen was 2.47 mm. The mean height of the mastoid emissary canal was 1.98mm, and the distance of the mastoid foramen from the asterion was 16.25 mm. **Conclusion:** The surgeons should pay close attention to the critical anatomical structures of the mastoid emissary canal and mastoid foramen. Before surgical intervention, it is crucial to systematically analyze these structures as they cannot be clearly defined and may cause complications during surgery. Failure to recognize variations in the mastoid emissary canal and mastoid foramen on CBCT scans can lead to misdiagnosis and unnecessary procedures. CBCT scans can help detect the mastoid emissary canal, allowing radiologists and surgeons to understand the emissary vein's course better.

INTRODUCTION

The mastoid foramen is a hole in the temporal bone's posterior border. This hole transmits an emissary vein between the sigmoid sinus and the suboccipital venous plexus. A small branch of the occipital artery, the posterior meningeal artery, is also transmitted through this hole to the dura mater.[1] The mastoid foramen opening is typically very narrow, with an average distance of 18 mm from the asterion and about 34 mm from the external auditory meatus.[2,3] The cranial emissary veins (CEVs) connect the posterior cranial fossa's intracranial and extracranial venous systems.[4] The emissary veins are located in the posterior cranial fossa, pass through the emissary ducts, and provide venous drainage through the dural venous sinuses.[5] The mastoid emissary canals are tiny and slim channels that connect the mastoid air cells of the temporal bone to the external environment. They are usually between 0.5 and 1 cm long and comprise a thin bony wall with a lumen lined with mucosal tissue. The canals follow a curved path, usually towards the lateral and posterior direction, and end with a small opening on the rear surface of the mastoid process.[6] Some veins in the

ISSN (O): 2687-5365; ISSN (P): 2753-6556

skull have many variations and connect extracranial vessels to intracranial vessels through different canals. These canals develop from the dural venous sinus during the embryological period. The vena emissaries do not have valves, allowing for two-way blood flow. This helps balance intracranial venous blood temperature by allowing cold blood from the surface of the skull to mix with it.[7] The present study aimed to evaluate the morphological and morphometric characteristics of mastoid emissary canals in patients using CBCT.

MATERIALS AND METHODS

The study was conducted in the Narina Medical College, Kanpur and Amar Shaheed Jodha Singh Attaiya Thakur Dariyav Singh Medical College, Fatehpur at Department of Anatomy. A soft copy of the CBCT scans of 500 patients was collected from the radiology department; these scans were studied with the help of RadiAnt DICOM Viewer. The duration of the study was January 2023 to November 2023.

The presence of Mastoid Foramen
The number of Mastoid Foramen,
The mean diameter of the mastoid emissary canals
The mean diameter of the mastoid foramen,
The distance of Mastoid Foramen and asterion

Statistical Analysis: Statistical analysis was performed using the computer-based software Statistical Package for Social Science (SPSS).

RESULTS

In our study, we took 500 patients with 1000 sides and detected Mastoid Foramen in 400 patients in 800 sides. Of these, 280 were male, and the rest, 120, were female. The average mean age group of males was 38.12±44 year and 36.25±19 year in female in which age were vary from 20 year to 60 year.

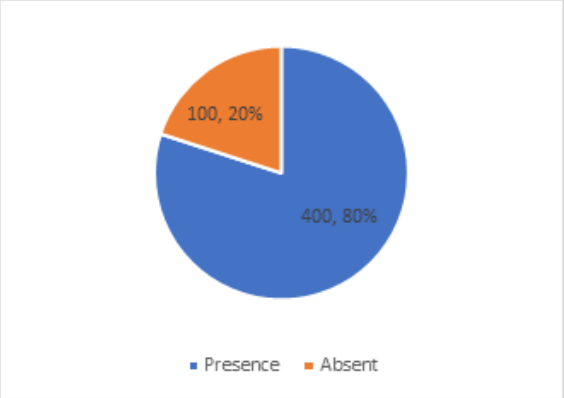

Figure 1: showing the presence and absence of Mastoid emissary canal in male and female patients

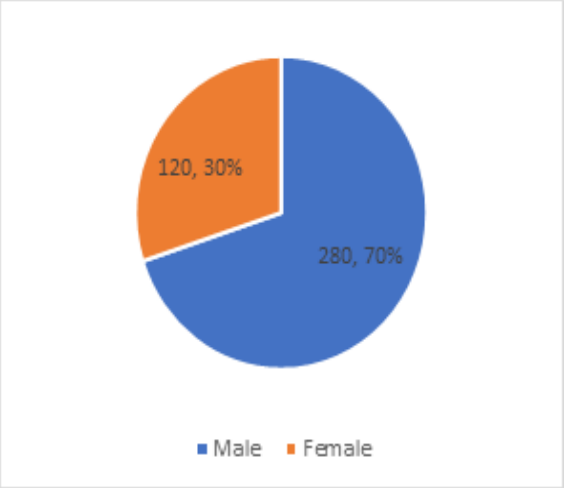

Figure 2: Chart shows the number of male and female patients in our study.

Table 1: showing the presence and absence of mastoid emissary canal in given skull.

Mastoid emissary canal	Number
Presence	400(80%)
Absence	100(20%)

Table 2: showing the male and female patients in our study

Parameter	Number
Male	280()
Female	120 ()

In our current study, we observed unilaterally in 253 (36%) and 147 (37%). The mean diameter of the mastoid foramen was 2.47 mm. The mean height of the mastoid emissary canal was 1.98mm, and the distance of the mastoid foramen from the asterion was 16.25 mm.

DISCUSSION

In our recent study, we observed the presence of a mastoid foramen unilaterally in 253 cases (36%) and bilaterally in 147 cases (37%). The average diameter of the mastoid foramen was 2.47 mm. The average height of the mastoid emissary canal was 1.98 mm, and the distance between the mastoid foramen and the asterion was 16.25 mm. When compared to the study by Demirpolat et al,[8] which analyzed the prevalence and diameter of the mastoid foramen and mastoid emissary canal with three-dimensional images obtained from 248 patients using multidetect or computed tomography, our study found the prevalence of mastoid emissary canal to be 91.5% in women, 93.3% in men, 84.7% on the right side, and 82.3% on the left side in unilateral cases. Similarly, in this study, the prevalence of the mastoid emissary canal was examined based on gender and the side. The diameters of the mastoid foramen and mastoid emissary canal were measured. However, three-

ISSN (O): 2687-5365; ISSN (P): 2753-6556

dimensional images were obtained in a shorter time and with a lower radiation dose using cone-beam computed tomography instead of multidetector computed tomography. Which is similar to our study. A study conducted by Mustafa Temiz et al,[9] 270 sides of 135 patients were observed using CBCT images. They found that the prevalence of the mastoid foramen was 119 (88.1%). The mastoid emissary canal and mastoid foramen were identified as bilateral in 80 patients (67.20%) and unilateral in 39 patients (32.80%). The prevalence of mastoid emissary canal and mastoid foramen was 55.5% in females and 44.5% in males. The mean diameter of the mastoid foramen was 2.4 ± 0.9 mm, and the mean height was 2.3 ± 0.9. The mean diameter of the mastoid emissary canal was 2.1 ± 0.8, and the mean height was 2.1 ± 0.8. There was a statistical difference between genders (p = 0.043) in foramen diameter. Males had a significantly larger mean diameter of mastoid foramen in comparison to females. Another study of murlimanju et al.[10] A study examined 96 temporal bones from 48 cadaver skulls to analyze the prevalence, morphology, and number of mastoid foramina. The study found that 91.7% of the temporal bones had a mastoid foramen. One mastoid foramen was observed in 62.5% of the temporal bones, two mastoid foramina in 22.9%, and three mastoid foramina in 6.2%. The study also found that the incidence of mastoid emissary veins did not significantly differ among different races. Another study by Ozkan Ozen et al,[11] analyzed mastoid emissary canal diameters in patients with COM and found that the mean diameter of the main mastoid emissary canal on the side of the ear with COM was 1.6 mm, and the total accessory and main mastoid emissary canal diameters were 1.8 mm, which were significantly higher than in the control group. The study also found that the presence of the accessory mastoid emissary canal on the side of the ear with COM was significantly higher (61.8%) than in the control group.

Similarly, a study by G. Demirpolat et al,[12] analyzed 248 patients (496 sides) and found that mastoid foramen was present in 92.3% of the cases. Mastoid emissary canal was present on the right side in 84.7% and on the left side in 82.3% of temporal bones. The mean diameter of the mastoid foramen was 1.92 ± 1.02 mm on the right and 1.84 ± 0.98 mm on the left, and the mean diameter of the mastoid emissary canal was 1.58 ± 0.86 mm on the right and 1.48 ± 0.79 mm on the left side. The study found that the mean diameter of the mastoid emissary canal was significantly larger in men and that there was no significant correlation between age and the mastoid emissary canal diameter.

CONCLUSION

The surgeons should pay close attention to the critical anatomical structures of the mastoid emissary canal and mastoid foramen. Before surgical intervention, it is crucial to systematically analyze these structures as they cannot be clearly defined and may cause complications during surgery. Failure to recognize variations in the mastoid emissary canal and mastoid foramen on CBCT scans can lead to misdiagnosis and unnecessary procedures. CBCT scans can help detect the mastoid emissary canal, allowing radiologists and surgeons to understand the emissary vein's course better.

REFERENCES

1. Gray's Anatomy page no -141 of the 20th edition.
2. Hampl, Martin; Kachlik, David; Kikalova, Katerina; Riemer, Roxane; Halaj, Matej; Novak, Vlastimil; Stejskal, Premysl; Vaverka, Miroslav; Hrabalek, Lumir; Krahulik, David; Nanka, Ondrej (2018-07-01). "Mastoid foramen, mastoid emissary vein and clinical implications in neurosurgery" . Acta Neurochirurgica. 160 (7): 1473–1482. doi:10.1007/s00701-018-3564-2. ISSN 0942-0940. PMID 29779186. S2CID 29158669.
3. Kim, Won Sik; Kim, Soo Il; Kim, Sun; Zheng, Guo Dong; Yang, Eun Jin; Han, Seung Ro (2000-03-31). "Mastoid Foramen and Superficial Mastoid Canals of Korean Men". Korean Journal of Physical Anthropology. 13 (1): 11–19.
4. Syed AZ, Sin C, Rios Ret al. et al. Incidental occurrence of an unusually large mastoid foramen on cone-beam computed tomography and literature review. Imaging Sci Dent 2016 Mar; 46: 39–45.
5. Pekçevik Y, Pekçevik R. Why should we report posterior fossa emissary veins? Diagn Interv Radiol 2014; 20: 78–81.
6. Ozen O, Sahin C. Evaluation of the mastoid emissary canals with computerized tomography in patients with chronic otitis media. J Neurol Surg B Skull Base 2007; 81: 82–87.
7. Gulmez Cakmak P, Ufuk F, Yagci AB, et al. Emissary veins prevalence and evaluation of the relationship between dural venous sinus anatomic variations with posterior fossa emissary veins: mR study. Radiol Med 2019; 124: 620–627.
8. Demirpolat G, Bulbul E and Yanik B. The prevalence and morphometric features of mastoid emissary vein on multidetector computed tomography. Folia Morphol 2016; 75: 448–453.
9. Temiz M, Ozen DC, Duman SB, Bayrakdar IS, Kazan O, Jagtap R, Altun O, Z Abdelkarim A, Syed AZ, Orhan K. Morphometric and morphological evaluation of mastoid emissary canal using cone-beam computed tomography. Sci Prog. 2023 Apr-Jun;106(2):368504231178382. doi: 10.1177/00368504231178382. PMID: 37262004; PMCID: PMC10450264.
10. Murlimanju BV, Chettiar GK, Prameela MD, et al. Mastoid emissary foramina: an anatomical morphological study with discussion on their evolutionary and clinical implications. Anat Cell Biol 2014; 47: 202–206.
11. Ozen O, Sahin C. Evaluation of the Mastoid Emissary Canals with Computerized Tomography in Patients with Chronic Otitis Media. J Neurol Surg B Skull Base. 2020 Feb;81(1):82-87. doi: 10.1055/s-0039-3399518. Epub 2019 Oct 28. PMID: 32021754; PMCID: PMC6996993.
12. Demirpolat G, Bulbul E, Yanik B. The prevalence and morphometric features of mastoid emissary vein on multidetector computed tomography. Folia Morphol (Warsz). 2016;75(4):448-453. doi: 10.5603/FM.a2016.0021. Epub 2016 Nov 10. PMID: 27830877.

ISSN (O): 2687-5365; ISSN (P): 2753-6556