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

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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 Ataiya Thakur Daryiy 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 (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
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 venous 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.

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

<table>
<thead>
<tr>
<th>Mastoid emissary canal</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Presence</td>
<td>400(80%)</td>
</tr>
<tr>
<td>Absence</td>
<td>100(20%)</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>280(1)</td>
</tr>
<tr>
<td>Female</td>
<td>120(1)</td>
</tr>
</tbody>
</table>

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 1.98 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-
The prevalence of mastoid emissary veins (32.80%). The variations in neurosurgery.[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