A Morphological study of Mastoid Emissary Foramina in dry human skulls and its Surgical importance

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Abstract

Introduction: Emissary foramina are found in various bones of the skulls. They transmit emissary veins, connecting extracranial veins with the intracranial dural venous sinuses. The mastoid emissary foramen transmits an emissary vein joining sigmoid sinus with the posterior auricular vein and also meningeal branch of occipital artery. This foramen is usually found as a single entity in mastoid region. There are variations in the prevalence and number of the mastoid emissary foramina. Identification of such veins is significant in neurosurgery and otologic surgeries.

Objectives: To study the morphology of mastoid foramina of each temporal bone in relation to 1. Presence or Absence of mastoid foramina 2. Number of mastoid foramina 3. Comparison with available data and emphasis on its surgical importance.

Materials &Method: Dried adult skulls n=154 (308 temporal bones) have been used in the current study. Each temporal bone is observed for the Presence, Number and Position of the Mastoid emissary foramina. The patency of the foramina is confirmed by passing a probe. The results were tabulated and compared with the available data. Evolutionary aspects and Surgical importance of the study was discussed.

Results: Out of the 154 skulls (308 sides), 298 temporal bones showed the presence of Mastoid foramina (97.4%). 10 of the temporal bones didn't show mastoid foramen. Prevalence of mastoid emissary foramen was 97.4% on the right side and 96.1% on the left side. In four of the skulls, mastoid emissary foramen was absent bilaterally.

Conclusion: Knowledge of variable number and prevalence of mastoid emissary foramina is significant in mastoid related surgeries and also in transtemporal approach to the posterior cranial fossa. This study provides an essential data about such foramina, thus will be helpful for surgeons. Further the study can be supported with radiological correlation.

Key words: emissary, mastoid, foramen, temporal

Introduction

Emissary veins pass through the cranial apertures and connect intracranial dural venous sinuses with the extra cranial veins. These are significant in determining the spread of infection from extra cranial foci to the dural venous sinuses[1]. The mastoid emissary vein (MEV) arises from the sigmoid sinus, exits via mastoid foramen, which is located posterior to the mastoid process[2,3,4] The mastoid emissary vein establishes connection between sigmoid sinus and posterior auricular vein or the occipital veins, thus channeling cerebral venous blood to suboccipital venous plexus and vertebral venous system[5,6]. Being valveless, these veins may lead to intracranial spread of infections, thrombus formation and when not recognized properly, they may form a reason for hemorrhage during mastoid related operative procedures[7]. The mastoid emissary foramen (MEF) is usually located in the posterior part of the mastoid temporal bone or over the occipitomastoid suture or it may be absent[8,9].

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The number of mastoid emissary foramina are variable from zero to four[3]. Surgeons are to be careful to avoid injuries to the vessels passing through this foramen and to avoid complications [10]. Identification of mastoid emissary vein is of significance in plastic and reconstructive surgeries[5]. Pre-operative identification of mastoid veins is essential and so multidetector computed tomography of the temporal bone should be scheduled before planning surgery[11]. Owing to the significance of the mastoid emissary foramen, current study is important with an objective to study the morphology of mastoid foramina of each temporal bone in relation to 1. Presence or Absence of mastoid foramina 2. Number of mastoid foramina 3. Comparison with available data and emphasis on its surgical importance.

Materials & Methods

The current study incuded 154 dried adult skulls (308 temporal bones) irrespective of sex have been used in. The dry skulls are from department of anatomy KIMS, Koppal, Karnataka and also from those observed during osteology classes. Exclusion criteria: damaged skulls, morphologically deformed skulls, skulls with abnormal growths and erosions. Each temporal bone is observed for the Presence and Number of the Mastoid emissary foramina. The patency of the foramina is confirmed by passing a probe. The results were tabulated and compared with the available data. Evolutionary aspects and surgical importance of the study was discussed.

Results

Out of the 154 skulls (308 sides), 298 temporal bones showed the presence of Mastoid foramina (96.7%). 10 of the temporal bones didn't show mastoid foramen. Prevalence of mastoid emissary foramen was 97.4% on the right side and 96.1% on the left side. In four of the skulls, mastoid emissary foramen was absent bilaterally.

Table 1: Incidence of Mastoid emissary foramina

Number of MEF	n = 308	Right (154)	Left (154)
1	206	96	110
2	70	38	32
3	22	16	6
0	10	4	6

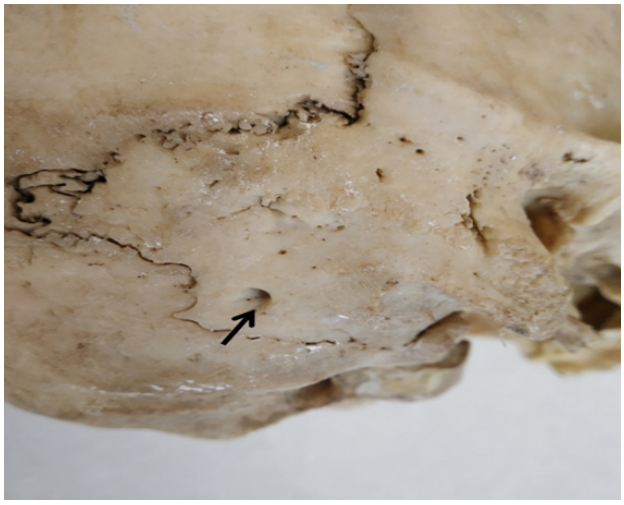

Figure 1: Single mastoid emissary foramen

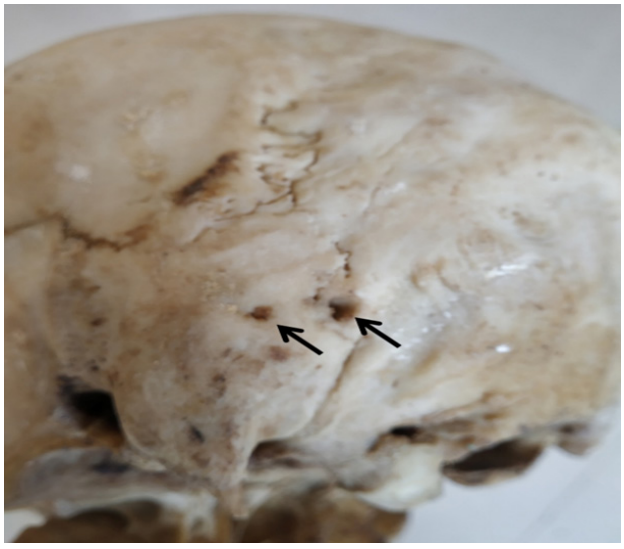

Figure 2: Double mastoid emissary foramina

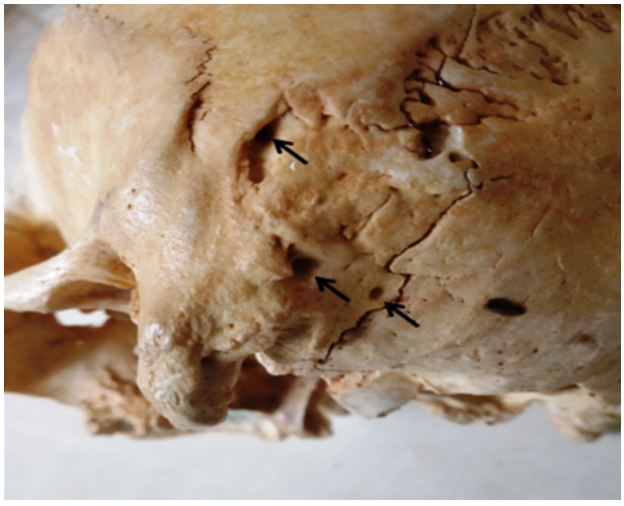

Figure 3: Triple mastoid emissary foramina

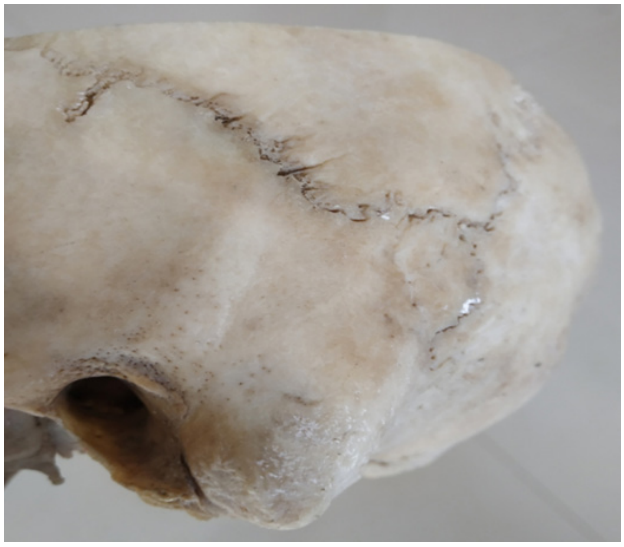

Figure 4: Absent mastoid emissary foramen

Discussion

The Mastoid Emissary Veins (MEV) passes through the Mastoid Emissary Foramina (MEF). Normally blood flow through the MEV is sluggish, but in case of increased intracranial tension, MEV forms the drainage channel to reduce the pressure[4]. The mastoid emissary vein is one of the important posterior cranial fossa veins, which passes via the mastoid emissary foramen. These foramina are absent in non-human primates, but with evolution in picture, the emissary foramina formed the major routes for the intracranial venous flow to the vertebral veins[5]. The prevalence and number of mastoid foramina were reported in different studies.

Table 2: Prevalence of Mastoid Emissary Foramen in different studies

Author	Incidence of MEF (in %)
Louis[3]	85
Reis[4]	89
Kim[5]	83.7
Falk [11]	90
Boyd [12]	68
Pereira[13]	82.4
Murlimanju B V[14]	91.7
Current study	96.7

We report 96.7% prevalence of mastoid emissary foramen out of 308 temporal bones.

In a study by Louis, it was reported that the prevalence was 85% and the mastoid foramina may vary from zero to as many as four[3]. In a study by Boyd[12] 68% prevalence was reported, which is very low. As per Murlimanju[13], the prevalence in south Indian skulls is 91.7%. We report 96.7% of prevalence of mastoid emissary foramen out of 308 temporal bones. Compared to the studies so far, the prevalence in our study is higher and only 10 of the temporal bones didn't show MEF out of 308.

Variations in the number of mastoid emissary foramina may be attribute to evolutionary changes[13]. Temporal bone venous variations are common in CHARGE syndrome[14]. The location and variations of MEF and MEV shold never be ignored. It is essential to analyze these anatomical structures systematically before the surgical intervention. [15]

In a study by Gaining Gangmei[10] MEF were grouped as single, multiple and absent, which reported 89% of incidence of MEF. Incidence of single MEF was 82%, double in 6% and triple in 1%, whereas incidence of absence of MEF was 11%. In current study the incidence of single MEF (Figure.1) was 66.9%, double MEF (Figure.2) was 22.7%, triple (Figure.3) was 7.1%. We report 3.2% of absence of MEF (Figure.4). The MEF were bilaterally absent in 4 skulls (out of 154 skulls).

Conclusion

A sound knowledge of Mastoid Emissary Foramina (MEF) is essential before handling mastoid area. Our study revealed a high prevalence of MEF, thus supports the evolutionary aspects as reported by previous researchers. Recognition of Mastoid Emissary Vein (MEV) during surgeries could avoid hemorrhage and reduce complications. An orientation about the MEF and MEV is essential during transtemporal approach to the posterior cranial fossa. Further, this study provides essential data for the neurosurgeons, plastic and ENT surgeons. However, more valuable information can be given if this study is supported with radiological correlation, involving CT or MRI revealing the location, connections and course of the MEV.

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