Int. J. Morphol.,
44(1):309-318, 2026.

Anatomical and Morphological Variations of Mastoid Emissary Foramen and Its Clinical Significance in Adult Human Skulls

Variaciones Anatómicas y Morfológicas del Foramen Emisario Mastoideo y su Importancia Clínica en Cráneos Humanos Adultos

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SALAMA, R. M. Anatomical and morphological variations of mastoid emissary foramen and its clinical significance in adult human skulls. *Int. J. Morphol., 44(1)*:309-318, 2026.

SUMMARY: The mastoid emissary foramen (MEF) is an anatomically variable opening located within the temporal bone that allows passage of the mastoid emissary vein (MEV), which connects the sigmoid sinus to extracranial venous channels. Its occurrence and dimensions show wide variation among individuals and populations, making it of particular surgical and anatomical importance. The foramen is generally found at or near the posterior margin of the mastoid process of the temporal bone or close to the occipitomastoid suture. This study aimed to describe in detail the anatomical and morphological features of the MEF in adult human skulls and to assess its prevalence, position, number, and size. In this study 48 adult human dry skulls (96 hemiskulls) of undetermined sex were macroscopically examined. Each temporal bone was evaluated for the presence, number, and diameter of the MEF using standardized measurement techniques. Among the examined specimens, the MEF was absent in 10 skulls (21 %), unilateral in another 10 skulls (21 %), and bilateral in 28 skulls (58 %). Out of 96 temporal bones assessed, 42 (43.75 %) exhibited a single MEF, 12 (12.5 %) showed double foramina, and 22 (22.9 %) presented with triple foramina. The foramen diameter demonstrated wide variation, with a mean of 3.16 ± 1.68 mm and a range between 0.18 and 5.6 mm. The MEF demonstrates marked variability in position, size, and number. Recognizing these variations is vital for radiologists, anatomists, and surgeons, as accurate anatomical knowledge helps avoid vascular injury and minimize complications during skull base or mastoid surgical procedures.

KEY WORDS: Mastoid emissary foramen; MEV; Temporal bone; Occipitomastoid suture.

INTRODUCTION

Emissary veins constitute vital vascular pathways that establish communication between the intracranial venous sinuses and the extracranial venous system through small apertures known as emissary foramina within the cranial bones. Owing to the absence of valves within their structure, these veins permit bidirectional blood flow, thereby functioning as compensatory channels that regulate venous circulation and assist in maintaining the hemodynamic equilibrium of the dural venous sinuses (Singhal & Ravindranath, 2013).

Among these emissary veins, the mastoid emissary vein (MEV)—also referred to as the *Vena emissaria mastoidea*—is particularly significant. It traverses the mastoid emissary foramen (MEF) and serves as a conduit between the sigmoid dural venous sinus and the posterior auricular or occipital vein (Fig. 1) (Hampl *et al*., 2018).

Anatomically, the mastoid emissary foramen, or *Foramen mastoideum*, is an irregularly shaped aperture whose presence, number, position, and size exhibit substantial inter-individual and inter-population variability. It may be located either along the occipitomastoid suture or near the posterior aspect of the mastoid process of the temporal bone. The foramen typically transmits the MEV together with a small meningeal branch of the occipital artery, both of which play critical roles in venous drainage and arterial supply of the posterior cranial fossa (Hampl *et al*., 2018).

From a surgical standpoint, comprehensive preoperative awareness of the morphological and topographical variations of the MEF and its associated vascular components is indispensable. Such understanding aids in the prevention of iatrogenic complications during surgical interventions in the posterior cranial fossa or mastoid region, including profuse hemorrhage, venous thrombosis, air embolism, and postoperative infection. Accidental injury to these structures, particularly during

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Received: 2025-11-17 Accepted: 2025-12-25

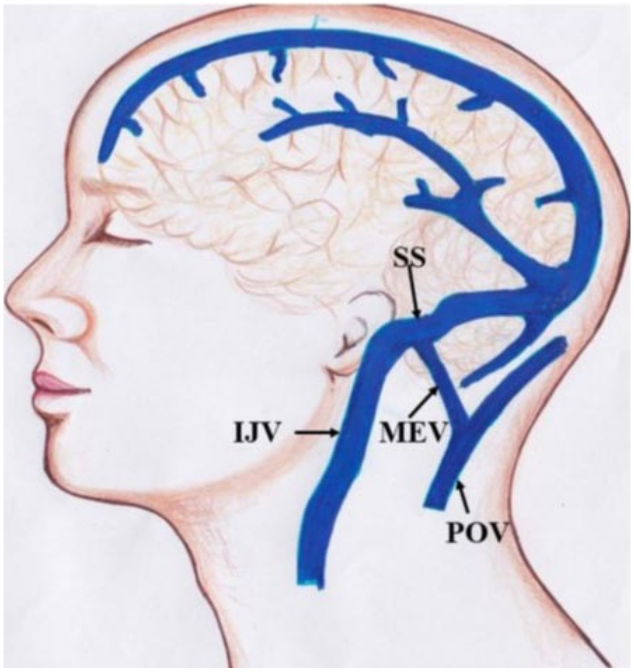

Fig. 1. Photograph illustrating mastoid emissary vein (MEV) connecting the posterior auricular vein (POV) and sigmoid sinus (SS). IJV = internal jugular vein (Singh, 2023).

neurosurgical or otologic procedures, may result in severe and potentially life-threatening outcomes (Pekçevik *et al*., 2021; Zhou *et al*., 2023).

Anthropologically, the mastoid emissary vein has attracted attention for its evolutionary and physiological significance in human cranial development. It has been proposed that the emergence and enlargement of emissary foramina, including the MEF, were adaptive features in early hominins that facilitated enhanced venous drainage through the vertebral venous plexus as humans evolved to an upright posture. In the bipedal position, the occipital and transverse sinuses, together with emissary veins, assumed greater importance in redirecting venous return from the brain toward the vertebral venous system rather than the internal jugular vein (Kim *et al*., 2014). Conversely, in the recumbent position, venous blood predominantly drains into the internal jugular pathway. Studies in evolutionary anatomy have suggested that the remodeling of the mastoid portion of the temporal bone correlates with the development of the MEV, reinforcing its significance as a marker of human cranial evolution (Goucha *et al*., 2002).

A profound understanding of these structures remains a cornerstone of clinical anatomy, as every aspect of medical practice—from interpreting plain radiographs to performing intricate neurosurgical operations—depends on precise anatomical knowledge (Mavrodi & Paraskevas, 2013).

Accordingly, the present study was designed to consolidate and analyze data regarding the position, number, symmetry, size, and diameter of the mastoid emissary foramen and to interpret these parameters within their clinical and surgical contexts. By elucidating the relationship between MEF morphology and its associated vascular elements, particularly the MEV, this study aims to support neurosurgeons and vascular surgeons in executing procedures with minimal invasion and reduced complication rates, thereby enhancing surgical precision and patient safety.

MATERIAL AND METHOD

Exclusion criteria

Current study did not include skulls with pathological alterations at the cranial base. Bony erosions, invasions, spurs, and growths were among the exclusion criteria that were closely inspected in the anterior, middle, and posterior skull base regions. Skull bases with these types of alterations, which are indicative of tumor invasion, were deemed pathologically abnormal and eliminated. Additionally, pathological indicators of a tumor invasion were looked for in the cranial cavity and excluded if they were discovered.

Study

Cross-sectional descriptive observational study was conducted for approximately three months from August to November 2025 in 48 adult human dry skulls, with intact mastoid region, from the anatomy laboratory, Anatomy and Histology department, College of Medicine, Qassim University, Saudi Arabia.

The 48 adult human dry skulls containing 96 mastoid parts of the temporal bones were macroscopically observed for the occurrence, number, and diameter of the MEF. The MEF has been observed using a magnifying lens. A Digital Vernier caliper was applied to measure the diameter of mastoid foramina. A probe was passed through each foramen to validate its patency.

The morphological characteristics of the foramina were carefully documented, and high-resolution photographic records were obtained to ensure precise visual analysis. Imaging was performed using a professional digital single-lens reflex camera (Canon D6 DSLR, Canon Inc., Japan) fitted with a 100 mm macro lens (Canon EF

100 mm f/2.8 USM Macro Lens, Canon Inc., Japan). This setup allowed for detailed close-up photography, providing clear visualization of the foraminal contours, margins, and positional relationships to adjacent anatomical landmarks. These images served as essential references for confirming the macroscopic observations and enhancing the reliability of morphometric documentation.

Design

Gross incidence of the 48 adult human dry skulls, according to the side position of MEF, was assigned into three groups as follow:

1. Group I (No MEF) (N=10): where there is no mastoid emissary foramen on the temporal bone.
2. Group II (Unilateral MEF) (N=10): where there are unilateral mastoid emissary foramen/foramina on the temporal bone.
3. Group III (Bilateral MEF) (N=28): where there are bilateral mastoid emissary foramen/foramina on the temporal bone.

Gross incidence of the 96 mastoid parts of the temporal bones of the hemiskulls of the adult human dry skulls, according to the number of MEF, was categorized into four groups as follow:

1. Group I (No MEF) (N=20): where there is no mastoid emissary foramen on the temporal bone.
2. Group II (Single MEF) (n=42): where there is a single mastoid emissary foramen on the temporal bone.
3. Group III (Double MEF) (n=12): where there is double mastoid emissary foramen on the temporal bone.
4. Group III (Trible MEF) (n=22): where there is trible mastoid emissary foramina on the temporal bone.

Ethical approval

All research procedures were conducted in strict accordance with the ethical standards outlined in the Declaration of Helsinki, which serves as the foundational guideline established by the World Medical Association for research involving human subjects. Compliance with these principles ensured that participants' rights, dignity, and confidentiality were fully protected throughout the study. Furthermore, all methodological steps were designed to maintain transparency, integrity, and accountability in accordance with institutional and international research ethics frameworks.

The study received formal ethical approval from the Committee of Research Ethics, Deanship of Graduate Studies and Scientific Research, Qassim University, Saudi Arabia (Approval No. 25-13-06).

Statistical analysis

All quantitative variables were analyzed using descriptive statistical methods, including the computation of the mean, standard deviation (SD), and range to summarize the distribution and variability of the data. Conversely, qualitative variables were expressed as frequencies and percentages to represent categorical outcomes effectively. The statistical analysis was performed using the Statistical Package for the Social Sciences (SPSS), version 26.0 (IBM Corp., Armonk, NY, USA). This software facilitated data entry, organization, and computation of statistical indicators with high accuracy. All analyses were conducted with meticulous attention to ensure data reliability, consistency, and reproducibility, thereby supporting the robustness of the study's findings and enhancing the interpretability of the results.

RESULTS

In this investigation, the frequency and percentage distribution of the morphological presence of mastoid emissary foramina were examined in 48 adult human dry skulls (96 hemiskulls/mastoid portions of the temporal bones) free from any apparent pathological alterations. The assessments were carefully conducted on the mastoid portions of the temporal bones, the occipitomastoid sutures, and the medial parts of the occipital bones adjacent to the suture on each skull before documenting the findings.

It was noticed that 38 adult human skulls (76 hemiskulls/mastoid parts of the temporal bones) (79 %) have MEF and 10 adult human skulls (20 hemiskulls/mastoid parts of the temporal bones) (21 %) have no MEF.

Gross incidence of the 48 adult human skulls, according to the side position of MEF, represented absence of the MEF in 10 skulls (21 %) (Table I, Figs. 2 and 3), unilateral MEF in 10 skulls (21 %) (Table I, Figs. 2 and 4), and bilateral MEF in 28 skulls (58 %) (Table I, Figs. 2, 5, 6, 7 and 8).

Table I. Distribution of MEF according to the side position (n= 48 skulls).

Distribution of MEF according to the side position	Frequency	Percentage %
No MEF	10	21
Unilateral MEF	10	21
Bilateral MEF	28	58

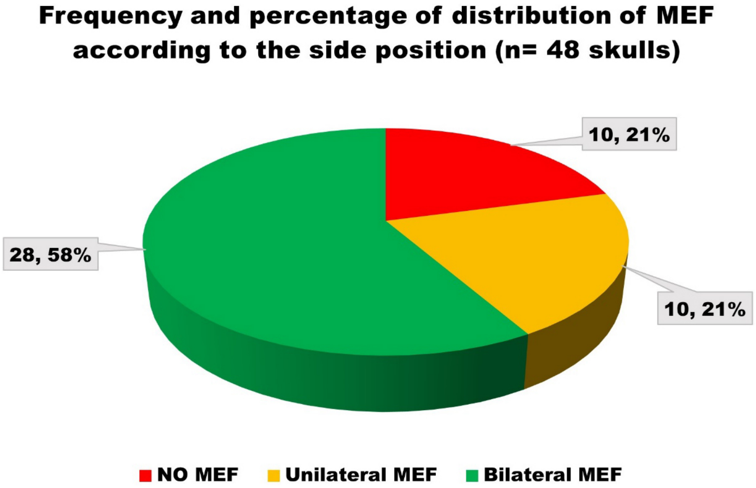

Fig. 2. Distribution of MEF according to the side position (n= 48 skulls).

Fig. 3. Viewing the base of the skull depicting the absence of the MEF at the posterior margin of the mastoid process of the temporal bones of both sides.

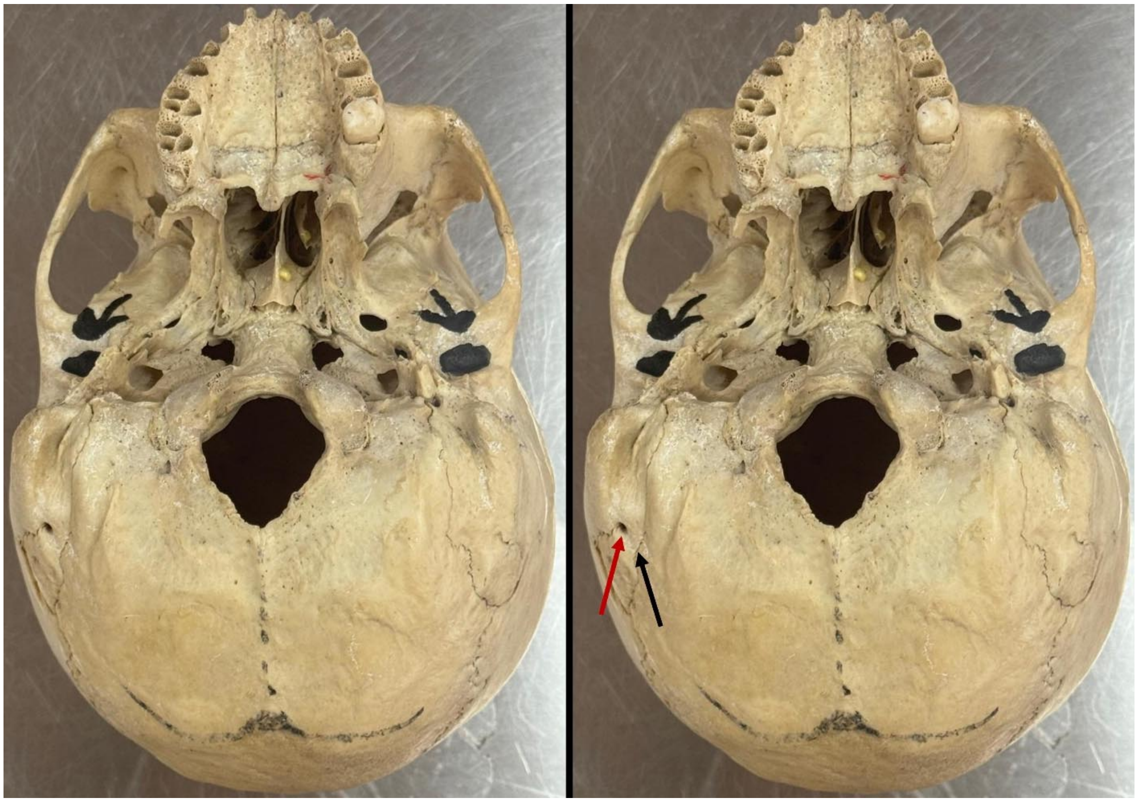

Fig. 4. Displaying the base of the skull depicting the presence of unilateral MEF on the right side (red arrow) at the posterior margin of the mastoid process of the temporal bone, and near the occipitomastoid suture (black arrow).

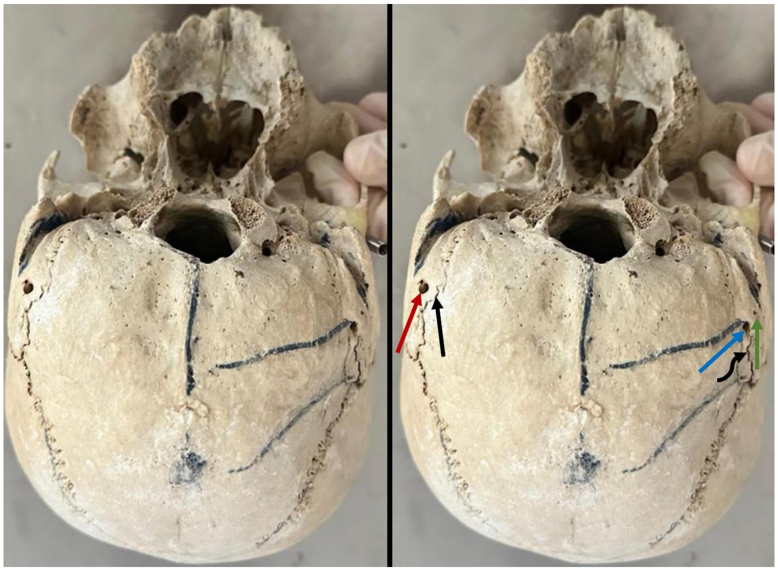

Fig. 5. Viewing the base of the skull showing the presence of bilateral mastoid emissary foramina, one foramen on the right side (red arrow) near the occipitomastoid suture (black arrow) and double foramina on the left side, one (blue arrow) on the occipitomastoid suture (zigzag black arrow), and the other (green arrow) on the posterior margins of the mastoid processes of the temporal bones near the occipitomastoid suture (zigzag black arrow).

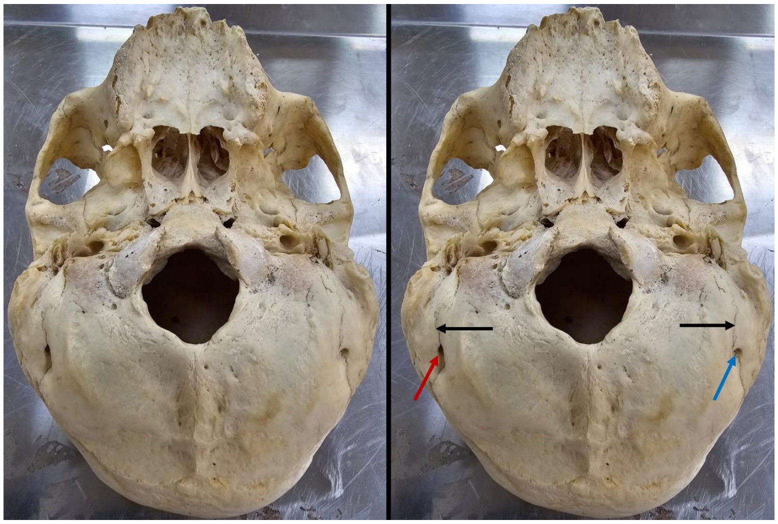

Fig. 6. Demonstrating the base of the skull depicting the presence of bilateral mastoid emissary foramina, one on the right side (red arrow) and the other one on the left side (blue arrow). Both foramina are on the occipitomastoid sutures (black arrow).

Fig. 7. Illustrating the base of the skull showing the presence of bilateral mastoid emissary foramina, triple foramina on the right side (red arrows) and double foramina on the left side (blue arrows) of the posterior margins of the mastoid processes of the temporal bones, and near the occipitomastoid sutures (black arrow).

Gross incidence of the 96 hemiskulls/ mastoid parts of the temporal bones, according to the number of MEF, was displayed absence of the MEF in 20 temporal bones (20.83 %) (Table II, Figs. 3 and 9), Single MEF in 42 temporal bones (43.75 %) (Table II, Figs. 4, 5, 6 and 9), Double MEF in 12 temporal bones (12.5 %) (Table II, Figs. 5, 7 and 9), and Trible MEF in 22 temporal bones (22.92 %) (Table II, Figs.7 to 9).

Regarding variations of the MEF diameters examined, the total number of mastoid emissary foramina detected were 218 with a mean diameter of (3.16±1.68 mm), and a range of (0.18 mm– 5.6mm) for the minimum and the maximum diameters of foramina respectively (Table III, Fig. 10).

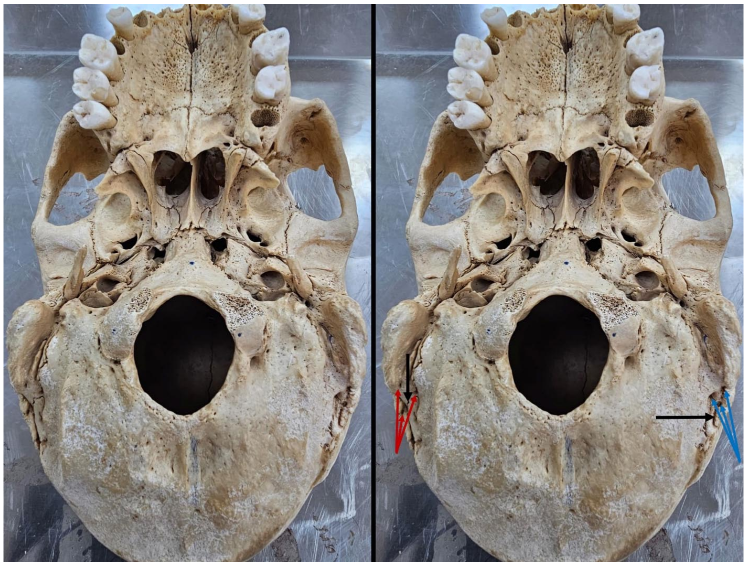

Fig. 8. Viewing the base of the skull depicting the presence of bilateral mastoid emissary foramina; triple foramina on the right side (red arrows) and triple foramina on the left side (blue arrows). Note; on each side two foramina are present on the posterior margins of the mastoid processes of the temporal bones near the occipitomastoid sutures (black arrow), while the third foramen is present on the occipitomastoid suture (black arrow).

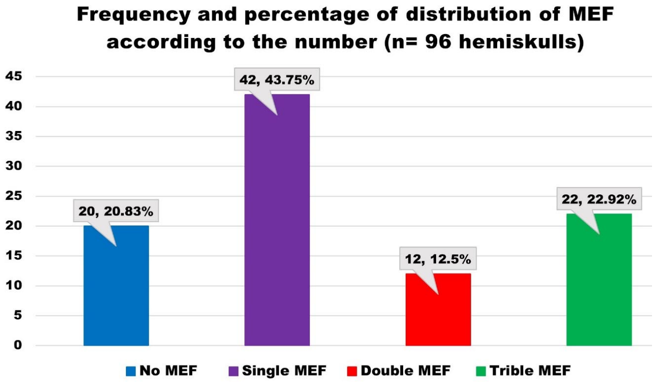

Fig. 9. Distribution of MEF according to the number (n= 96 hemiskulls).

Table II. Distribution of MEF according to the number (n= 96 hemiskulls).

Distribution of MEF according to the number	Frequency	Percentage %
No MEF	20	20.83
Single MEF	42	43.75
Double MEF	12	12.5
Trible MEF	22	22.92

Table III. Descriptive statistics of the variations of the MEF diameter (n = 218).

Variable	Number of foramina detected	Mean± SD	Range (Minimum- Maximum)
Diameter of foramen (mm)	218	3.16±1.68	0.18 – 5.6

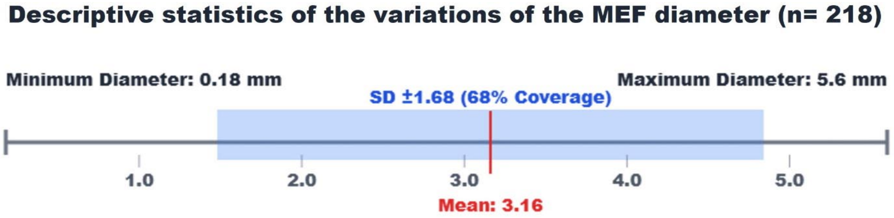

Fig. 10. Descriptive statistics of the variations of the MEF diameter, illustrating the mean diameter is (3.16±1.68 mm), and the range is (0.18 mm–5.6 mm) of the minimum and the maximum foramina diameters respectively, where the total number of mastoid emissary foramina detected were 218.

DISCUSSION

The human skull is characterized by numerous openings, or foramina, through which vital neural and vascular structures pass. These apertures serve as conduits for arteries, veins, and nerves that supply and drain various intracranial and extracranial regions. Hence, the accurate identification and documentation of these foramina are indispensable, not only for understanding the intricate neurovascular anatomy of the skull but also for distinguishing normal anatomical configurations from developmental or acquired anomalies. A comprehensive appreciation of these variations is fundamental for anatomists, radiologists, and surgeons alike, as any misinterpretation during diagnostic imaging or surgical intervention can result in iatrogenic neurovascular injuries, surgical complications, or even procedural failure. The consequences of such errors highlight the necessity of precise anatomical knowledge in both clinical and academic settings (Freire *et al*., 2013).

Over the past century, anatomical variations in the cranial foramina have consistently captured the attention of researchers and clinicians. These morphological variations, often referred to as non-metric cranial traits, play a crucial role in anthropological and forensic investigations, as they serve as indicators of population diversity, genetic inheritance, and evolutionary adaptation. From an evolutionary perspective, certain foraminal configurations are believed to reflect selective adaptations related to vascular physiology and brain metabolism (Kaur *et al*., 2012).

Clinically, the presence, number, and size of foramina can significantly influence surgical planning, radiological interpretation, and the management of neurovascular diseases. Despite their clinical and scientific relevance, some of these morphological features are often underrepresented or oversimplified in classical anatomy textbooks, being regarded as minor anomalies or incidental findings with limited significance. However, growing clinical evidence underscores their importance, especially within neurosurgical, otolaryngological, and maxillofacial procedures, where precise anatomical localization can be critical to avoiding postoperative complications (Keskil *et al*., 2003).

With the widespread integration of advanced imaging technologies, such as magnetic resonance imaging (MRI), computed tomography (CT), and cone-beam CT (CBCT), there has been an increasing focus on the detailed visualization of skull foramina in vivo. These non-invasive imaging techniques enable three-dimensional reconstruction, accurate measurement, and evaluation of foraminal relationships with adjacent neurovascular structures. Consequently, their role has expanded from mere anatomical curiosity to a key diagnostic and preoperative planning tool. In clinical radiology, the identification of foramina has become a standard criterion in differentiating normal anatomical landmarks from pathological lesions such as vascular malformations, metastatic deposits, or bone erosions. Nevertheless, the comprehensive depiction of these structures remains insufficient in most gross anatomy references, indicating a persistent gap between traditional morphological education and modern imaging-based anatomy (Berge & Bergman, 2001).

Among the various cranial openings, the mastoid emissary foramen (MEF) has received particular attention due to its variable morphology and significant clinical implications. Morphological variations of the mastoid process and its foramina have been documented since the early 20th century, primarily through studies conducted on dried skulls and cadaveric specimens (Pereira *et al*., 2013). More recent in vivo studies utilizing CT scans, radiography, and advanced image analysis software have enhanced the understanding of MEF characteristics, allowing for comparative analyses across populations and species (Yurdabakan *et al*., 2023). Based on accumulated findings, it has been hypothesized that the presence of the mastoid foramen contributes to enhanced cerebral venous drainage, thereby supporting more efficient regulation of intracranial hemodynamics. This feature has been interpreted as a physiological and possibly evolutionary adaptation linked to increased cerebral activity in humans (Pereira *et al*., 2013; Yurdabakan *et al*., 2023). Consequently, the MEF not only holds clinical and surgical relevance but also represents a crucial anthropological and evolutionary marker, widely studied in forensic science and physical anthropology (Reis *et al*., 2007).

In the present investigation, 48 adult human dry skulls, corresponding to 96 mastoid portions or hemiskulls, were examined to determine the prevalence and morphological characteristics of the MEF. The foramen was identified in 79 % of the studied skulls, a figure slightly higher than the 78.5 % prevalence reported in a study of Turgut *et al.* (1998), in 586 skulls from the Anatolian region. However, this frequency was markedly lower than that observed in a Colombian sample of 103 skulls, where a prevalence of 94.17 % was documented, with minimal side asymmetry (right: 95.15 %; left: 93.20 %) (Duque-Parra *et al*., 2024). Studies conducted in other populations, such as in Australia and Turkey, reported prevalence rates of 83.4 % and 82 %, respectively (Kim *et al*., 2014; Yurdabakan *et al*., 2023).

Such variation among populations underscores the influence of genetic, environmental, and developmental factors on MEF formation and persistence, emphasizing the importance of population-specific anatomical databases.

Regarding the number of foramina, the distribution in the current study demonstrated that 43.75 % of hemi skulls possessed a single MEF, 12.5 % exhibited double foramina, and 22.92 % had triple foramina. These values differ considerably from previously published data of Duque-Parra *et al*. (2024), where the prevalence of single, double, and triple foramina was 37.63 %, 42.78 %, and 10.82 %, respectively.

This variability may reflect both individual anatomical diversity and methodological discrepancies in measurement and classification criteria among researchers.

Additionally, the mean diameter of the MEF observed in the present study was (3.16 ± 1.68 mm), ranging between (0.18 mm and 5.6 mm). This measurement is higher than that reported in Duque-Parra *et al*. (2024), works, where the average diameters 1.82 mm ranged from 0.28 mm to 7.3mm and also higher than the study of Kim *et al*. (2014), where the mean diameter was 1.64 mm, but remains slightly below the 3.39 mm average described in other anatomical studies of Yurdabakan *et al*. (2023).

Differences in measurement techniques, imaging resolution, and skull preservation may account for such discrepancies, reinforcing the need for methodological standardization in morphometric research.

Beyond its anatomical curiosity, the MEF holds major clinical relevance due to the presence of the mastoid emissary vein (MEV), which traverses it (Koesling *et al*., 2005). The MEV acts as a venous conduit linking the intracranial dural sinuses, particularly the sigmoid sinus, with the extracranial venous system. Although frequently omitted from classical anatomy manuals, this venous structure assumes significant physiological importance (Hernández-Rodríguez *et al*., 2014). Under normal conditions, venous blood flows slowly through the MEV, contributing minimally to cerebral drainage. However, in conditions characterized by elevated intracranial pressure, jugular vein hypoplasia, or sinus thrombosis, the MEV becomes an essential compensatory pathway, expanding to accommodate increased venous outflow. This compensatory mechanism highlights its functional role in maintaining intracranial pressure homeostasis and preventing venous congestion (Reis *et al*., 2007).

From a surgical standpoint, the MEV represents both a landmark and a potential hazard. During posterior cranial fossa or retro-sigmoid approaches, particularly in procedures addressing acoustic neuromas, vascular malformations, or cerebellopontine angle tumors, the vein is frequently encountered along the surgical corridor. Injury to the MEV can result in significant hemorrhage, air embolism, or postoperative thrombosis. Minor bleeding from smaller veins can typically be controlled using bone wax or electrocautery; however, larger or dilated MEVs pose greater challenges and may lead to life-threatening complications, especially when the vein is torn near its junction with the sigmoid sinus. In such cases, rapid identification, meticulous hemostasis, and preoperative recognition of venous anatomy are critical (Zhou *et al*., 2023).

The bidirectional nature of MEV flow further increases the clinical risk associated with its injury, as it can serve as a conduit for the spread of infections or embolic material between the intracranial and extracranial compartments. Thromboembolic events originating from the MEV or its tributaries can have serious neurological consequences. Therefore, precise preoperative mapping of emissary veins through high-resolution CT or MR venography is essential, particularly in patients with congenital anomalies such as craniosynostosis, where emissary veins may represent the principal venous drainage pathway (Kim *et al*., 2014; Zhou *et al*., 2023).

In this context, a detailed understanding of the anatomical and morphological variability of the MEF and MEV is indispensable for neurosurgeons, otolaryngologists, and maxillofacial surgeons. Surgical awareness of these structures allows for safer operative planning, minimizes intraoperative complications, and enhances overall outcomes. Furthermore, from an academic perspective, such studies contribute to bridging the gap between classical osteological anatomy and modern clinical anatomy, establishing a more comprehensive understanding of cranial vascular architecture. Ultimately, the integration of morphometric, radiological, and clinical data across diverse populations will advance both anatomical science and surgical safety, underscoring the continued importance of studying these subtle yet clinically significant cranial structures (Pekçevik *et al*., 2021; Zhou *et al*., 2023).

CONCLUSION

The findings of the present study, in alignment with evidence reported in the global literature, demonstrate substantial variability in the presence, number, size, diameter, and asymmetry of mastoid foramina in adult human dry skulls. These foramina may be completely absent in certain specimens, whereas in others, multiple foramina with distinct diameters may appear on one or both sides of the skull. Such morphological diversity is likely influenced by population-specific and geographical factors. A precise understanding of the morphological characteristics of the mastoid emissary foramen (MEF) holds significant clinical relevance for both neurosurgeons and vascular surgeons. This anatomical knowledge is crucial during surgical procedures involving the posterior cranial fossa to minimize the risk of inadvertent injury to the mastoid emissary vein (MEV), which could otherwise lead to serious intraoperative complications such as hemorrhage or venous air embolism.

Recommendations

1. **Preoperative Radiological Assessment.** It is recommended that high-resolution computed tomography (CT) or magnetic resonance venography (MRV) be routinely employed to delineate the anatomical characteristics of the MEF and the MEV. Such preoperative imaging facilitates accurate localization and dimensional assessment, thereby reducing the risk of iatrogenic vascular injury during otologic and posterior cranial fossa surgeries.

2. **Enhanced Anatomical Education and Surgical Training.** Integration of detailed instruction on MEF and MEV anatomical variability into surgical anatomy curricula is strongly advised. Cadaveric dissections complemented by three-dimensional (3D) imaging models can provide surgeons with critical spatial awareness, enhancing operative safety and precision.

3. **Standardization and Anatomical Database Establishment.** Future investigations should aim to standardize morphometric methodologies and develop comprehensive population-based anatomical databases. Such efforts would allow for meaningful interstudy comparisons, support clinical risk assessment, and serve as valuable references for neurosurgical and maxillofacial procedures.

Limitation of the study

The present study was constrained by the absence of demographic data, as the exact age and sex of the examined skulls were undetermined. Moreover, the evaluation of mastoid foramen dimensions was restricted to dry skulls, without the incorporation of radiological imaging modalities such as computed tomography (CT) or magnetic resonance imaging (MRI), which are essential for comprehensive clinical correlation in the diagnosis and management of cranial base pathologies. Future investigations integrating imaging analyses and demographic profiling are warranted to provide a more detailed and clinically applicable understanding of MEF variations across different populations.

ACKNOWLEDGEMENTS

I would like to express my sincere appreciation to the Deanship of Higher Education and Research at Qassim University for their invaluable and continuous support, which played a pivotal role in facilitating the successful completion of this research. Their commitment to advancing scholarly inquiry and providing essential logistical and administrative resources greatly contributed to the achievement of this study’s objectives.

SALAMA, R. M. Variaciones anatómicas y morfológicas del foramen emisario mastoideo y su importancia clínica en cráneos humanos adultos. *Int. J. Morphol., 44(1)*:309-318, 2026.

RESUMEN: El foramen emisario mastoideo (FEM) es una abertura anatómicamente variable ubicada dentro del hueso temporal que permite el paso de la vena emisaria mastoidea (VEM), la cual conecta el seno sigmoideo con los canales venosos extracraneales. Su presencia y dimensiones varían ampliamente entre individuos y poblaciones, lo que le confiere especial importancia quirúrgica y anatómica. El foramen se encuentra generalmente en o cerca del margen posterior del proceso mastoides del hueso temporal, o cerca de la sutura occipitomastoidea. Este estudio tuvo como objetivo describir en detalle las características anatómicas y morfológicas del FEM en cráneos humanos adultos y evaluar su prevalencia, posición, número y tamaño. En este estudio, se examinaron macroscópicamente 48 cráneos secos humanos adultos (96 hemicráneos) de sexo indeterminado. Se evaluó la presencia, el número y el diámetro del MEF de cada hueso temporal mediante técnicas de medición estandarizadas. Entre los especímenes examinados, el MEF estuvo ausente en 10 cráneos (21 %), unilateral en otros 10 cráneos (21 %) y bilateral en 28 cráneos (58 %). De los 96 huesos temporales evaluados, 42 (43,75 %) exhibieron un solo MEF, 12 (12,5 %) mostraron forámenes dobles y 22 (22,9 %) presentaron forámenes triples. El diámetro del foramen mostró una amplia variación, con una media de 3,16 ± 1,68 mm y un rango entre 0,18 y 5,6 mm. El MEF demuestra una marcada variabilidad en posición, tamaño y número. Reconocer estas variaciones es vital para radiólogos, anatomistas y cirujanos, ya que un conocimiento anatómico preciso ayuda a evitar lesiones vasculares y minimizar complicaciones durante procedimientos quirúrgicos de la base del cráneo o del proceso mastoides.

PALABRAS CLAVE: Foramen emisario mastoideo; Hueso temporal; Sutura occipitomastoidea.

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