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# A Study of Mastoid Foramina in Adult Human Skulls

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***Abstract:***
***Background****: Variations in the foramina of the craniofacial skeleton have always been an important topic of research among the anatomists as well as other research workers. These cranial variants are of great importance, both clinically and anthropologically. Therefore, the present study was carried out to study the prevalence of mastoid foramen, their number and position.*
***Materials and methods****: 50 dry adult human skulls of unknown sex and age were collected and analysed for the presence or absence of mastoid foramen, their number and location.*
***Results:*** *Mastoid foramen was observed in 89% and absent in 11% cases. Absent mastoid foramen was found more prevalent on the left side than on the right side. The mastoid foramen was found most predominantly in the mastoid part of temporal bone (90%), in the occipitomastoid suture in 9% and in the squamous part of occipital bone in 1%.*
***Conclusion:*** *The findings were discussed and compared with those of other workers so as to come to a significant inference. Knowledge of the mastoid foramen and its variations along with the structures passing through it is important during surgery in this region to avoid complications.*
***Keywords:*** *Mastoid foramen, emissary vein, temporal, occipital, cranial variants.*

## I. Introduction

Mastoid foramen, which is of variable size and position, is usually present in the posterior part of the mastoid temporal bone, at or near the occipitomastoid suture or in the squamous part of occipital bone or it may be absent. When present, it transmits an emissary vein from the skull connecting the sigmoid sinus with the posterior auricular vein or the occipital vein, and a small meningeal branch of the occipital artery.[1-4, 11] Therefore, surgery in this region should be unduly careful to avoid injury to these vessels and to avert from unwanted complications.

## II. Materials And Methods

The present study was carried out in the Department of Anatomy, Regional Institute of Medical Sciences, Lamphelpat, Imphal. 50 dry adult human skulls were collected from the Department of Anatomy, Regional Institute of Medical Sciences, Lamphelpat and J.N. Institute of Medical Sciences, Porompat, Imphal. The skulls were then examined on both sides for the presence or absence of mastoid foramen. If present, the actual number and position of the mastoid foramen were noted. However, age and sex of the skulls were not determined and too small foramina with size less than 1mm were not considered in the present study. Mastoid foramen more than one was counted as multiple mastoid foramina (double, triple) in the present study.

## III. Results

Out of the 50 skulls (100 sides/temporal bones), the mastoid foramen was observed in 89 temporal bones (89%). Single mastoid foramen (Fig. A1) was observed in 82 temporal bones (82%) - 43% on the right side and 39% on the left side. Double mastoid foramina (Fig. A3) were found in 6 temporal bones (6%) - 1% on the right side and 5% on the left side. One temporal bone was found with triple mastoid foramina (Fig. A4) on the right side (1%). Mastoid foramen was absent (Fig. A2) in 11 temporal bones (11%) - bilateral in 4 skulls (8 temporal bones=8%) and unilateral in 3 skulls (3 temporal bones=3%) - 1% on the right side and 2% on the left side.

Table 1: Variants of mastoid foramen in 50 skulls (100 temporal bones)-

| | | Absent mastoid foramen | Percentage (%) | Multiple mastoid foramina | Percentage (%) |
|---|---|---|---|---|---|
| Bilateral | | 8 | 8% | _ | _ |
| Unilateral | Right | 1 | 1% | 2 | 2% |
| | Left | 2 | 2% | 5 | 5% |
| | Total | 3 | 3% | 7 | 7% |

Incidence: Left > Right

Table 2: Variations in location of the mastoid foramen-

| Location | Percentage (%) |
|---|---|
| Mastoid temporal bone | 90% |
| Occipitomastoid suture | 9% |
| Squamous occipital bone | 1% |

## IV. Discussion

Out of the 100 temporal bones studied, mastoid foramen was observed in 89 temporal bones (89%). Single mastoid foramen was observed in 82 temporal bones (82%), double in 6 temporal bones (6%) and triple in 1 temporal bone (1%). Mastoid foramen was absent in 11 temporal bones (11%) – bilateral in 4 skulls (8 temporal bones=8%) and unilateral in 3 skulls (3 temporal bones=3%).

According to Boyd GI[6] the prevalence rate of absent mastoid foramen was 31.9% bilaterally and unilaterally absent in 33.7% (16.1% on the right and 17.6% on the left side). These findings were much higher than the study done by Kim et al[7] among the Korean men where the prevalence rate of absent mastoid foramen was only 1.4% bilaterally and 10.3% unilaterally (7.4% on the right side and 2.9% on the left side). Alok SK et al[8] also reported similar finding of bilateral absence of mastoid foramen in 1.4% and unilateral absence in 5.6% (2.8% on the right and 2.8% on the left side). They also reported bilateral multiple mastoid foramina in 8.5% and unilateral multiple mastoid foramina in 4.2% (1.4% on the right side and 2.8% on the left side). Murlimanju BV et al[9] reported absence of mastoid foramen in 3.1% bilaterally and unilateral absence in 2.1% (2.1% on the right and none on the left side). They also reported prevalence rate of multiple mastoid foramen in 29.1% bilaterally and 29.1% unilaterally (14.5% on the right and 14.6% on the left side). Debbarma S et al[5] reported 1.29% of bilateral absence of mastoid foramen and 3.9% of unilateral absence of mastoid foramen (1.95% each on both sides) among the North Indian population. They also reported multiple mastoid foramina in 12.99% bilaterally and unilaterally in 8.4% (2.6% on the right side and 5.6% on the left side). According to the study done by Vedula D et al[4] the prevalence rate of absent mastoid foramen was 10.0% bilaterally and 55.0% unilaterally (20.0% on the right side and 35.0% on the left side); the prevalence rate of bilateral multiple mastoid foramen was reported to be 2.5% and 7.5% unilaterally (2.5% on the right side and 5.0% on the left side).

Table 3: Variants of mastoid foramen as observed by different workers-

| | Absent mastoid foramen | | Multiple mastoid foramen | |
|---|---|---|---|---|
| | Bilateral | Unilateral | Bilateral | Unilateral |
| Boyd GI[6] | 31.9% | R-16.1%<br>L-17.6% | 10.8% | - |
| Kim WS et al[7] | 1.4% | R-7.4%<br>L-2.9% | - | - |
| Alok SK et al[8] | 1.4% | R-2.8%<br>L-2.8% | 8.5% | R-1.4%<br>L-2.8% |
| Murlimanju BV et al[9] | 3.1% | R-2.1%<br>L-nil | 29.1% | R-14.5%<br>L-14.6% |
| Debbarma S et al[5] | 1.29% | R-1.95%<br>L-1.95% | 12.99% | R-2.6%<br>L-5.8% |
| Vedula D et al[4] | 10.0% | R-20.0%<br>L-35.0% | 2.5% | R-2.5%<br>L-5.0% |
| Present study | 8.0% | R-1.0%<br>L-2.0% | - | R-2.0%<br>L-5.0% |

In the present study, 90% of the mastoid foramen was observed on the mastoid part of the temporal bone (Fig. A1), 9% on the occipitomastoid suture (Fig. B1) and 1% on the squamous occipital bone (Fig. B2). Kim WS et al[7] reported 3.64% of mastoid foramen on the mastoid temporal bone, 28.5% on the occipitomastoid suture and 5.2% on the occipital bone, 1.9% on the parietomastoid suture and one case on the parietal bone. According to Pereira GAM et al[10] majority of the mastoid foramen was found on the temporal bone (60-65%), on the temporo-occipital suture in 10-20% and few on the occipital bone (0-15%). Debbarma S et al[5] reported

that 23.38% of the mastoid foramen was exsutural, out of which 20.13% was found on the mastoid temporal bone and 3.25% on the squamous occipital bone.

Table 4: Variations in location of mastoid foramen as observed by different workers-

| Workers | Mastoid part of temporal bone | Occipitomastoid suture | Squamous part of occipital bone | Parietomastoid suture | Parietal bone |
|---|---|---|---|---|---|
| Kim WS et al[7] | 3.64% | 28.5% | 5.2% | 1.9% | 0.01% |
| Pereira GAM et al[10] | 60-65% | 10-20% | 0-15% | - | - |
| Debbarma S et al[5] | 20.13% | - | 3.25% | - | - |
| Present study | 90% | 9% | 1% | - | - |

Pereira GAM et al[10] stated that these variations might be the consequence of an adaptation process to different environments and survival patterns, while Murlimanju BV et al[9] attributed these variations to human evolution from the quadruped to the bipedal or upright posture. Choudhry R et al[12] cited different modes of development of the different parts of temporal bone as the cause of these variations.

## V. Conclusion

The present study demonstrates the existence of significant morphological variations in the foramina of the craniofacial skeleton. A thorough knowledge of these variations is important for every surgeon operating in this area to avoid complications. Today, the importance of structures in the mastoid area has increased manifold due to the increasing use of trans-temporal route for surgical procedures in the posterior cranial fossa and the mastoid air system by neurosurgeons and ENT surgeons.

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