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A Study on Mastoid Canals and Grooves in Adult Dry Skulls and its Importance in Otolaryngology

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ABSTRACT

The mastoid process is a bony projection on the temporal bone, it is located behind external acoustic meatus ears on each side of your skull. Due to its location, ear issues, such as a middle ear infection, can cause pain at the mastoid process. This bone also provides an attachment point for several muscles. This study aimed to evaluate the anatomical variations of mastoid canal and mastoid grooves. The present study was conducted in 138 adult dry skull belongs to Karnataka region collected from multiple medical institution. All the skulls were examined carefully and studied for the presence of mastoid canals and grooves. The skulls which were having canals and able to pass metal probe considered as possessing mastoid canals. We have recorded length and number of mastoid canals, bilateral, right unilateral and left unilateral appearance also recorded. We also recorded about grooves morphology. Mastoid canals were found in 89 (64.49%) out of the 138 skulls, we have seen mastoid canals either unilaterally or bilaterally. Out of the 89 skulls where we have found mastoid canals, in 26 (18.84%) skulls mastoid canals were bilateral, in 16 (11.59%) skulls we have found in unilateral right side, in 40 (28.98%) skulls we have found in unilateral left. In 26 (18.84%) skulls we have seen mastoid grooves out of 138 skulls, out of 26 skulls in 5 (3.62%) skulls grooves were bilateral, in 12 (8.69%) skulls right unilateral, in 9 (6.52%) skulls left unilateral. The present study concludes that mastoid canals and grooves morphological variations may help otolaryngologists and neurosurgeon's surgical procedures which involve access to structure in posterior cranial fossa and mastoid air system.

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Key Words
Mastoid process, air cells, mastoid canals, mastoid grooves

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INTRODUCTION

Mastoid canals having great importance in otolaryngology as the ear complex structure which in immersed in different parts of temporal bone. The mastoid emissary veins are part of cranial emissary veins, these are venous structures which connects intracranial and extracranial veins. Mastoid emissary veins connecting the venous sinuses present in posterior cranial fossa. Emissary ducts and canals helps to transmits mastoid veins. Mastoid emissary canals are verysmall and slender canals which are connecting the temporal bone's mastoid air cells to the extracranial venous plexuses. They usually sized between 0.5 and 1 cm in length and are composed of a thin bony wall with a lumen that is lined with mucosal tissue. The canals having curved root, they run lateral to posterior and these appears on the posterior surface of the mastoid process[1].

Mastoid emissary veins and mastoid canals are having importance surgically. In retro-sigmoid interventions which are done in the posterior cranial fossa, emissary veins may cause bleeding or embolism. Post surgery emissary vein bleeding may cause epidural hematoma formation. Emissary vessels can also access intracranial dural venous sinuses with endovascular applications.The connections of mastoid emissary veins extend to the suboccipital venous plexus, sigmoid sinus to the occipital or posterior auricular veins. The knowledge about the location and variations of the mastoid foramen will be great helpful to reduce the risk of complications during surgical procedures in the critical area of posterior cranial fossa. The present study is conducted to find the morphological features of mastoid canals and grooves[2].

MATERIALS AND METHODS

The present study was conducted in 138 adult dry skull belongs to Karnataka region collected from multiple medical institution.The age, sex of skullswas not known. All the skulls were examined carefully and studied for the presence of mastoid canals and grooves. A metallic wire was passed through the canal for its confirmation and then the length of mastoid canal and groove was measured.The skulls which were having canals and able to pass metal probe considered as possessing mastoid canals. After passing thread through canal, we have measured the length of thread to find the length of canal. The Length of the mastoid grooves was measured with the help of a thread. Measuring of the diameter of the mastoid canal is difficult task, only in few skulls where mastoid canals were larger, in very few skulls we could be able to measure the diameter[3].

RESULTS

Mastoid canals were found in 89 (64.49%) out of the 138 skulls, we have seen mastoid canals either unilaterally or bilaterally. Out of the 89 skulls where we have found mastoid canals, in 26 (18.84%) skulls mastoid canals were bilateral, in 16 (11.59%) skulls we have found in unilateral right side, in 40 (28.98%) skulls we have found in unilateral left, In 3 (2.17%) skull we found mastoid canal right unilateral side, in 4 (2.89%) skulls found both mastoid grooves and canals together. In 26 (18.84%) skulls we have seen mastoid grooves out of 138 skulls, out of 26 skulls in 5 (3.62%) skulls grooves were bilateral, in 12 (8.69%) skulls right unilateral, in 9 (6.52%) skulls left unilateral. We also recorded range between the distances between the 2 openings of mastoid canal, that was ranged from 3-26 mm. We have recorded the length of mastoid grooves, that were ranging from 7-18 mm. in most of the skulls the diameter of mastoid canals was less than 4 mm (Table 1).

DISCUSSIONS

The mastoid emissary vein connects intra cranial dural sinuses with extracranial venousplexus, this vein is passing through mastoid foramen or canal. This system may create risk of spreading of infections or tumour cells between extracranial to intra cranial areas. In the venous drainage of the brain emissary veins have limited role. These veins may be the primary outlet in high-flow vascular malformation, intracranial hypertension, hypoplasia, or aplasia of the internal jugular veins. The knowledge about foramina is very important and crucial in otolaryngology, neurosurgery, neurology and maxillofacial surgery. Knowing knowledge about foramen will lead to avoid the mistakes or errors by the surgeons. Bleeding from emissary veins in the region of posterior cranial fossa leads to epidural and subdural hematoma. The connection of the mastoid emissary vein with the sigmoid sinus and its bilateral flow may cause embolism or thrombus[1-4].

Mastoid canals were found in 64.49% skulls, Out of the that skulls where we have found mastoid canals, in 18.84% skulls mastoid canals were bilateral, in 11.59% skulls we have found in unilateral right side, in 28.98% skulls we have found in unilateral left, In 2.17% skull we found mastoid canal right unilateral side, in 2.89% skulls found both mastoid grooves and canals together. In 18.84% skulls we have seen mastoid grooves, out of that in 3.62% skulls grooves were bilateral, in 8.69%skulls right unilateral, in 6.52% skulls left unilateral. We also recorded range between the distances between the 2 openings of mastoid canal, that was ranged from 3-26 mm. We have recorded the

Table 1: Distribution of mastoid grooves and canals

	Total No. of Skulls Studied	Bilateral	Unilateral Right Side	Unilateral Left Side	Double Mastoid canal	Mastoid Canals and Groove both	Total
Mastoid Canals	138	26 (18.84%)	16 (11.59%)	40 (28.98%)	3 (2.17%)-1 (0.72%)-Left Unilateral 2 (1.51%)-Right Unilateral	4 (2.89%)	89 (64.49%)
Mastoid Grooves	138	05 (3.62%)	12 (8.69%)	09 (6.52%)	---------- ----------	26 (18.84%)	

length of mastoid grooves, that were ranging from 7-18 mm. In most of the skulls the diameter of mastoid canals was less than 4 mm.

In study of Murlimanju *et al*.[5] studied 96 temporal bones of 48 cadaver skulls to observe the mastoid foramen's prevalence, morphology, and number. Mastoid foramen was seen in 91.7% of the 96 temporal bones examined, one mastoid foramen was observed in 62.5%, two mastoid foramina in 22.9%, and three mastoid foramina were observed in 6.2%. In their study also found that the number of mastoid foramina through which the mastoid emissary vein passes varies between 0 and 4 and their diameters vary in line with the size of the vessels passing through[6]. In study of CT angiograms or finding mastoid emissary veins, Pekcevik *et al*.[7]. Found the prevalence of the mastoid emissary vein to be 49.4% bilaterally and 28.3% unilaterally. In study of 106 dry skulls by Kim *et al*.[8] observed the mean diameter of the mastoid foramen to be 1.64 mm. In the same study, the average diameters of the right and left mastoid foramen were different, with the largest mastoid foramen diameter being 7 mm. In study of Louis *et al*.[9]studies the mastoid emissary foramen on 200 skulls. They found the prevalence of the foramen to be 98% on the right side and 72% on the left side, and the mean mastoid emissary vein diameter to be 3.5 mm. In study Peira *et al*.[10] observed the mastoid foramen on the right side in 72.7% of female skulls, on the left side in 81.8%, on the right side in 90% of male skulls and on the left side in 85%.In study of Demirpolat *et al*.[5] found that the prevalence and diameters of the mastoid foramen and mastoid emissary canal with three-dimensional images obtained by multi-detector computed tomography from 248 patients. The 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 the study of Temiz *et al*.[1] 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. In study of Shaik *et al*.[6] in 59.2% adult dry skulls mastoid canals were found, out of that 28% bilateral, 16 % were right unilateral, 15.2% were left unilateral. In same study mastoid grooves were found in 20% of skulls, out of that bilateral were 8%, right unilateral were 6.4% and left unilateral were 5.2%. In Study of Hadimani *et al*.[3] also similar findings were found.

CONCLUSION

The present study concludes that knowledge of mastoid canals and grooves will be helpful to otolaryngologists, neurosurgeons and head and neck surgeons as mastoid canals are transmitting the mastoid emissary vein which connects extracranial venous system with intracranial counterpart.

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