Section: Anatomy

Original Research Article

MORPHOLOGICAL STUDY ON MASTOID GROOVES AND CANALS IN ADULT DRY SKULL OF KARNATAKA REGION

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Abstract

Background: Mastoid process is a part of temporal bone. Mastoid canals which are present mastoid region temporal bone of skull. These are located which are located on the outer surface of mastoid processes, posterior and parallel to the petrosquamous suture, anterior to the occipitomastoid suture and anteroinferior to the asterion. Perforated lateral walls of mastoid canals are called as mastoid grooves. Some authors have mentioned that blood vessels lie in this area which are connected inner dural venous sinuses mainly sigmoid sinus and transverse sinuses. **Materials and Methods:** The present study was conducted in 152 adult dry skull belongs to Karnataka region collected from multiple medical institution. Each was studied for the incidence of mastoid canals and grooves and recorded. 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. The Length of the mastoid grooves was measured with the help of a thread. **Result:** Mastoid canals were found in 91(59.86%) out of the 152 skulls, we have seen mastoid canals either unilaterally or bilaterally. Out of the 91 skulls where we have found mastoid canals, in 32(21.05%) skulls mastoid canals were bilateral, in 28(18.42%) skulls we have found in unilateral right side, in 23(15.13%) skulls we have found in unilateral left. In 39(25.65%) skulls we have seen mastoid grooves out of 152 skulls, out of 39 skulls in 9(5.92%) skulls grooves were bilateral, in 17(11.18%) skulls right unilateral, in 13(8.55%) skulls left unilateral. **Conclusion:** The present study concludes that the mastoid canals, traversed by the vessels, may lie undetected anterior to the mastoid emissary foramina and are thus liable to injury. It is necessary for surgeons operating in this area to be aware of this vascular arrangement to anticipate and avoid troublesome bleeding.

INTRODUCTION

Emissary veins travel through the emissary foramina of the skull and connect the intracranial veins with the extracranial. They are valveless veins and blood can flow in either direction; however, the flow is usually away from the brain. The mastoid emissary vein connects the posterior auricular vein with the sigmoid sinus. The emissary mastoid foramen transmits the mastoidal emissary vein and is present at the mastoid process of the temporal bone. It is not uncommon to see this foramen over the occipitomastoid suture. The mastoid emissary foramen also transmits a branch of the occipital artery, which is going to supply the duramater of the posterior cranial fossa.[1,2] Emissary veins course through emissary foramina present in the skull connecting extracranial veins with intracranial venous sinuses and veins. The emissary veins maintain blood pressure in venous sinuses constant. One of the various emissary veins is the mastoid emissary vein which passes through the mastoid emissary foramen located at outer surface the mastoid process of the temporal bone. The mastoid emissary vein connects the posterior auricular vein with the sigmoid venous sinus. The mastoid emissary vein is accompanied by a meningeal branch of the occipital artery, this artery supplies the cranial dura mater of the posterior cranial fossa. In normal healthy individuals, blood flows very slowly in the mastoid emissary vein and is directed from the intracranial venous system to extracranial veins.[3]

Mastoid canal is the canal formed in the mastoid region of the temporal bone of the skull and

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perforated lateral wall of this canal is called as mastoid groove. This vascular canal and groove are of variable calibre and length and the knowledge of them is very important for neurosurgeons and otolaryngologists. Identification of human skeletal remains is of major importance in medicolegal situations such as criminal cases and mass disasters. The sex determination is best assessed from the pelvis, while the skull is considered as second area for sex determination. Mastoid process is alone less prone to damage due to its anatomical position, and it is one of the slowest, late growing regions of the cranium, so it shows higher degree of sexual dimorphism.[4-6] The present study was conducted to find out mastoid canal and grooves, which may be helpful to forensic, anthropological, neurosurgery practices.

MATERIALS AND METHODS

The present study was conducted in 152 adult dry skull belongs to Karnataka region collected from multiple medical institution. Each was studied for the incidence of mastoid canals and grooves and recorded. The age, sex of skulls was 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.[2,7]

RESULTS

Mastoid canals were found in 91(59.86%) out of the 152 skulls, we have seen mastoid canals either unilaterally or bilaterally. Out of the 91 skulls where we have found mastoid canals, in 32(21.05%) skulls mastoid canals were bilateral, in 28(18.42%) skulls we have found in unilateral right side, in 23(15.13%) skulls we have found in unilateral left, in 1(0.65%) skull we found mastoid canal right unilateral side, in 7(4.60%) skulls found both mastoid grooves and canals together.

In 39(25.65%) skulls we have seen mastoid grooves out of 152 skulls, out of 39 skulls in 9(5.92%) skulls grooves were bilateral, in 17(11.18%) skulls right unilateral, in 13(8.55%) skulls left unilateral. We also recorded range between the distances between the 2 openings of mastoid canal, that was ranged from 3 to 26 mm. We have recorded the length of mastoid grooves, that were ranging from 7 to 18 mm. in most of the skulls the diameter of mastoid canals was less than 4 mm [Table 1].

Table 1: Distribution of Mastoid Grooves and Canals

	Total Number of Skulls Studied	Bilateral	Unilateral Right Side	Unilateral Left Side	Double Mastoid canal	Mastoid Canals and Groove both	Total
Mastoid Canals	152	32(21.05%)	28(18.42%)	23 (15.13%)	1(0.65%) – Right Unilateral	7(4.60%)	91 (59.86%)
Mastoid Grooves	152	09(5.92%)	17(11.18%)	13 (8.55%)	----------	----------	39 (25.65%)

DISCUSSION

Mastoid canals which contain vessels may be attributable to the mode of development of this part of the temporal bone. In the embryo, the bone develops from two components. The squamous part arises in mesenchyme in the 8th week of foetal life, and it forms the anterosuperior part. The petro mastoid part develops from the cartilaginous epiotic centre at 5-6th months of foetal life and it forms the posteroinferior part by 1 year of age. These are demarcated on the external surface as the petrosquamous suture and are directed downwards and forwards into the mastoid process. In the adult skull, these may barely be distinguishable or are seen as series of irregular depressions or well-marked fissures. The squamous plate grows posterior, and it covers a large area of the lateral surface of the petro mastoid bone. The 'junction' between these two components of the temporal bone is often separated by a heavy plate of bone in many adults, which is referred to as Korner's septum or a 'false bottom' and is a remnant of the suture. The ascending branch of the occipital artery, which lies on the developing petro mastoid in foetal life, is likely to be buried by the ossifying squamotemporal bone. In other words, this ascending branch of the artery in some skulls is 'trapped' between two growing bones.[7]

In the present study, the percentage of presence of mastoid canal was 59.86% of total skulls, in study of Saadia A et al,[4] it was recorded 28%. In study of Hussain et al,[2] on south Indian skulls, the percentage of mastoid canal was 59.2%. In study of Singh et al,[8] found that the mastoid canal was present in 52.4% in Japanese skulls. In study of Choudhry et al,[9] it was 41% in Indian skulls. In present study we have observed double mastoid canal in 1(0.65%) skull on same side. There was no double mastoid canal on the same side in the study of Saadia A et al,[4] and in same study there was both mastoid canal and mastoid groove on the same side in 8% of total skulls. In study of Hadimani et al,[7] on north Karnataka skulls, the

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percentage of double mastoid canal was 1% on left side and the percentage of both mastoid canal and mastoid groove on the same side was 2%.

In present study 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 to 26 mm. We have recorded the length of mastoid grooves, that were ranging from 7 to 18 mm. in most of the skulls the diameter of mastoid canals was less than 4 mm. In study of Hadimani et al,[7] the percentage of mastoid groove was 18% and in study of Saadia A et al,[4] it was 24% and it look higher compared to results on other races. In study of Singh et al,[8] found that the percentage of mastoid groove was 13.56% in Japanese skulls. In a study conducted by Hadimani et al,[7] this percentage was 18% in north Karnataka skulls. In another study it was 20% in South Indian skulls by Hussain et al.[2]

CONCLUSION

Pre-operative identification of mastoid veins is essential and having knowledge about this through CT of the temporal bone should be scheduled before planning surgery. Based on our study, mastoid emissary vein can guide the surgeon and help localize the deeper-lying sigmoid sinus. Knowledge of this anatomical relationship could be an adjunct to neuronavigational technologies. Further research may serve more distinct evidence about the clinical and anatomical implications mentioned in this subject.

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