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Research Article

A STUDY OF THE MASTOID FORAMEN IN DRIED SKULLS

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ABSTRACT
The mastoid foramen transmitting an emissary vein of the same name is present at least on one side in majority of the skulls studied, being absent only in 4 skulls out of 40. It was absent more on the left than the right. In 8 skulls it was duplicated. 2 skulls showed triple foramina. No large sized foramen was found in this study and the jugular foramina were of usual size. The clinical importance of the mastoid emissary vein traversing this foramen was discussed.

Keywords: *Mastoid Foramen (MF), Mastoid Emissary Vein (MEV), External Jugular Vein (EJV)*

INTRODUCTION
This study was, in fact, prompted by Arthur (1925) opinion that the MEV will in due course of time disappear completely in human beings.
The emissary veins are described as valve less communications between the extra cranial veins and intracranial sinuses and the infections could spread leading to thrombosis. Occasionally, the MEV could be very large leading to severe hemorrhage, during mastoidectomy and the other surgical procedures around the mastoid process (Rauf *et al.,* 2011). Though rare, an unusually large MF was associated with smaller jugular foramen. The MF was smaller in Australians compared to other white races (Boyd, 1930). The MEV originates at the outer edge of the sigmoid sinus, passes through the mastoid process to open at the base of the mastoid process before draining into posterior auricular vein or occipital vein contributing to the formation of the external jugular vein (Arthur, 1925).

MATERIALS AND METHODS
40 skulls from the Anatomy museum of Maharajah institute of medical sciences were examined macroscopically for the presence and number of the MF photographed and the results were tabulated. (Table and Figures 1, 2, 3).

RESULTS AND DISCUSSION
Results
Complete absence 4/40 (10%)
Absent on right side 8/40 (20%)
Absent on left side 14/40 (35%)
Duplicated 12/40 (30%) (5 on the right and 7 on the left)
Bilateral duplication 1/40 (2.5%)
Triplicate 2/40 (left, 5%) 1/40(right, 2.5%)

Discussion
The mastoid emissary vein (MEV) is an anatomical structure with limited description in the literature and its importance is even less recognized in the plastic surgical field. Investigations in its anatomy and physiology have described its anthropological significance in transition to bipedalism and preferential intracranial venous flow into the vertebral plexus in the upright man. Inadvertent injury of vessels of this size poses a significant problem due not only to difficulty with haemostasis but also from their bidirectional flow and close proximity to the sigmoid sinus where cases of thromboembolism have been

described. Recognition of this common anatomical structure and how to manage bleeding from the vessel it is important for the surgeon operating in this area and even more so for the craniofacial surgeon who operates on complex craniosynostotic patients where the MEV may be the sole dominant drainage pathway of the brain (Kim *et al.*, 2014).

Table showing the prevalence of MF

Skull no	**Mastoid foramen/foramina presence/absence**	
	right side	**left side**
1	1	0
2	1	3
3	1	2
4	2	1
5	1	1
6	1	0
7	1	1
8	3	2
9	1	0
10	1	0
11	1	1
12	0	0
13	0	1
14	1	2
15	2	1
16	1	0
17	1	1
18	1	1
19	1	1
20	1	3
21	1	2
22	0	0
23	1	0
24	1	2
25	1	0
26	2	0
27	2	0
28	1	0
29	0	2

30	2	1
31	0	0
32	1	1
33	2	2
34	1	1
35	0	1
36	1	1
37	0	0
38	1	1
39	0	1
40	1	1

The cerebral venous drainage pathway is mainly formed by the internal jugular vein. During the development of embryo primary capillary plexus develops in three layers, superficial layer drains into the external jugular vein middle and deep layers drains into internal jugular vein. Emissary veins consist of connections between the superficial and middle layers. They originate from the sigmoid sinus and communicate with extra cranial veins (Marsot-Dupuch *et al.,* 2001).

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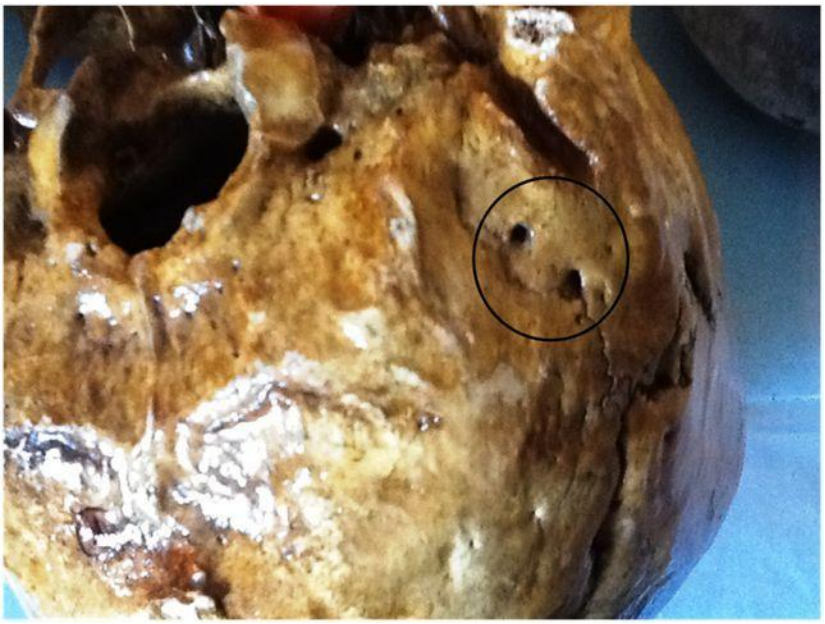
Figures showing the mastoid foramen/foramina

Single foramen on the right



Double foramina on the left side

Triple foramina on the right side

Emissary veins are usually <1 mm in diameter but can be as large as 4 mm (Boyd, 1930). The sigmoid sinus may be smaller in presence of large mastoid emissary vein. Three emissary venous pathways have been described in humans. The lower or posterior condylar vein (it exits the sigmoid sinus above the jugular bulb and is usually of moderate size). The middle or mastoid emissary vein, this is the most constant of all the three veins (it crosses the mastoid foramen and unites the sigmoid sinus with the posterior auricular or occipital vein) and the upper petrosquamosal emissary vein, originating at the junction of the transverse and sigmoid sinus (it is usually very small) (Marsot-Dupuch *et al.*, 2001). The vein may be opened at the exit in making incision or when striping up the periosteum in various operative procedures or in its course in removing bone for extensive cellular infections or for exploration and treatment of lateral sinus thrombosis in operation of decompression of facial nerve and in fracture of

skull. As a rule bleeding is trivial and easily controlled by plugging with gauze or bone wax but in case of large ones it may be troublesome. The vein may also be infected from lateral sinus and would appear to be edematous swelling or may form abscess at the exit (Smith and Danner, 2006).

Mastoid emissary vein is a rare but definite entity which if not diagnosed preoperatively could be a cause of severe hemorrhage at time of surgery which may prove to be life threatening. It can cause difficulty in proper eradication of the disease especially in hands of beginners and inexperienced surgeons. It can also be the source of infection or thrombosis. Preoperative imaging (HRCT) with or without contrast and magnetic resonance angiography can help to show the site and course of the vein.

Conclusion

The MEV may be a significant source of bleeding during surgery of the skull base or middle ear, particularly during retrosigmoid and far-lateral approaches and detailed anatomical knowledge may help to prevent these complications. Endovascular treatment of dural arteriovenous fistulas is often extremely difficult due to limited access; however, the use of the MEV represents a unique and potentially valuable technique for accessing an isolated or inaccessible transverse or sigmoid sinus system (Louis *et al.,* 2009).

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