

Incidence of Foramen Meningo-orbitale in Adult Pakistani Skulls

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SUMMARY

Presence of foramen meningo-orbitale was studied in 220 well preserved adult Pakistani skulls. The orbits of 25 embalmed cadavers were dissected to observe the location and proposed embryological explanation for the presence of the foramen. Foramen meningo-orbitale was found present in 145 (66%) skulls, 107 (74%) unilaterally and 38 (26%) bilaterally. The most common site of the foramen observed was "hyposutural" (64.95%) while the least common site noted in this study was "episutural" (10.74%).

INTRODUCTION

In dried skulls, minute openings are present on the corresponding posterior surface of the greater wing of sphenoid. Many of these openings do not lead through to the orbit, but terminate within the substance of the bone representing nutrient foramina of the greater wing of the sphenoid. The foramen which leads through to the orbital cavity representing the path of anastomosis between middle meningeal artery and lacrimal branch of the ophthalmic artery has been named by various authors as the anastomotic foramen¹, the lacrimal foramen² the foramen meningo-orbitale³, the foramen of Hyrtl⁴ and cranio-orbitale foramen⁵. Foramen meningo-orbitale is not listed in Nomina Anatomica (1980). It is said to be present inconsistently in the human skulls⁶. The foramen is usually described in relation to the intracranial course of the middle meningeal artery where it provides a route for an anastomosis between the orbital branch of the middle meningeal artery and the recurrent meningeal branch of the ophthalmic artery, it therefore acts as a conduit between the middle cranial fossa and the orbit^{6,7}. Foramen meningo-orbitale was present in 49% cases studied recently in 50 skulls, more than one foramen was found in 15% of the cases⁸. The term stapedia-ophthalmo-lacrimal foramen was proposed to proclaim the embryonic significance of this foramen⁹. The location of the foramen meningo-

orbitale is not fixed. It varies considerably⁸. The purpose of this study is to observe the location, number and position of the foramen in crania and compare them with that of available data in literature.

MATERIAL AND METHODS

Two hundred and twenty well preserved adult human crania of both sexes from department of Anatomy, King Edward Medical College, Lahore were selected for this study which were obtained from the cadavers of Pakistani origin during 1986-1995.

A foramen present on the supero-lateral aspect of the greater wing of the sphenoid bone was considered as a foramen meningo-orbitale if it could be shown by means of a 0.1mm diameter flexible probe to act as a conduit between the middle cranial fossa and the orbital cavity. This excluded nutrient branches to greater wing of sphenoid bone. The orbits of 25 embalmed cadavers were dissected to observe the proposed embryological explanation for the presence of the foramen. Location of the foramen meningo-orbitale was also recorded in each case.

OBSERVATIONS

Foramen meningo-orbitale was found present in 145 (66%) and absent in 75 (34%) skulls. It was present unilaterally in 107 (74%) and bilaterally in

38 (26%) cases.

Out of 107 skulls having unilateral foramen, 52 (49%) had it on the right (Rt) side and 55 (51%) on the left (Lt) side. Among 52 skulls having unilateral foramen on Rt side, single foramen was found in 48 (92%) and double foramina in 4 skulls (8%). Out of 55 skulls having unilateral foramen on Lt side 39 (71%) had single foramen and 16 (29%) double foramina.

The foramen was found bilaterally in 38 (26%) skulls, 20 skulls (53%) showed a single foramen on both right and left side (Figs. 1,4), 11 (29%) showed single foramen in Rt and double foramina in left orbits (Fig. 2) and 7 (18%) showed single foramen in Lt and double foramina in Rt side. Foramen meningo-orbitale was present on three commonest sites, (i) above the suture between orbital plate of frontal bone and greater wing of sphenoid (epi-sutural), (ii) in suture (sutural), and (iii) below the suture in the greater wing of sphenoid (hyposutural). Incidence of location of foramen meningo-orbitale in all the orbits examined in the present study is given in the Table 1 and Table 2.

Table 1: Incidence of site of foramen-meningo-orbitale when present unilaterally (214 orbits) (107 - skulls).

	Episutural		Sutural		Hyposutural	
	No.	%	No.	%	No.	%
Single right (n=96)	11	11.45	20	20.83	65	67.70
Double right (n=8)	2	25.00	2	25.00	4	50.00
Single left (n=78)	5	6.41	25	32.05	48	61.53
Double left (n=32)	5	15.62	5	15.62	22	68.75
Total (orbits) (n=214)	23	10.74	52	24.29	139	64.95

DISCUSSION

Presence of the grooves in the middle cranial fossa arising from foramen ovale and spinosum, their significance and the vessels responsible for these grooves has been discussed in the past¹⁰⁻¹³. These openings present in the greater wing of sphenoid through to the orbital cavity represent the path of anastomotic vessels between lacrimal branch

of ophthalmic artery and anterior division of middle meningeal artery. These openings labelled as foramen meningo-orbitale are not listed in Nomina Anatomica (1980). Presence of foramen shows a great difference in its incidence between the skulls of Asian origin studied in USA n = 50 (51%) and those of Pakistani n = 220 (66%).

Table 2: Incidence of site of foramen-meningo-orbitale when present bilaterally (76 orbits) (38 - skulls).

	Episutural		Sutural		Hyposutural	
	No.	%	No.	%	No.	%
Single right (n=20)	6	30.00	4	20.00	10	50.00
Single left (n=20)	5	25.00	3	15.00	12	60.00
Single Right + Double left (n=22)	6	27.27	6	27.27	10	45.45
Double right + Single left (n=14)	4	28.57	4	28.57	6	42.85
Total (orbits) (n=76)	21	27.63	17	22.36	38	50.00

Different combinations of the foramen in varying ratios between left and right sides were observed i.e. left, right 0:0, 0:1, 2:2 etc. These ratios were almost identical with those reported previously⁸. The exact location of the foramen was rarely identical between different skulls or on different sides of same skull. Incomplete or half foramen as reported in the past¹⁰ were not observed even in a single skull in the present study. The commonest location of foramen, when present unilaterally as single or double was hyposutural, (64.95%) (Fig. 4). The second most common site was Sutural (24.24%), and the least common site noted in this study was episutural (10.74%) (Table 1). The hyposutural type showed dominance on right side (67.70%) when present as single foramen and dominance on left side (68.75%) when present as double foramina.

The most common site of the foramen when present bilaterally in single or double was hyposutural (50.00%) (Figs. 2,4) episutural (27.63%) (Fig. 1) and Sutural (22.36%) in order of their frequency. Hyposutural type showed dominance on left side in all combination (Table 2).

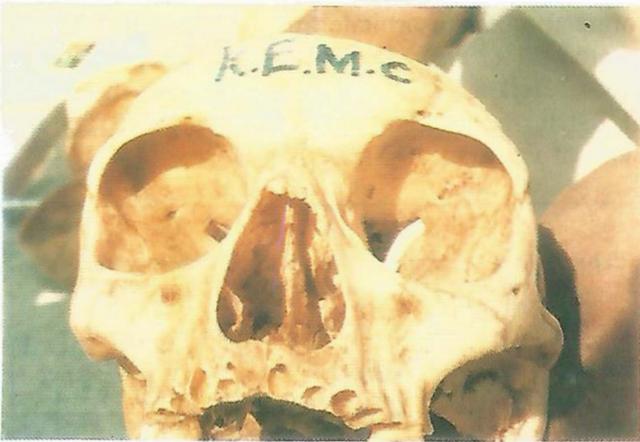


Fig. 1: Bilateral single foramen meningo-orbitale right sutural (FMOS) and left episutural (FMOE).

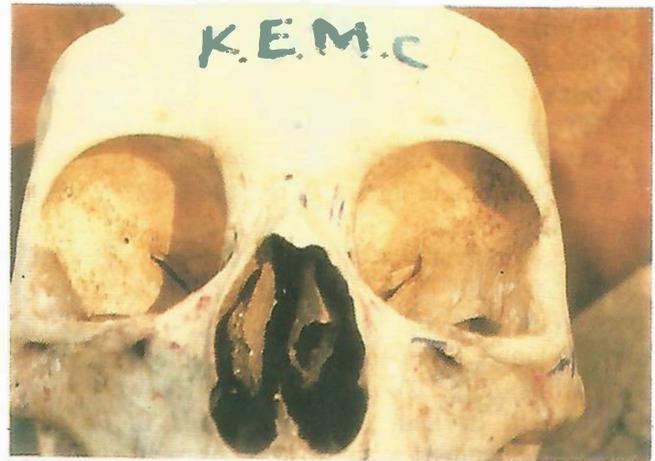


Fig. 3: Unilateral, right, single hyposutural foramen meningo-orbitale (FMOH).

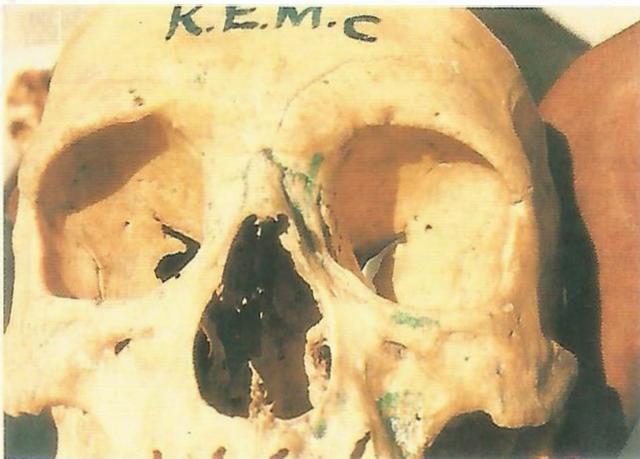


Fig. 2: Bilateral single foramen meningo-orbitale single right hyposutural (FMOS) and double left hyposutural (FMOSH).



Fig. 4: Bilateral single hyposutural foramen meningo-orbitale (FMOH).

As a whole the most frequent location of the foramen found was hyposutural in the present study. Categorisation of the site of foramen and their incidence is not found in the literature available. As the anatomical variation is correlated with embryological processes¹⁴, so the position of the foramen must be correlated with development of the vessel that it transmits.

Foramen meningo-orbitale is referred to as description of the anastomosis between the anterior division of middle meningeal and ophthalmic arteries^{3,6}. The positional variation of the foramen has been correlated with the development of ophthalmic artery¹⁵. A considerable portion of adult ophthalmic artery is derived from the supraorbital division of the stapedial artery. Thus it is possible that the foramen when present

represents the position at which the supraorbital division of the stapedial artery entered the orbital cavity. Greater wing of sphenoid is not ossified at these stage of development (18-24mm embryo, 7-8 weeks). The foraminal position varies according to the position of the supraorbital division of the stapedial artery at the time of ossification. The embryonic supraorbital division of the stapedial artery is represented in the adult by middle meningeal artery. This medial-lateral positional variation is supported by the grooves of the orbital branch of middle meningeal artery within middle cranial fossa^{3,8}. The authors agree with the conclusions made previously⁸ that the foramen represents an embryonic conduit between the supraorbital division of the stapedial artery and the permanent stem of ophthalmic artery. In adults, it may be represented by a connecting vessel between the orbital branch of the anterior division of middle meningeal artery and the lacrimal branch of ophthalmic artery, an alternative more medial pathway for this vessel exists via the superior orbital fissure.

Recently it was suggested that as the foramen represents the path for the "meningolacrimal" artery (supraorbital division of stapedial artery)^{8,16} on the basis of embryological significance the term "stapedial-ophthalmo-lacrimal foramen" is preferably suited for this foramen. This is consistent with the conclusion of the present study.

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