Morphology and Topographic anatomy of Meningo-orbital foramen in North-Indian Population

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ABSTRACT

Introduction- Variations can be found in every system of the body and can rarely be labeled as abnormal.¹ Human skull is the most complex and important bony structure as it houses the most vital organ, known as Brain. Minor variations in the ossicles, foramina and ridges of the cranium have aroused the curiosity of anatomist worldwide for many decades and for many reasons.² Variations in foramina have been studied by various people as these variants have been found to be related to many disease states like osteopetrosis, osteoporosis, cruzons syndrome, neurofibromatosis, brachymicrocephaly and mental retardations.³,⁴,⁵,⁶ This study involves Meningo-orbital foramen and its variations in human subjects. It is found in the lateral wall of the orbit, lateral to the lateral end of superior orbital fissure. It can be single or multiple. This foramen represents an embryonic conduit between supra-orbital division of the stapedial artery and the permanent stem of ophthalmic artery.⁸ The anatomy of the cranio-orbital foramen and the course of the orbital branch should be well known by surgeons reconstructing the anterior base of the skull, the orbit after orbital base surgery, and during excision of meningiomas.⁹ The knowledge of this foramen and structures related with it has a great significance for ophthalmologist and neurosurgeons. With this background in mind the present study was conducted to explore the incidence and location of this foramen in North-Indian population.¹⁰

Key words- Meningo-orbital foramen, Fronto-zygomatic suture, orbit, Superior orbital fissure, osteoporosis, variations

INTRODUCTION

Variations can be found in every system in the body and can rarely be labeled as abnormal.¹ Skull, the most complex bony structure in the body houses the most vital organ, the brain. Minor variations in the ossicles, foramina and ridges of the cranium have aroused the curiosity of anatomist worldwide for many decades and for many reasons.²
Openings or foramina of the skull allow passage of blood vessels or nerves. Variations in these foramina can be in the form of shape, location or number. Different age groups, sex, geographical locations, ethnic groups have impact in the occurrence. It can be congenital or acquired and can result in various diseases like osteopetrosis, osteoporosis, crurozon syndrome, neurofibromatosis, brachymicrocephaly and mental retardations. (3,4,5,6)

This study involves the knowledge of Meningo-orbital foramen. The other names of this foramen are-Lacrimal foramen, foramen of Hyrtl, foramen meningo-orbitale, cranio-orbital foramen and sphenoid-orbital foramen. (7) It is found in the lateral wall of the orbit, lateral to the lateral end of superior orbital fissure. It can be single or multiple. This foramen represents an embryonic conduit between supra-orbital division of the stapedial artery and the permanent stem of ophthalmic artery (8). In adults it represents a passage for the vessel connecting the orbital branch of middle meningeal artery and lacrimal branch of the ophthalmic artery. This connecting vessel is an accessory blood supply to the orbit (9).

Although the location of MOF is not fixed, it lies superolateral to the superior orbital fissure. Ophthalmologists should be aware of presence of this foramen and its distance from important landmarks while performing any surgical procedure through the lateral wall of the orbit in order to avoid injury of this vessel accidently. Neurosurgeons also need to be familiar about presence of this foramen while operating on the base of anterior or middle cranial fossae to avoid any vascular catastrophe (8).

Thus, the anatomy of the cranio-orbital foramen and the course of the orbital branch should be well known by surgeons reconstructing the anterior base of the skull, the orbit after orbital base surgery, and during excision of meningiomas. (10)

The knowledge of this foramen and structures related with it has therefore a great significance for ophthalmologist and neurosurgeons.

Because there is a lack of clarity in the literature concerning the morphology and morphometry of FMO this study aimed to clarify the issue with clinical relevance (12) With this background in mind the present study was conducted to explore the incidence and location of this foramen in North-Indian population. (11)

MATERIALS AND METHODS
The study was conducted in the department of Anatomy of Adesh Institute of Medical sciences & Research, Bathinda, Punjab and department of Anatomy of Guru Gobind Singh Medical College, Faridkot, Punjab.

One hundred and twenty orbits of 60 North Indian, dried human skulls were studied. The skulls were of adults with unknown sex. The frequency of occurrence of meningo-orbital foramen in right & left orbits were noted. Only patent foramina were included. This was confirmed by passing fine probe. The position of MOF with reference to supra-orbital notch/ supraorbital foramen and frontozygomatic suture were recorded. The minimum distance was recorded using metallic divider and was calibrated on scale. The distance was measured in millimeters.

RESULTS
On inspection the meningo-orbital foramen was visible macroscopically and was mostly round. The meningo-orbital foramen was present in 60% of the orbits studied. 38.33% of the skulls had the presence of the foramen unilaterally (either on left or right side) and 21.66% skulls had it on both sides. The mean distance of the meningo-orbital foramen from supra-orbital notch was for Right-29.8mm (range22.0-39.0), for Left-31.7 mm (range16.0-40.0) and from the frontozygomatic suture was Right-24.5mm(range15.0-38.0), Left-25.1mm(0.6-42.0)

DISCUSSION
The study examined the occurrence of meningo-orbital foramen in 120 orbits of 60 skulls. Its
prevalence was compared with various studies and it was concluded that there are variations in its existence. The variations are dependent upon genetic, nutritional and climate zone or ambient temperature during growth, which should be considered before performing surgery in the orbital cavity\[^{12}\]. Its knowledge would carve a way for ophthalmologists, neurosurgeons and radiologists for performing safe surgeries and avoiding vascular catastrophe.

**REFERENCES**

2. Singh PR, Raibagkar C J. Study of variation in atypical foramina of dry human skull. NJIRM 2011; VOL2(2) . April-June-Special
Fig. 1. Meningo-orbital foramen (right orbit)

Fig. 2. Bilateral MOF

Fig. 3. Measurement of MOF
Table-1 Prevalence of MOF

<table>
<thead>
<tr>
<th>Studies</th>
<th>Prevalence of MOF(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Georgiou et al (13) (1992)</td>
<td>49%</td>
</tr>
<tr>
<td>Kwiatkowski et al(2003)</td>
<td>28%</td>
</tr>
<tr>
<td>Erturk et al (2005)</td>
<td>82.9%</td>
</tr>
<tr>
<td>Krishnamurthy et al(2008)</td>
<td>80%</td>
</tr>
<tr>
<td>Jadhav et al (14) (2012)</td>
<td>44.3%</td>
</tr>
<tr>
<td>Chauhan et al (2013)</td>
<td>32%</td>
</tr>
<tr>
<td>Tomaszewska et al(2014)</td>
<td>69.88%</td>
</tr>
<tr>
<td>Present study</td>
<td>60.0%</td>
</tr>
</tbody>
</table>

Table-2 Incidence of meningo-orbital foramen and its distance to the supra-orbital notch/foramen and the frontozygomatic suture

<table>
<thead>
<tr>
<th>Side of orbit</th>
<th>Incidence of MOF (%)</th>
<th>Distance from MOF to Supra-orbital notch/Foramen (mm)</th>
<th>Distance from MOF to Frontozygomatic suture at the entrance of the orbit(mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right</td>
<td>35%</td>
<td>22.0-39.0 mm (mean- 29.8mm)</td>
<td>15.0-38.0 mm (mean- 24.5mm)</td>
</tr>
<tr>
<td>Left</td>
<td>41.66%</td>
<td>16.0-40.0 mm (mean-31.7 mm)</td>
<td>0.6-42.0mm (mean-25.1)</td>
</tr>
</tbody>
</table>

Table-3 Distances between MOF to the Supra-orbital notch and MOF to Frontozygomatic suture in mm(Various studies)

<table>
<thead>
<tr>
<th>Study</th>
<th>MOF to the supra orbital foramen/Notch</th>
<th>MOF to the frontozygomatic suture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kwiatkowski et al (2003)</td>
<td>34.4 (R); 35.8(L)</td>
<td>25.0 (R); 26.8(L)</td>
</tr>
<tr>
<td>Krishnamurthy et al (2008)</td>
<td>34.2(R); 34.1(L)</td>
<td>26.5(R), 25.7(L)</td>
</tr>
<tr>
<td>Present Study (2014)</td>
<td>29.8(R); 31.7(L)</td>
<td>25.5(R), 25.1(L)</td>
</tr>
</tbody>
</table>