Research Article

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ABNORMAL BONE OUTGROWTHS AND OSSEOUS STRUCTURES AROUND THE FORAMEN OVALE MAY LEADS TO MANDIBULAR COMPRESSION OR ENTRAPMENT NEUROPATHY

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Abstract: Foramina ovale is an important opening on the infratemporal surface of the posterior part of the greater wing of the sphenoid bone, any bone outgrowths and osseous structures around it could influence the anatomical organisation of the nerves and vessels that run through this opening. Accordingly the present study was designed to find out the bony outgrowths and osseous structures around the foramen ovale in available dried adult human skulls. The study was carried out using 100 dried adult human skulls irrespective of sex were obtained from the Department of Anatomy-Santhiram Medical College Nandyal, Department of Anatomy- Melaka Manipal Medical College (MMMC)-Manipal and Department of Anatomy- Viswabharati Medical College Kurnool. Among 100 dry adult skulls studied, sixty one (61%) of the skulls had neither any abnormal bony outgrowths nor osseous structures around the foramen ovale. Abnormal bone outgrowths in 22 skulls (22%) and osseous structures in seventeen skulls (17%) around the foramen ovale were noted. Anatomical knowledge of such abnormal bone outgrowths and osseous structures around the foramen ovale is important for neurosurgical procedures involving the percutaneous trigeminal rhizotomy for trigeminal neuralgia, transfacial fine needle aspiration technique in perineural spread of tumour and electroencephalographic analysis for seizure.

Keywords: Foramen ovale, Mandibular Compression Neuropathy, Osseous Structures, Porus Crotaphitico Buccinatorius.

INTRODUCTION

Foramen ovale is an important opening on the infratemporal surface of the posterior part of the greater wing of the sphenoid bone, which serves as a passage for the mandibular nerve, accessory meningeal artery, emissary vein and the lesser petrosal nerve. The abnormal bony outgrowths such as spines, spurs, tubercles, bony plates may be due to abnormal ossification or over growth of surrounding parts of bones around the foramens of base of the skull, may leads to ischaemia, necrosis and possible paralysis of the parts of the body being supplied, drained or innervated by its contents.

Various ligaments present in the base of skull are of clinical and surgical importance. Among them, the pterygospinous ligament extends from the pterygospinous process of the lateral lamina of the pterygoid process of the sphenoid bone to the spine of the sphenoid and pterygoalar ligament extends from the pterygospinous process of the lateral lamina of the pterygoid process to the infratemporal surface of the sphenoid bone or its greater wing and was not connected to the sphenoid spine. These ligaments are located close to the foramen ovale, disordered ossification or calcification of such ligaments may obliterate the foramen ovale, which may cause mandibular neuralgia.

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Such abnormal bone outgrowths and osseous structures may alter the normal course of the mandibular nerve or its branches and they can cause serious implications in any surgical intervention in the region, and may lead to false neurological differential diagnosis. Accordingly the present study was designed to find out the bony outgrowths and osseous structures around the foramen ovale in available dry human skulls.

MATERIALS AND METHODS

The study was carried out using 100 dried adult human skulls irrespective of sex, were obtained from the Department of Anatomy-Santhiram Medical College Nandyal, Department of Anatomy- Melaka Manipal Medical College (MMMC)-Manipal University-Manipal and Department of Anatomy- Viswabharati Medical College Kurnool. The bases of the skulls were macroscopically inspected for the abnormal bony outgrowths such as spines, spurs, tubercles, bony plates and osseous structures around the foramen ovale and appropriate photographs were taken.

RESULTS

Among 100 skulls studied, sixty one (61%) of the skulls had neither any abnormal bony outgrowths nor osseous structures around the foramen ovale. The following abnormal bone outgrowths (22%) and osseous

structures (17%) around the foramen ovale were observed:

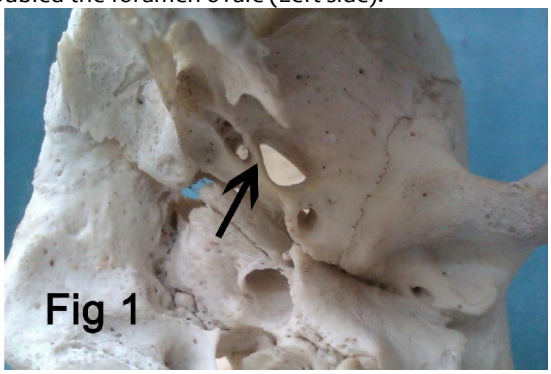
Abnormal bone outgrowths around the foramen ovale (22%):

- In 19 skulls, unilateral [3 right side and 16 left side skulls] bony plates or bony bars protruding from the margin of the FO were noted. These bony plates or bony bars divided the foramen ovale in to 2 foramina [anterior and posterior foramina]. [Fig.1 and 5]
- In three skulls, unilateral [left side] bony plate protruding from the cerebral surface of the greater wing of the sphenoid bone obliterated [slit like shape] the foramen ovale, were noted. [Fig.2]

Osseous structures around the foramen ovale (17%):

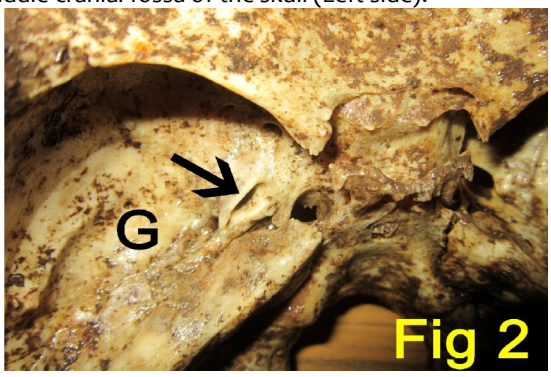
- In 11 skulls, unilateral [left side] complete ossified pterygoalar ligament with porus crotaphitico buccinatorius [foramen] were noted. [Fig.3]
- In two skulls, unusual unilateral [left side] complete ossified pterygoalar ligament with obliterated porus crotaphitico buccinatorius [foramen] were noted. In these two skulls thick plate of lateral lamina of the pterygoid process is attached to the infratemporal surface of the greater wing of the sphenoid bone and adjoing temporal bone. [Fig.4]
- In one skull, unilateral [left side] complete ossified pterygoalar ligament, incomplete ossified pterygospinous ligament and unique bony bar in-between ossified pterygoalar and pterygospinous ligaments were noted. [Fig.5]
- In three skulls, unilateral [left side] complete ossified pterygospinous ligament were noted. Ossified pterygospinous ligament divided the foramen ovale in to medial and lateral compartments [Fig.6]

Figure.1: Base of the skull showing abnormal bony bar doubled the foramen ovale (Left side).



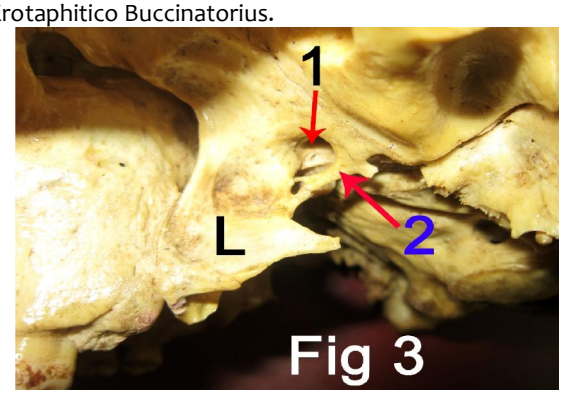
Arrow mark-Abnormal bony bar doubled the Foramen ovale (Left side).

Fig.2: Showing unilateral slit like foramen ovale in the middle cranial fossa of the skull (Left side).



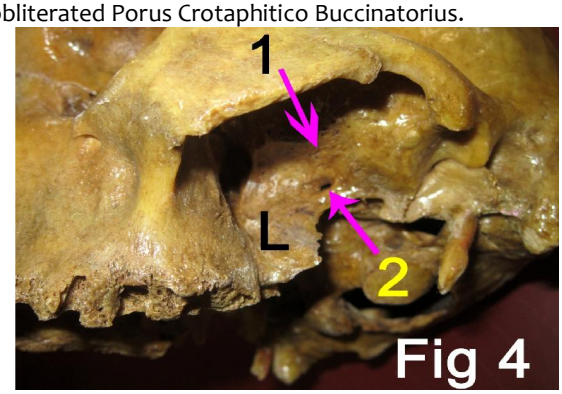
Arrow mark- bony plate protruding from the cerebral surface of the greater wing of the sphenoid bone obliterated the foramen ovale; G- Greater wing of the sphenoid bone.

Figure.3: Infratemporal fossa on the left side of skull showing complete pterygoalar bar and Porus Crotaphitico Buccinatorius.



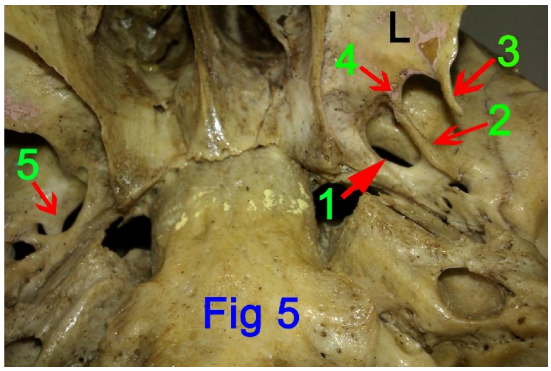
L- Lateral lamina of the pterygoid process of the sphenoid bone; 1- Porus (Foramen) Crotaphitico Buccinatorius; 2- Pterygoalar bar.

Figure.4: Infratemporal fossa on the left side of skull showing unusual complete pterygoalar bar and obliterated Porus Crotaphitico Buccinatorius.



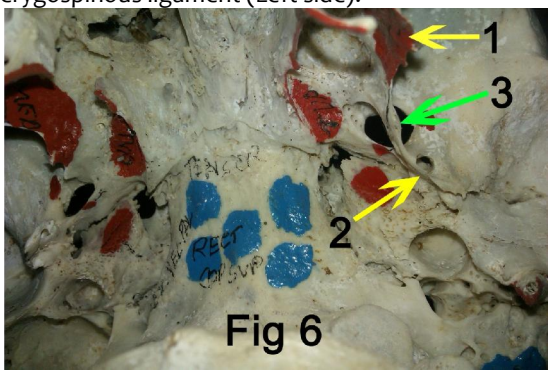
L- Lateral lamina of the pterygoid process of the sphenoid bone; 1- Thick plate of Pterygoalar bar. 2- Obliterated Porus (Foramen) Crotaphitico Buccinatorius;

Figure.5: Base of the skull showing abnormal bone outgrowths (right) and osseous structures (left) around the foramen ovale.



L- Left Lateral lamina of the pterygoid process of the sphenoid bone; 1- Foramen ovale (Left side); 2- Pterygoalar bar; 3- Ossified pterygospinous ligament; 4- unique bony bar in-between ossified pterygoalar and pterygospinous ligaments; 5- Abnormal bony plate doubled the Foramen ovale (Right side).

Figure.6: Base of the skull showing Ossified pterygospinous ligament (Left side).



1- Lateral lamina of the pterygoid process of the sphenoid bone; 2- Spine of the sphenoid bone;
3- Ossified pterygospinous ligament.

DISCUSSION

Mandibular nerve is the largest of the three divisions of trigeminal nerve, which leaves the middle cranial fossa (Both sensory and motor roots) through the foramen ovale and enters the infratemporal fossa; just below the foramen ovale it divides in to anterior and posterior divisions. An entrapment or compression neuropathy is a nerve lesion caused by pressure or mechanical irritation from some anatomic structures next to the nerve. Such entrapment or compression neuropathy occurs frequently where the nerve passes through an abnormal fibro-osseous canal or between abnormal bone outgrowths or entrapment between soft and hard tissues.

The bony outgrowths around the foramen ovale like spines, spurs, tubercles, bony plates and osseous structures may lead to ischaemia, necrosis and possible paralysis of the parts of the body being supplied, drained or innervated by its contents. Trigeminal neuralgia is caused by entrapment neuropathy or microvascular compression in 80% of cases and in the remaining 20% is by other factors such as bone anomalies in the skull base. [1]

The abnormal bony outgrowths around the foramen ovale like spurs divided the foramen ovale in to double foramen ovale in 2.8% of subjects. [2] In study by Reymond et al the foramen ovale was found to be divided into 2 or 3 compartments in 4.5% of cases. [3] Where as in the present study 22% of skulls had unilateral abnormal bony outgrowths around the foramen ovale, which obliterated the foramen ovale and divided in to double foramen ovale. Such abnormal bony outgrowths can cause mandibular neuralgia or may interfere in surgical and diagnostic procedures such as electroencephalographic analysis and percutaneous biopsy of cavernous sinus tumours. [4-6]

The slit like shape of foramen oval noted in this study signifies an over-growth during the developmental process between its first appearance and the perfect ring formation such bony obstructions could interfere with the transcutaneous needle placement into the foramen ovale or can cause the mandibular neuralgia. [7]

Disordered ossification or calcification of ligamentous structures in various parts of the body is frequently observed which may seriously hamper clinical and diagnostic procedures such as compression to neighbouring structures or complications in the regional surgery. Patnaik et al discovered a pterygoalar ligament [8] which forms a foramen known as porus crotaphitico buccinatorius with posterior border of lateral pterygoid plate such foramen provides passage for masseter nerve and deep temporal nerves. Ossified pterygoalar ligament is called as Pterygoalar bar. Partial or complete ossification of pterygoalar ligament results in compression of masseter and deep temporal nerves. [9]

Partial or complete ossified pterygoalar ligament and pterygospinous ligament have been reported, [10-15] however it can be noted that none of these cases were similar to our observations in the present study. Unusual unilateral complete ossified pterygoalar ligament with obliterated porus crotaphitico buccinatorius noted in this study may potentially compress the deep temporal, buccal nerve, branches of auriculotemporal nerve, chorda tympani or lingual nerve. Compression of mandibular nerve branches and chorda may leads to chewing disorders, pain during speech, numbness of the buccal region, changes to the parotid gland salivation, loss of taste and anaesthesia in the anterior two-thirds of the tongue [16-19] and may eventually cause trigeminal neuralgia.

Unusual unilateral complete ossified pterygoalar ligament, partial pterygospinous ligament and unique bony bar in-between ossified pterygoalar and pterygospinous ligaments noted in this study make this study more unique. Such abnormal multiple osseous variations can obliterate the foramen ovale. Such narrow passages are more susceptible to chronic neurovascular compression which alters the normal anatomical and functional integrity of the neurovascular structures. A rare unilateral complete ossified pterygospinous ligament noted in this study divided the foramen ovale in to medial and lateral compartments, such variations can cause mandibular entrapment or compression neuropathy and this compression neuropathy could provoke trigeminal neuralgia. As per our knowledge such abnormal osseous variations noted in this study were not reported in the modren medical literarure.

CONCLUSION

Anatomical knowledge of abnormal bone growths and osseous structures around the foramen ovale noted in the present study may be helpful for neurosurgical and diagnostic procedures like percutaneous biopsy of cavernous sinus tumours, electroencephalographic analysis, and microvascular decompression by percutaneous trigeminal rhizotomy. Moreover we believe that our data on the abnormal bone growths and osseous structures around the foramen ovale will be enlightening, not only for anatomists, but also for neurosurgeons in cases of trigeminal neuralgia, anaesthetists, radiologists, dentists and oral maxillofacial surgeons.

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