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Original Research Article

Pterygospinous Bar: An Ossified Ligament at the Base of Skull and Its Clinical Importance

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ABSTRACT

Introduction: Lateral pterygoid plate of Sphenoid on its upper part of posterior border usually presents a spine. This spine gives attachment to Pterygospinous ligament. Ossification of this ligament may cause compression system for the neurovascular structures.

Material and method: Total 39 human skulls present in Government Medical College; Chandigarh's bone bank was included in study. Skull with complete base and lateral wall of skull were included. The presence of Pterygospinous bar, its completeness, bilaterality, and size were noted.

Result: Out of 39, three skulls had pterygospinous bar bilaterally. In these three skulls too One skull had incomplete bars bilaterally while two others had complete bar forming foramen on right side. In other two skull incomplete bars were present unilaterally. The shape of the Foramen formed by the complete bar was round in two while oval in one skull.

Conclusion: Complete ossification of Pterygospinous ligament can result in formation of a foramen through which mandibular nerve branches which can manifest as various clinical symptoms. Therefore, this knowledge is important to neurosurgeons, radiologists, maxillofacial surgeons, anesthetists along with anatomists and anthropologist

KEY WORDS: Pterygospinous Bar, Ossified Ligament , Spine, Mandibular nerve.

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INTRODUCTION

The skull being a complex part of axial skeleton, has attracted the attention of both anatomists and anthropologists. It is composed of many bones. Some of the bones like ethmoid, sphenoid and occipital bone are placed in midline and make the floor of cranial cavity. Sphenoid bone is one of the midline bone making floor and also contributing in the lateral wall of skull[1]. It is placed between the frontal, temporal, and occipital bones. It has a body, paired greater and lesser wings, and two pterygoid processes. Each of these processes, descending perpendicularly from the junctions of greater wings and body of sphenoid, consists of a medial and a lateral plate. The medial pterygoid plate is comparatively narrower and longer while the lateral pterygoid plate is broad, thin, and everted. From the lateral pterygoid plate's irregular

posterior border pterygospinous process projects. pterygospinous process is connected by a ligament (sometimes ossified) to the sphenoid spine [1].

Objective

Cranial cavity foramina give passage to various nerves. Tight, short and ossified ligament around nerves may be a cause of neuropathy, as in case of pterygospinous bar, the mandibular or trigeminal neuralgia can be the presentation. So, this study was taken up to know the presence of Pterygospinous bony bridge and foramen and its variations in the adult human skulls of our region and also to discuss its clinical significance.

MATERIALS AND METHODS

The study was carried out in the Department of Anatomy, Government medical college & hospital, Sector 32, Chandigarh. The study was conducted on 39 adult human dry skulls of unknown sex in the north Indian population.

Aim of this study was to find out the incidence, side, degree of ossification (complete/incomplete), length & shape of pterygospinous bar. Complete undamaged adult skulls were Included in the study.

RESULTS

The study was done in 39 non-deformed dried human skulls, among them, 5 skulls showed complete or incomplete pterygoalar bar fig1 (A, B).

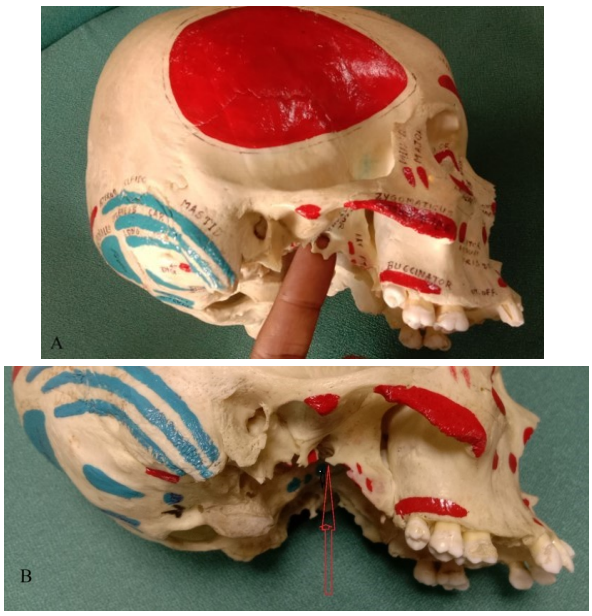

Fig. 1: (A) complete bar on right side forming foramen, (B) incomplete bar on right side.

Table 1: Presence of complete/incomplete Pterygospinous bar on right and left side.

Skull no.	Right side	Left side
1	Present, complete bar	Absent
2	Present, complete bar	Incomplete bar
3	Incomplete bar	Absent
4	Present, complete bar	Incomplete bar
5	Incomplete bar	Incomplete bar

In our study we found in 5 cases of pterygospinous bar/foramen out of 39 dry human skulls. In none of the cases the bar was complete bilaterally. In three cases the pterygoalar bar was complete on right side while incomplete on two on right side and three on left side. (Table 1). In one skull incomplete bar was present on both sides, while two skulls had complete bar on one side and incomplete on left side. (Table 1)

Table 2: Length of complete Pterygospinous bar in foramen formation.

Skull no.	Right side	Left side
1	7.2mm	-
2	11.6	-
3	-	Absent
4	7.6	-
5	-	-

In one of the cases the pterygoalar bar covered foramen spinosum to form a foreman. Maximum length of bar was found to be 11.6 mm. (Table 2). The largest foreman formed because of complete bar had 6.5mm AP diameter of and vertical diameter of 6.2 mm.

Table 3: Shape of the foramen formed in case of complete bar.

Skull no.	Right side	Left side
1	Round	-
2	Round	-
3	-	-
4	Oval	-
5	-	-

In two case the shape of so formed foramen was round while in one case it was oval. (Table 3). Ossified bars were in close relation to the foramen ovale; the pterygospinous bar was inferior or medial to foramen ovale.

DISCUSSION

The pterygospinous ligament was first described by Civinini in 1829. It connects the spinous process of the sphenoid bone to

Civinini's spine located in the posterior margin of the lateral pterygoid lamina of the sphenoid bone [2].

The term pterygospinous bar is often confused by pterygoalar bar which is a different entity. The pterygoalar bar which is formed as a result of ossification in ligament was first described by Hyrtl in 1862. It extends from the undersurface of the greater wing of the sphenoid bone to the lateral pterygoid lamina of the sphenoid bone. Complete ossification of the pterygospinous ligament is known as the pterygospinous bar . On completely ossification, the pterygospinous and pterygoalar ligaments form the pterygospinous foramen and porus crotaphytico-buccinatorius [3].

The pterygospinous bar has been seen in Hawaiian and lemurs and may locate normally medially or inferiorly to foramen ovale as seen i. Co – existence of bar with the wide lateral pterygoid plate exhibits development of the bar from **herbivore, carnivore** and **old-world monkeys**. Comparatively absence or small spine of **civinini** noted in new world monkeys, rodents and platyrrhines. Pterygospinous bar represents the *phylogenetic* remnant in Human beings [2].

The Pterygospinous ligament is actually the **thickening of the fascia** between the lateral and medial pterygoid muscles stretches between the spine of sphenoid to the upper part of the posterior border of the lateral pterygoid plate. sometimes this ligament is replaced **Pterygospinous muscle** which is usually inserted into the temporomandibular joint capsule and articular disc [3].

Ossification may be secondary ossification of fibrous structure. The some factor contributing the ossification are hereditary and aging. However, the presence of these bony bridges in children suggested the possibility of genetic factors [4]. The smallest age ossification detected was 5 months old [4].

Sometimes the Pterygospinous ligament may get ossified completely or incompletely. Complete ossification of this ligament was named after Civinini, an Italian anatomist as Civininian bar or Pterygospinous bar [5].

The foramen so formed by this bar was called as foramen of Civinini or Pterygospinous foramen through which passes the medial pterygoid vessels and nerves as well as branches mainly of mandibular nerve to the muscles of mastication and also, Chorda tympani branch of facial nerve [5].

In surgical interventions required for relieving trigeminal neuralgia, these ossified ligaments can obstruct the passage of needle into the foramen ovale, thereby disabling the anaesthetization, thermocoagulation of the trigeminal ganglion or the mandibular nerve [5].

In such situations CT scan of the cranial base may be obtained to better delineate the anatomy of obstructive lesions around the foramen ovale[5].The Hirtz axial radiograph and submento vertex projection permit a clear observation of anatomical structures at the skull base [5].

Preoperative radiological identification of these bars enables surgeon to use infra mandibular approach to the trigeminal ganglion instead of routine supramandibular or trans zygomatic approach to overcome failure of trigeminal ganglion block [6]. Thus, radiological guidance is also required to visualize the foramen ovale and its related structures, which makes puncture easier and more precise.

Table 4: Comparisons of percentage of pterygospinous bar in different population in previous studies.

Author	Pterygospinous bar percentage		Total percentage
	Complete	Incomplete	
Tubbs et al 2009 [6]	0.65	0.65	1.3
Kapur E et al 2007 [7]	1.31	14.74	16.05
Peker T et al 2002 [8]	5.5	-	-
Pinar Y et al 2004 [9]	3.3	9.7	13
RR Rosa et al 2010 [5]	8.61	19.36	31.2
Antonopopoulou M et al 2008 [10]	2	25	27
Devi JD et al 2012 [11]	0.98	10.78	11.78
Present study	7.6	12.8	20.4

The pterygospinous bony bridge can also pass among the fibers of the lingual nerve and divide it into anterior and posterior parts. Anterior part passes medially and lies between tensor veli palatini muscle and the bony bridge, so these fibers are vulnerable to the risk of compression [12].

CONCLUSION

Partial or complete ossification of ligaments in skull which are around or near any foramen is important from an anatomical, anthropologic, Radiologists, anesthesiologists and neurologist from clinical point of view. Pterygospinous ligament can result in compression of mandibular nerve branches which can manifest as various clinical symptoms, depending upon the dimensions of the Pterygospinous foramina and degree of compression. In our study we found that the percentage of finding ossification in pterygospinous ligament, whether complete or incomplete is quite high (20.4%). the highest percentage was found in Brazilian population [6] (31.2%). In our study we found that the right side predominance of the presence of complete bar. Relation of more presence on right side may be related to the dexterity which is yet to be researched.

Author Contributions

Vimal Gupta: Carried the collection of Materials, Methodology, Literature review **Anshu Sharma:** Conception, plan, research, drafting and execution

Conflicts of Interests: None

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