Section: Anatomy

Research

PTERYGOSPINOUS AND PTERYGOALAR BAR AND FORAMINA: OSSIFIED LIGAMENTS AT THE BASE OF ADULT HUMAN DRY SKULL IN NORTH INDIAN POPULATION

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Abstract

Background: Studying variations in the anatomy of the base of skull is important for clinicians to perform surgeries pertinent to the base of skull. Ossification of ligaments at base of skull is not uncommon and the knowledge of variations in the anatomy of the pterygospinous bar and pterygoalar bar leading to formation of respective foramina at the base of skull is important for infratemporal approach of various surgical procedures. Many of the literatures have studied the relation of these bars and foramina in relation to Foramen Ovale. In addition to this the purpose of our study is to study the relation of the Foramen Spinosum with respect to the ossified ligaments at the base of the skull. **Materials and Methods:** The study was conducted on 94 sides of 47 adult human dry skulls of unknown sex in north Indian population. (complete/incomplete) and relation of the pterygospinous (PS) and pterygoalar (PA) bars and foramina to the Foramen Ovale and Foramen Spinosum. **Result:** The incidence of complete PS bar was 2.21 % amongst the 94 sides of skulls and for complete PA bar was 1.06 %. The incidence of PS foramen was 2.21% and PA foramen was 1.06%. The pterygospinous foramen presented an average diameter between 8.36 –11.66 mm, whereas, for the pterygoalar foramen, it was between 2.73-5.20mm. The relation of Pterygospinous foramen and Pterygoalar foramen with respect to Foramen Ovale and Foramen Spinosum was also noted. **Conclusion:** The presence of pterygospinous and pterygoalar bar and foramina can lead to various symptoms due to entrapment neuropathy and should also be considered in therapeutic procedures that are performed via infratemporal approach and also during giving nerve blocks in anesthesia. These should also be considered in planning surgical approaches to the retropharyngeal and parapharyngeal space. These variations may not be of academic interest but are beneficial for maxillofacial and dental surgeons.

INTRODUCTION

The pterygospinous ligament stretches between the spine of the sphenoid to the upper part of the posterior border of the lateral pterygoid plate. Ossification of this ligament leads to the formation of a Pterygospinous bar which can be complete or incomplete. This ossification leads to the formation of a foramen called pterygospinous foramen. Ossification of these ligaments can lead to symptomatic compression of the mandibular nerve branches passing through the same regions.[1] Filippo Civinini in 1837 was the first anatomist to discover this ossified ligament hence pterygospinous bar is also known as Civinini's bar and the foramen formed by the pterygospinous bar was called as Foramen of Civinini.[2-4] Very few studies have and textbooks have included another intrinsic ligament called pterygial ligament.[5] In 1862, German anatomist Hyrtl described the pterygoalar ligament (Hyrtl's ligament) which extends from the root of the lateral pterygoid plate to the undersurface of greater wing of sphenoid near the anterolateral edge of the foramen spinosum resulting a foramen called

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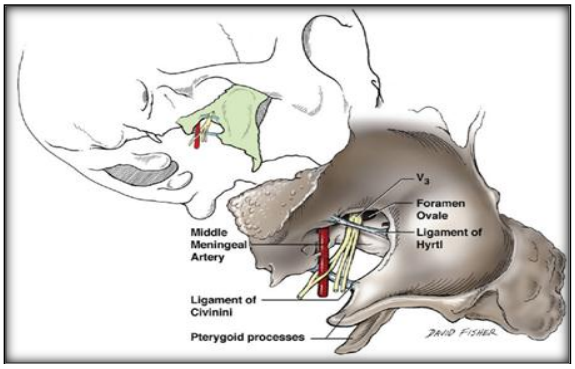
pterygoalar foramen also known as porus crotaphitico-buccinatorius.[1]

Pterygoalar ligament (ligament of Hyrtl)



Schematic view of the skull base demonstrating the ligaments of Civinini and Hyrtl and their relationships to the foramen ovale.

MATERIALS AND METHODS

Material

The study was carried out in the Department of Anatomy, Dr. Ram Manohar Lohia Institute of Medical Sciences, Lucknow, Uttar Pradesh from march 2020 to march 2021. The study was conducted on 94 sides of 47 adult human dry skulls of unknown sex in the north Indian population. Aim of this study to the incidence, side, degree of ossification (complete/incomplete), and relation of the pterygospinous (PS) and pterygoalar (PA) bars and foramina to the Foramen Ovale and Foramen Spinosum.

Method

All measurements were taken by using sliding digital Vernier calipers. Photographs of the ossified ligament were taken in relation to FP.

Inclusion Criteria

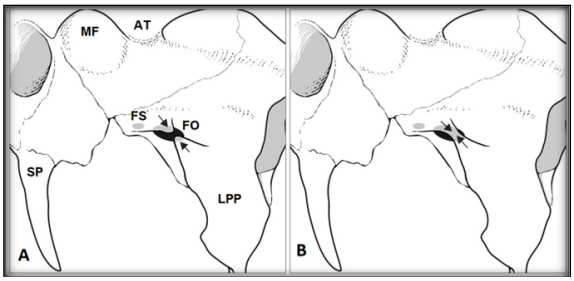
The criteria for including the individuals from the study was as follows-

1. Complete skull Undamaged
2. Adult skull

Exclusion Criteria

1. Damage Skull
2. infant skull

Statistical Analysis: Statistical analysis was performed by using computer-based software, Statistical Package for Social Science (SPSS). Mean values of parameters were compared to determine.



(A)Incomplete pterygoalar bridging.
(B)Complete pterygoalar bridging.
AT, articular tubercle;
FO, foramen ovale;
FS, foramen spinosum;
LPP, lateral plate of the pterygoid process;
MF, mandibular fossa;
SP, styloid process.

Figure 1: Showing the Completely ossified pterygospinous bar and foramen on the right side

RESULTS

The study was done in 94 non-deformed dried human skulls, among them, 28 skulls showed complete or partially ossified pterygoalar bar. In 6 skulls bilateral Complete and in 15 skulls unilateral complete pterygoalar bar was found. An incomplete pterygoalar bar was found in 7 skulls, of which 4 skulls had unilateral and 3 had bilateral pterygoalar bars.

Table 1: Showing the complete and incomplete present of pterygoalar bar in skull

Pterygoalar Bar						
	Complete			**Incomplete**		
	Bilateral	**Unilateral**		**Bilateral**	**Unilateral**	
		Rt.	**Lt.**		**Rt.**	**Lt.**
	1	**2**	**4**	**5**	**6**	**10**
Total	1	6		5	16	
Total	7			21		

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Table 2: showing compression between our present study with past study

Pterygoalar Bar								
	Population	**Sample size**	**Complete**			**Incomplete**		
			Bilateral	**Unilateral**		**Bilateral**	**Unilateral**	
				Rt.	**Lt.**		**Rt.**	**Lt.**
Present study	Indian		1	2	4	5	6	10
Sol-Ji Ryu et al. 12(2016)	Korean	142	0	6	2	0	5	11
Kamath K 13 (2014)	Indian	100	0	0	1	7	7	15
Tubbs RS 14 (2009)	American	154	0	0	1	0	0	1

Table 3: showing pterygospinous foramen & pterygoalar foramen diameter

pterygospinous foramen & pterygoalar foramen average diameter			
	Population	pterygospinous foramen	pterygoalar foramen
Present study	Indian	8.36 –11.66 mm	2.73-5.20 mm

Table 4: showing compression between our present study with past study

pterygospinous foramen & pterygoalar foramen average diameter			
	Population	pterygospinous foramen	pterygoalar foramen
Present study	Indian	8.36 –11.66 mm	2.73-5.20 mm
Suazo Galdames[15]	Chile	10.626 mm	7.366 mm
Devi Jansirani D	Indian	3-9 mm	2-5

The pterygospinous foramen presented an average diameter between 8.36 –11.66 mm, whereas, for the pterygoalar foramen, it was between 2.73-5.20mm.

DISCUSSION

Pterygoalar bar anatomy is not so frequently described in anatomical literature and even in morphological variants papers and books of gross anatomy.[6] Mineralization of skull base ligaments can occur as a result of an interplay between a broad range of factors, including genetics, metabolic abnormalities, and mechanical stress.[7] The pterygoalar bar and foramen are normally seen in lower animals and persist in a variable percentage of the human population of different races. The clinical significance of pterygoalar ligament is as this ligament attaches more superiorly to pterygoid plate near ao root of this plate and grows backwards and laterally towards the greater wing of the phenoid bone, obliterates the foramen ovale, which may cause mandibular neuralgia.[8] Pterygoalar ligament may potentially compress the branches of the mandibular nerve ie. deep temporal, lateral pterygoid, buccal nerves, and on branches of the auriculotemporal nerve, and may cause chewing disorders, pain, numbness of the buccal region and changes to the parotid gland salivation.[9,10] Percutaneous approaches to the trigeminal ganglion with lateral subzygomatic routes can be difficult when a bony bar results from ossification of the ligaments of Civinini or Hyrtl because these obstruct the foramen ovale.[11] In the present study pterygoalar ligaments were found in 28 skulls.In our current study we observed the pterygospinous foramen presented an average diameter between 8.36 –11.66 mm, whereas, for the pterygoalar foramen, it was between 2.73-5.20 mm. while comparing our study with Iván Suazo Galdames[15] they observed The maximum diameter of this foramen was 10.626 mm and the average minimum diameter was 7.366 mm another study of Devi Jansirani D[16] showing the length of complete pterygospinous bar was 9-11 mm and its width measured 2-3 mm. The length of complete pterygoalar bar measured 3-9 mm and its width was 2-5 mm.

CONCLUSION

The presence of pterygospinous and pterygoalar bar and foramina can lead to various symptoms due to entrapment neuropathy and should also be considered in therapeutic procedures that are performed via infratemporal approach and also during giving nerve blocks in anesthesia. These should also be considered in planning surgical approaches to the retropharyngeal and parapharyngeal space. These variations may not be of academic interest but are beneficial for maxillofacial and dental surgeons.

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