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Research Article

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An Observational Study of the Pterygoalar Bar & Porus Crotaphitico Buccinatorius and its Clinical Correlations among North Indian Population

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ABSTRACT

Background: The bony structures known as the "pterygoalar bar" develop when ligaments between the greater wing of the sphenoid bone and the lateral pterygoid plate ossify along the outer base of the skull, close to the foramen ovale. Dentists, anaesthetists, and neurosurgeons must understand how common the pterygoalar bar is. In addition to investigating the presence of related anatomical characteristics such as the foramen crotaphitico-buccinatorius, this study aims to determine whether the pterygoalar bar is present in dry human skulls and sphenoid bones.

Methods: In the present study, fifty fully ossified adult skulls from the North Indian population were used for a cross-sectional anatomy investigation. The skulls were taken from the Dept of Anatomy, Varun Arjun Medical College and Rohilkhand Hospital in Shahjahanpur, Uttar Pradesh and Maharishi Markandeshwar College of Medical Science & Research in Ambala, Haryana.

Results: Out of 50 skulls, 76% had no ossification of the pterygoalar ligament. In the remaining 24%, ossification was present. Specifically, 4% had bilateral complete bars, 12% had unilateral complete bars, and 8% had incomplete bars.

Conclusion: For anaesthetists, surgeons, and dentists, understanding the full or partial ossification of ligaments in this area is essential. The mandibular nerve and its branches are susceptible to entrapment neuropathy due to these ossified structures, which are closely associated with the foramen ovale.

Key-words: Foramen ovale, Pterygoalar bar, Pterygospinous, Porus-Crotaphitico Buccinatorius, Neuralgia, Sphenoid bone

INTRODUCTION

"Pterygoalar bar" describes bony structures that form at the outer base of the skull, close to the foramen ovale, when the ligaments joining the greater wing of the sphenoid bone and the lateral pterygoid plate ossify [1].

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This ossification can be partial or total. When completely ossified, it creates a unique foramen known as the porus-crotaphitico Buccinatorius (PCB), or pterygoalar foramen, which is surrounded at the rear by the lateral pterygoid plate [2-4]. Branches of the mandibular nerve, including the deep temporal and masseter nerves, pass via this foramen [5]. Hyrtl named this foramen PCB [6] Chouki and Hodes referred to an ossified pterygoalar ligament as the "pterygoalar bar" [7]. Neurosurgeons are limited in their ability to access the retropharyngeal and parapharyngeal spaces by the ossified pterygospinous (PS) and pterygoalar (PA) bars, which are situated between the lateral pterygoid plate and the sphenoid spine [8].

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Situated next to the foramen ovale, the infratemporal fossa is often the source of compression for the ossified pterygoalar ligament and the mandibular nerve. This region functions as a critical anatomical landmark under these compressed circumstances [9]. Approximately 80% of cases of trigeminal neuralgia are caused by microvascular compression or entrapment neuropathy [10]. Ossification of the pterygoalar ligament, either partially or completely, may obstruct the foramen ovale because of its proximity, thereby causing mandibular neuralgia [11].

Dentists, anaesthetists, and neurosurgeons must comprehend the occurrence of the pterygoalar bar. In addition to evaluating the frequency of associated anatomical features such as the foramen crotaphitico-buccinatorius, this study aims to determine if the pterygoalar bar is present in dry human skulls and sphenoid bones. The intention is to shed light on these discoveries' clinical implications.

MATERIALS AND METHODS

In the present cross-sectional anatomical investigation, fifty (50) adult, fully ossified, dry skulls from the North Indian population were used. The sources of these skulls were the Department of Anatomy, Varun Arjun Medical College and Rohilkhand Hospital, Shahjahanpur, U.P. and Maharishi Markandeshwar College of Medical Science & Research in Ambala, Haryana. This in-depth investigation took three months to complete, starting in February 2024 and ending in April 2024.

Inclusion criteria- Selected for the study were only those dry, fully preserved adult skulls free from any visible signs of disease or injury, sourced from the Anatomy Department at Varun Arjun Medical College and Rohilkhand Hospital in Shahjahanpur, U.P. and Maharishi Markandeshwar College of Medical Science & Research in Ambala, Haryana, India.

Exclusion criteria- Skulls showing fractures or abnormal deformities were excluded from the study.

Sample size calculation- The minimal sample size was determined based on a convenient sampling approach [10]. Using the below formula

$$N = z^2 * \alpha * p * q / L^2$$

Where,
N represents the sample size,
p stands for percentage,
q equals 1 minus p,
α denotes the type I error rate of 5%,
L signifies the allowable error set at 15% of p.
Consequently, the calculated estimated sample size was 50.

Study Procedure- The desiccated remnants of skulls underwent a process of anonymization, their identities obscured through random coding and detachment from any traceable sources (ICMR National guidelines for biomedical and health research involving human participants, ICMR, 2017, sec 5, Box 5.2) [11]. Detailed macroscopic examinations of the skull bases aimed to discern the presence and nature of the PCB. Observations noted whether these anatomical features appeared unilaterally or bilaterally and whether they exhibited completeness or incompleteness.

Statistical Analysis- Morphological variations were meticulously observed twice to minimize errors, followed by averaging the results. The acquired data was meticulously tabulated for the study. With great care, graphs and tables were created using Microsoft Word 2013 and Excel.

Ethical Approval- The Human Ethical Committee of the Maharishi Markandeshwar College of Medical Science & Research in Ambala, Haryana, and the Department of Anatomy at Varun Arjun Medical College and Rohilkhand Hospital in Shahjahanpur, U.P approved the above study.

RESULTS

In a current observational study involving 50 dry human skulls, the examination revealed intriguing findings regarding the pterygoalar ligament. Among the specimens, 38 skulls (76%) exhibited no ossification of the pterygoalar ligament, either complete or partial. In contrast, the remaining 12 skulls (24%) displayed varying degrees of ossification in this ligament. Notably, two skulls (4%) showed bilateral complete pterygoalar bars and PCB, while six skulls (12%) exhibited unilateral complete pterygoalar bars and PCB. Additionally, four skulls (8%) demonstrated incomplete pterygoalar bars and PCB.

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Interestingly, one of the skulls with bilateral complete ossified pterygoalar ligaments stood out due to its thicker structure and the presence of double PCB (Fig. 1).

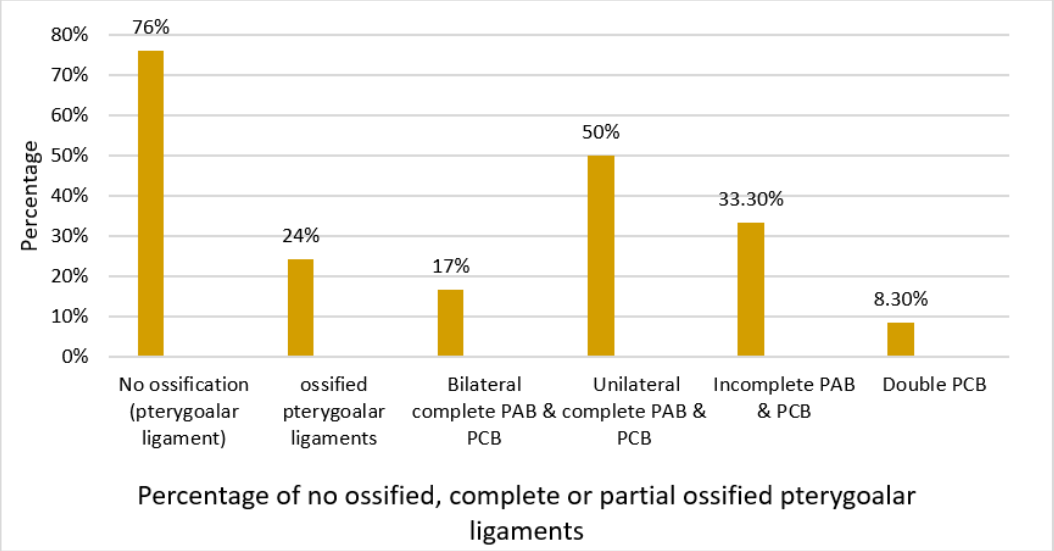

Fig 1: Percentage of morphological variability of no ossified, complete or partial ossified pterygoalar ligaments and double PCB.
PAB: pterygoalar bar, PCB: Porus-Crotaphitico Buccinatorius

Beneath Fig. 2, 3, and 4 are illustrations showing bilateral complete Pterygoalar bars and pterygoalar foramina, unilateral incomplete Pterygoalar bars and pterygoalar foramina, and unilateral complete double PCB and pterygoalar bars.

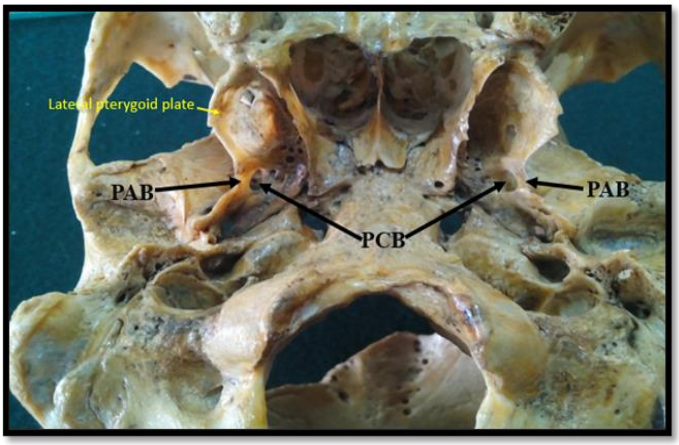

Fig. 2: Inferior view of skull showing bilateral complete Pterygoalar bar & pterygoalar foramen

A detailed comparison of pterygoalar bar incidences across different populations is shown in Table 1.

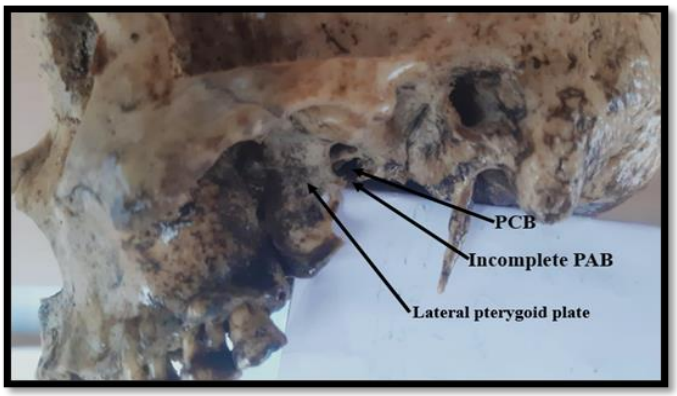

Fig. 3: Lateral view of skull showing unilateral incomplete Pterygoalar bar & pterygoalar foramen

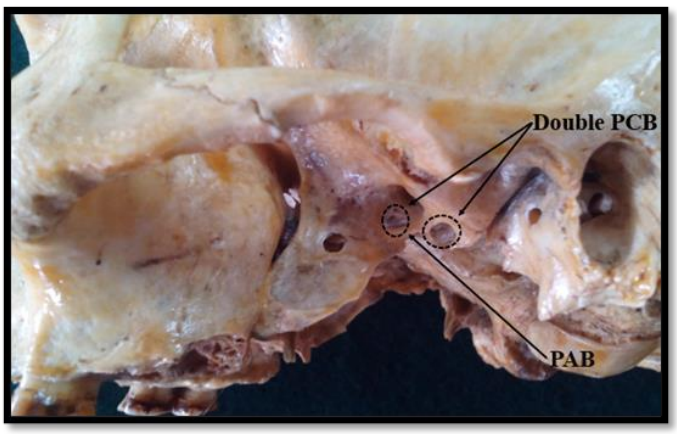

Fig. 4: Lateral view of skull showing unilateral complete double Porus crotaphitico-buccinatorius & pterygoalar bar.

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Table 1: Comparative analysis of incidence (% age) of pterygoalar bar in various population groups

Author & Year	Population Group	Sample size (N)	Incidence of PAB (%)	Complete PAB (%)	Incomplete PAB (%)
Bala *et al*. [3]	American whites & Negroes	1544	6.8	-	-
Kapur *et al*. [15]	Croatian	305	20.3	5.9	14.4
Pinar *et al*. [16]	Turkish	361	6.08	1.1	4.98
Antonopoulou *et al*. [17]	Greek	50	8	1	7
Tubbs *et al*. [5]	American	154	1.3	0.65	0.65
Rosa *et al*. [2]	Brazilian	93	68.8	12.9	49.4
Daimi *et al*. [18]	Western Indian	90	7.8	7.8	
Chakravarthi *et al*. [10]	South Indian	71	28.17	19.7	8.5
Natsis *et al*. [12]	Greek	145	31.7	4.1	27.6
Goyal *et al*. [13]	North Indian	75	22.7		22.7
Ciric *et al*. [19]	Bosnia & Herzegovina	100	35	15	20
Vishali *et al*. [20]	South Indian	90	13.3	1.11	12.22
Yanarates *et al*. [21]	Turkish	700	11.57	4.85	6.71
Present study	North Indian	50	24	16	8

DISCUSSION

Osseous bridging throughout the body represents a widespread, age-related phenomenon that remains poorly elucidated, marking the culmination of secondary ossification within fibrous structures [12]. Within the cranial region, the fascia dividing the medial and lateral pterygoid muscles undergoes thickening at its superior connections, giving rise to fibrous bands termed the pterygospinous and pterygoalar ligaments [13]. The pterygospinous ligament spans from the posterior edge of the lateral pterygoid plate to the spine of the sphenoid bone. Notably, their posterior attachments relative to the foramen spinosum distinguish these structures: the pterygospinous ligament consistently lies medial to the foramen spinosum, whereas the pterygoalar ligament is consistently positioned lateral to it [14].

Trigeminal neuralgia typically stems from nerve or microvascular compression in 80% of cases, while the remaining 20% can be attributed to factors like skeletal irregularities at the base of the skull [15,16]. The ossification of the pterygoalar ligament and the presence of porus crotaphitico buccinatorius are particularly noteworthy in clinical contexts. However, comprehensive data on the prevalence of these anatomical formations in the general population remains sparse, and detailed morphological insights are scant in existing literature [17]. In our investigation, we observed that the pterygoalar bar appeared in 24% of cases, primarily in its complete form and often on one side only. These findings align closely with prior research [2,13,18,19]. Interestingly, Natsis *et al*. [12] noted a higher prevalence of incomplete pterygoalar bars among the Greek population [20,21]. Conversely, studies focusing on South Indians predominantly revealed incomplete formations of the pterygoalar bar. Our anatomical study also confirmed the presence of this structure within a sample of North Indians.

LIMITATION

Sexual dimorphism did not manifest in the findings. To bolster the baseline data's credibility for clinicians, expanding the pool of desiccated specimens would prove advantageous. The intricate anatomical features encompassing the outer skull base pose considerable complexity in managing surgical interventions for

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mandibular neuralgia, yet they are readily discernible in radiographs. Henceforth, upcoming endeavors might integrate radiological correlations with the examination of desiccated crania.

CONCLUSIONS

The full ossification of the pterygoalar bar culminates in the creation of the pterygoalar foramen, also known as the crotaphitico-buccinatorius. This metamorphosis results in a bony or ligamentous barrier that obstructs access to the mandibular nerve or the trigeminal ganglion through the foramen ovale, regardless of whether approached from above or below the zygomatic arch. Prior research has noted instances of ossified ligaments in various global locations, albeit their clinical significance remains constrained by their infrequency and additional anatomical impediments.

Nonetheless, comprehending the complete or partial ossification of ligaments in this region is indispensable for anesthetists, surgeons, and dentists alike. These ossified bars, closely linked with the foramen ovale, have the potential to induce entrapment neuropathy of the mandibular nerve and its ramifications.

CONTRIBUTION OF AUTHORS

Research concept- Vibhash Kumar Vaidya

Research design- Vibhash Kumar Vaidya, Gagandeep Kaur, Akhil Sathyan

Supervision- Vibhash Kumar Vaidya, Gagandeep Kaur

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Final approval- Vibhash Kumar Vaidya

REFERENCES

[1] Skrzat J, Walocha J, Środek R. An anatomical study of the pterygoalar bar and the pterygoalar foramen. Folia Morphologica., 2005; 64(2): 92-96.

[2] Rosa RR, et al. Radiographic study of ossification of the pterygospinous and pterygoalar ligaments by the Hirtz axial technique. Acta Odontol Latinoam, 2010; 23: 63-67.

[3] Bala KK, Kumar V. Anatomical study of pterygospinous and pterygoalar bar in human skulls with their phylogeny and clinical significance. J Clin Diagn Res., 2014; 8(9): AC10-3.

[4] Patnaik VV, Singla RK, Bala S. Bilateral pterygoalar bar and porus crotaphitico buccinatorius – A case report. J Anat Soc India, 2001; 50: 161-72.

[5] Tubbs RS, et al. Ossification of ligaments near the foramen ovale: An anatomic study with potential clinical significance regarding transcutaneous approaches to the skull base. Neurosurg., 2009; 65: 60-64.

[6] Henry BM et al. Prevalence, morphology, and morphometry of the pterygospinous bar: a metaanalysis. Surg Radiol Anat., 2020; 42(5): 497-07.

[7] Erdogmus S, Pinar Y, Celik S. A cause of entrapment of the lingual nerve: ossified pterygospinous ligament – a case report. Neuroanat., 2009; 8: 43-45.

[8] Piagkou MN, et al. Mandibular nerve entrapment in the infratemporal fossa. Surg Radiol Anat., 2011; 33: 291-09.

[9] Hai J, Li ST, Pan QG. Treatment of atypical trigeminal neuralgia with microvascular decompression. Neurol India, 2006; 54: 53-56.

[10] Chakravarthi KK, Babu KS. An anatomical study of the pterygo-alar bar and porus crotaphitico buccinatorius. Int J Med Health Sci., 2012; 1(3): 3-9.

[11] Conditions for granting waver of consent. ICMR National guideline for biomedical and health research involving human participants ICMR 2017; Section 5 (Box 5.2): 53.

[12] Natsis K, et al. The ossified pterygoalar ligament: an anatomical study with pathological and surgical implications. J Craniomaxillofac Surg., 2014; 42(5): e266–e70.

[13] Goyal N, Jain A. An anatomical study of pterygoalar bar and its clinical relevance. Chrismed J Health Res., 2015; 2: 333-36.

DOI: 10.21276/SSR-IIJLS.2024.10.4.11

[14]Hai J, Li ST, Pan QG. Treatment of atypical trigeminal neuralgia with microvascular decompression. Neurol India, 2006; 54: 1-4.

[15]Kapur E, Dilberovic F, Redzepagic S, Berhamovic E. Variation in the lateral plate of the pterygoid process and the lateral subzygomatic approach to the mandibular nerve. Med Arh., 2000; 54: 133-37.

[16]Pinar Y, Arsu G, Aktanlkiz ZA, Bilge O. Pterygospinous and pterygoalar bridges. Sendrom, 2004; 16: 66-69.

[17]Antonopoulou M, Piagou M, Anagnostopoulou S. An anatomical study of the pterygospinous and pterygoalar bars and foramina–Their clinical relevance. J Craniomaxillofac Surg., 2008; 36: 104-08.

[18]Daimi SR, Siddiqui AU, Gill SS. Analysis of foramen ovale with special emphasis on pterygoalar bar and pterygoalar foramen. Folia Morphol., 2011; 70: 149-53.

[19]Ciric D, Kapur E, Talović E. Ossification of the pterygospinous and pterygoalar ligaments and their clinical relevance. Folia Medica Facultatis Medicinae Universitatis Saraeviensis, 2017; 52-56.

[20]Vishali NT, Jones E, Rajathi G, Charanya N. Anatomical analysis of the abnormal bone outgrowths with special emphasis on pterygoalar bar and its crotaphitico buccinatorius foramen. Int J Anat Res., 2018; 6(1.2): 4963-67.

[21]Yanarates G, Ozdemir F, Salim H, Ari B. A comprehensive morphometric analysis of pterygospinous and pterygoalar bars on computed tomography images. Med., 2024; 103(8): 367-72.