

Research Article

A Study on Bilateral Ossified Pterygospinous Ligament and Its Clinical Significance

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Abstract

The pterygospinous ligament extends from lateral pterygoid plate to spine of sphenoid bone. The ossification of pterygospinous ligament is very rare. The pterygospinous ligament located close to foramen ovale and of anatomical, clinical and surgical importance because ossified ligaments may compress neurovascular structures present in region of foramen ovale causing trigeminal neuralgia. In many studies, the incomplete ossified pterygospinous ligament was more common than complete one and unilateral ossified pterygospinous ligament was more common than the bilateral one. Whether complete or incomplete ossified pterygospinous ligament can produce various symptoms depending upon the dimensions of the pterygospinous foramina and grades of neurovascular compression. Antonopoulou *et al* observed incompletely ossified pterygospinous ligaments in 2.5% skulls and completely ossified Pterygospinous Bridge bilaterally in 2% of the skulls by 3D reconstruction in a CT image. The present study, analysed morphologically exposed the presence of bilateral ossified pterygospinous ligament and Civinini's foramina which are clinically important with an incidence 0.95% found 1 out of 105 dried human adult skull bones of either sex. Therefore, the knowledge of Anatomical variation of the pterygospinous ligament- ossification is clinically important to radiologists and neurosurgeons, maxillofacial and dental surgeons, and anaesthetists along with academically for anatomists and anthropologists.

Keywords: Pterygospinous ligament, Spine of sphenoid bone, Civinini's foramen, Mandibular nerve, Pterygoid plate, Ossification, Pterygospinous bar

1. Introduction

The pterygospinous ligament extends from lateral pterygoid plate to spine of sphenoid bone. This ligament is ossified sometimes, forming a foramen, which can be traversed by mandibular nerve branches to supply temporalis, masseter and lateral pterygoid muscle¹. In 1837, Civinini described the pterygospinous ligament and found that this ligament ossified in 2% to 3% of his specimen². The pterygospinous ligament and ossified foramen formed is named after Civinini³.

Nayak *et al* found Civinini ligament fully ossified in 5.76% and incompletely ossified in 3.84% of their specimen⁴. The complete ossification of pterygospinous ligament is known as the pterygospinous bar⁵. Partial or complete ossification of pterygospinous ligament seems to be a major cause of trigeminal neuralgia⁴, causing lingual numbness and pain associated with speech impairment⁶.

Knowledge of ossified pterygospinous ligament (Civinini ligament), pterygospinous foramen (Civinini foramen) and pterygospinous bar are important for anatomists, radiologists, anthropologists, neurosurgeons, maxillofacial surgeons, dental surgeons and anaesthetists especially while treating Trigeminal neuralgia and also while performing surgical operations on the pterygoid region⁷.

2. Materials and Methods

A total of 105 dried Human adult skull bones of either sex were carefully studied from the collection in the osteology lab, Department of Anatomy, Vijayanagar institute of medical sciences, Bellary, Karnataka, India.

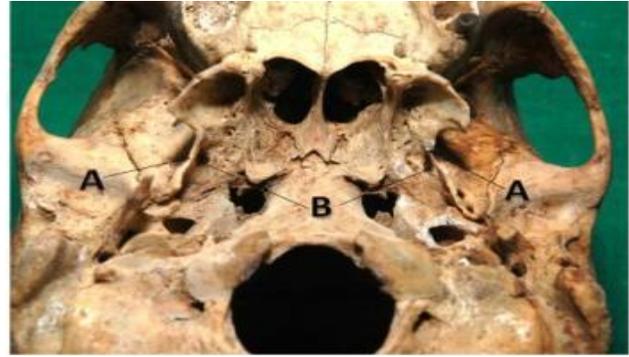
3. Results

A total of 105 dried Human adult skull bones were studied and only in one skull bone we found the bilateral complete ossification of pterygospinous ligament. In the present study, the bilateral complete ossified pterygospinous ligament incidence 0.95%.

Fig.1- 105 Dried Human Adult Skulls



Fig.2- Dried Human Adult Skull base showing- A) Completely Ossified Pterygospinous ligament (bilateral), B) Civinini's foramen.



4. Discussion

The ossification of pterygospinous ligament is very rare^{8,9}. The presence of an osseous bar between the lateral pterygoid plate and the spine of sphenoid has been considered as a phylogenetic remnant in human beings¹⁰.

The pterygospinous ligament located close to foramen ovale and of anatomical, clinical and surgical importance because ossified ligaments may compress neurovascular structures present in region of foramen ovale causing trigeminal neuralgia¹¹. The ossified pterygospinous ligaments can produce difficulty in accessing the foramen ovale in therapeutic approach¹².

An unusual course of lingual nerve with entrapment of nerve between ossified pterygospinous ligament and medial pterygoid plate was found¹³. The lingual nerve and the inferior alveolar branch of mandibular nerve in the region of the infratemporal fossa are forced to take a long curved course in presence of a large pterygoid plate and during contraction of pterygoid muscles, these nerves are subjected to compression¹⁴. 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 compression¹⁵. In view of close relationship of the chordatympani nerve, it may also be compressed by anomalous bar of bone and its involvement would result in impairment taste sensation in anterior 2/3rd of the tongue¹⁶. The presence of ossified pterygospinous ligament means that there would be less accessible space to gain entry into the para and retro pharyngeal space¹⁰.

Lateral pterygoid plate forms an important landmark for mandibular anaesthesia and any anomalies in lateral pteryoid plate is bound to confuse anaesthetists and also cause difficulty during thermocoagulation of trigeminal ganglion due to pterygospinous ligament ossification¹⁷.

According to Newton and Potts an ossified pterygospinous ligament can be an obstacle in a radiographically guided trigeminal ganglion blockage¹⁸. While applying conductive anaesthesia on mandibular nerve by lateral subzygomatic route may encounter obstacle to high quality conductive anaesthesia due to ossified pterygospinous ligament at lateral pterygoid plate¹⁸. A research study had also advocated that a distance of approximate 0.25cm beyond the distance to the lateral pterygoid plate be taken while performing maxillary nerve block by lateral extraoral approach¹⁹.

Incidence of ossified pterygospinous ligament has been reported by different authors with different results. Wood reported an 8% pterygospinous ligament ossification in Hawaiian skulls²⁰. Verma *et al* carried out their study on 116 macerated adult human skulls and reported a total incidence of 18.1%²¹. Krmpotic-Nemanic *et al* reported ossified pterygospinous ligaments in 5 out of 100 skulls and emphasized that these bony bridges may be one of the reasons of mandibular neuralgia¹⁴. Shinde *et al* studied a total of 65 skulls and only in 2 cases found incompletely ossified pterygospinous ligament⁸. Nayak *et al* observed 3.84% with incomplete pterygospinous ligament and 5.76% with complete pterygospinous bony bar out of 416 dry human skulls of Indian origin⁴. Antonopoulou *et al* observed incompletely ossified pterygospinous ligaments in 2.5% skulls and completely ossified pterygospinous bridge bilaterally in 2% of the skulls by 3D reconstruction in a CT image⁵. Peker *et al* studied 452 adult dry crania and found completely ossified pterygospinous ligament in 5.5% of the skulls. In 14 out of 452 skulls (3.1%) complete pterygospinous bridges were bilateral²². Pinar *et al* found completely ossified pterygospinous ligament in 12 cases (3.32%) and incompletely ossified ligaments in 35 cases (9.69%) out of 361 dry skull bones²³. Kapur *et al* reported a prevalence of 18.36% of pterygospinous bar in a sample of 305 Croat skulls. Complete ossification of pterygospinous ligament was found in 3.6% skulls—1.31% bilaterally as well as 1.31% on the right side and 0.98% on the left side. Incomplete type was found in 14.7% skulls—bilaterally in 12 skulls and unilaterally in 33 skulls. They emphasized that the presence of such an ossified Pterygospinous ligament may prevent anaesthesia of mandibular nerve at the lateral subzygomatic approach¹⁸. Yadav *et al*²⁴ studied 500 skulls reported 10.2% of total incidence of pterygospinous bar incompletely ossified in 6.2% (unilateral -5%, Bilateral-1.2%) and completely ossified in 4% (unilateral -4%, Bilateral-nil)²⁴. Bilateral presence of complete Pterygospinous bars/bridges has not been reported by Yadav *et al* or in the study by Verma *et al* or Thomson *et al*²⁵. Rafaela *et al* reported higher frequency of partial ossification of pterygospinous ligament - 19.36% when compared to complete ossification 8.61%²⁶. Agarwal *et al* studied 67 adult human skulls of Punjab region and revealed the incidence of pterygospinous bar as 9.7%—complete pterygospinous bridges in 2.99% and incomplete ones in 6.72% of skulls²⁷. The present study reports an incidence of 0.95% complete ossification of pterygospinous ligament bilaterally resulting in a well formed pterygospinous foramen.

In most of the above studies the incomplete variety was more common than complete one and unilateral variety was more common than the bilateral variety. The present study analysed morphologically exposed the presence of bilateral ossified pterygospinous ligament and civinini's foramen which may involved in multiple complication involving both vascular and nervous compression. The present observation (fig.1 and fig.2) on bilateral presence of pterygospinous bar in 1 skull out of 105 Skull bones makes the study clinically important with an incidence 0.95% .

5. Conclusion

Different authors have reported with different results, though and this difference is probably regional. The ossification of pterygospinous ligament is very rare^{8,9}. In the present study, the bilateral complete ossified pterygospinous ligament incidence 0.95% found 1 out of 105 dried human adult skull bones of either sex.

In most of the above studies the complete bilateral ossified pterygospinous ligament very rare. Whether complete or incomplete ossified pterygospinous ligament can produce various symptoms depending upon the dimensions of the pterygospinous foramina and grades of neurovascular compression.

Pterygospinous bar leads to difficulty while performing surgical operation on pterygoid region by leaving little space due to increase in width and flattening of lateral pterygoid plate causes less accessible space to gain entry into para and retropharyngeal space¹⁰. Thus, the knowledge of the ossified pterygospinous ligament is important for surgeons for planning surgical procedures and who perform invasive procedures in/near infratemporal fossa would

increases the success rate of the surgical procedures²⁵. Also important for anaesthetists and neurosurgeons since anomalous bony obstructions could interfere positioning the needle during transfacial needle approaches to foramen ovale³.

Therefore, the knowledge of Anatomical variation of the pterygospinous ligament- ossification is clinically important to radiologists and neurosurgeons, maxillofacial and dental surgeons, and anaesthetists along with academically for anatomists and anthropologists.

References

1. Standring S. Grays Anatomy. The Anatomical basis of clinical practice. 40th edition Edinburgh; Elsevier Churchill Livingstone, 2005: p.540.
2. Civinini F: The pterygospinous ligament as described by Filippo Civinini Pistoiese in 1837 [in Italian]. *Arch sc med-fis Toscane* 1, 1837; 381–387.
3. Shane Tubbs R et al. "Ossification of ligaments near the foramen ovale; An Anatomic study with potential clinical significance regarding transcuteaneous approaches to the skull base". *Neurosurgery*; 2009; 65(1): 60- 64.
4. Nayak SR, Saralaya V, Prabhu LV, Pai MM, Vadgaonkar R, D'Costa S: Pterygospinous bar and foramina in Indian skulls: Incidence and phylogenetic significance. *Surg Radiol Anat* 29, 2007: 5–7.
5. 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: 104–108.
6. Peuker ET, Fischer G, Filler TJ: Entrapment of the lingual nerve due to an ossified pterygospinous ligament. *Clin Anat* 2001; 14: 282–284.
7. Srijit Das and Shipra Paul. Ossified Pterygospinous ligament and its clinical implications. *Bratisl Lek Listy*, 2007; 108 (3): 141 -143.
8. Shinde V. S., Mallikarjun M., and Patil R., "Astudyonanossified pterygospinous ligament," *Journal of Clinical and Diagnostic Research* 2011; 5 (5): 978–979.
9. Shweta Solan and Gokul Krishna Reddy Nune. Anomalous ossified pterygospinous ligament in eastern Zone- a case study. *IOSR-JDMS* 2014; 13 (4): 60-62.
10. Ludinghausen M., Kageyama I., Miura M., and Aikhatib M., "Morphological peculiarities of the deep infratemporal fossa in advanced age," *Surgical and Radiologic Anatomy* 2006; 28 (3): 284–292.
11. Faig-Leite H, Faig-Leite FS, Fernandes RG. Anatomia do ligamento pterigoalar e do forame crotafítico bucinatório [resumo]. *Int J Morphol*, 2007; 25:15.
12. Suazo G, Zavando, M. D, Smith, R.L. Anatomical Study of the Pterygospinous and Pterygoalar Bony Bridges and Foramens in Dried Crania and its Clinical Relevance. *Int. J. Morphol.*, 2010; 28(2):405-408.
13. Soubhagya R Nayak, Rajalakshmi Rai. An unusual course and entrapment of the lingual nerve in the infratemporal fossa. *Comp. Anat*, 2008; 109[11]; 525-527.
14. Krmpoti'c-Nemani'c J., Vinter I., Hat J., and Jalsovec D., "Mandibular neuralgia due to anatomical variations," *European Archives of Oto-Rhino Laryngology*, 1999; 256 (4): 205–208.
15. Erdogmus S., Pinar Y., and Celik S., "A cause of entrapment of the Lingual nerve: ossified pterygospinous ligament- a case report," *Neuroanatomy*, 2009; 8: 43–45.
16. S. Das and S. Paul, "Ossified pterygospinous ligament and its clinical implications," *Bratislavsk é Lek árske Listy* 2007; 108 (3): 141–143.
17. Lang J., Skull base and related structures. *Schattauer, Stuttgart*, 1995: p.300 -311.
18. Kapur E., Dilberovi'c F., Redzepagi'c S., and Berhamovi'c E., "Variation in the lateral plate of the pterygoid process and the lateral subzygomatic approach to the mandibular nerve," *Medicinski arhiv*, 2000; 54 (3): 133–137.
19. Singh B., Srivastava SK., Dang R., Anatomic Considerations in relation to the maxillary nerve block. *Reg. Anesth Pain Med*, 2001; 26: p.507 – 511.
20. Wood J. F., "The non-metrical morphological characters of the skulls as criteria for racial diagnosis," *Journal of Anatomy* 1931; 65: 179–195.
21. Verma R. K., Rani A., Chopra J., Pankaj A. K., and Kumar N., "Civinini Bar: incidence in North Indians and its clinical relevance," *NJCA* 2013; 2 (3): 128–133.
22. Peker T., Karak'ose M., Anil A., Turgut H. B., and Gulekon N., "The incidence of basal sphenoid bony bridges in dried crania and cadavers: their anthropological and clinical relevance," *European Journal of Morphology*, 2002: 40 (3): 171–180.
23. Atamaz-Pinar Y., Arsu G., Aktan-Ekiz Z. A., and Bilge O. "Pterygospinous and pterygoalar bridges," *Sendrom*, 2004; 16 (7): 66–69.
24. Yadav Anjoo et al. "Pterygospinous bar and foramen in the adult Human skulls of North India; Its incidence and clinical relevance". *Anatomy research International*. Article id. 286794, 2014.
25. Thomson Jones Ebenraj et al. "Pterygospinous bar and multiple civinini foramen- A rare anatomical variant and its clinical implications". *Int J cur Res Rev*, 2014; 06(10).
26. Rafaela. R. Rosa et al. "Radiographic study of ossification of the pterygospinous and pterygoalar ligaments by the Hirtz axial technique. *Acta odontol. Latinoam*. 2010; 23 (1): 63-67.
27. Agarwal B., Gupta M., and Kumar H., "Ossified ligaments of the skull," *Journal of the Anatomical Society of India*, 2012; 61 (1): 37–40.