

## BILATERAL OSSIFICATION OF THE STYLOHYOID LIGAMENT

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The stylohyoid ligament extends from the styloid process of the temporal bone to the lesser horn of the styloid bone. Various forms of ossification of this anatomical structure have been described in the literature. In our case, there was bilateral ossification of the stylohyoid ligament, a very rare occurrence. Ossification was partial on the right, and complete on the left side. The right stylohyoid ligament was only loosely attached to the styloid process, followed by a larger, ossified part of the attachment, finally attaching to the lesser horn of the hyoid bone in the form of a connective tissue bond. On the left, styloid process was present with its base and completely ossified stylohyoid ligament all the way to the lesser horn of the hyoid bone. *Acta Medica Medianae* 2016;55(2):46-49.

**Key words:** stylohyoid ligament, ossification

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### Introduction

Lingual or hyoid bone, situated unarticulated in the muscles of the anterior portion of the neck, is associated with the visceral skeleton of the head, being itself a part of it, since it develops from the second and third branchial arches.

The stylohyoid bond, a ligament, is a fibrous band extending posteriorly and inwards from the eponymous muscle (1), starting from the apex of the temporal bone styloid process and reaching the lesser horn of the hyoid bone.

Stylohyoid process, stylohyoid ligament and lesser horn of the hyoid bone constitute the human stylohyoid complex or stylohyoid chain. The complex originates from the second branchial arch and has four parts: tympanohyal part, stylohyal part, ceratohyal part, and hypohyal part. Stylohyoid ligament sometimes undergoes ossification without any obvious reason, forming solid structures. Due to cartilaginous content of the ligament, different degrees of ossification may be present. Although partial ossification of the stylohyoid ligament is not uncommon, complete ossification

is rare. Due to variations in ossification and fusion of the elements, stylohyoid ligament may often have variable radiographic appearances (2).

The stylohyoid syndrome, or Eagle syndrome, occurs as the consequence of elongation of the styloid process or stylohyoid ligament calcification, which may give rise to painful sensations due to a pressure on different structures in the head and neck region (3). The syndrome is characterized by the symptoms suggestive of stylalgia, although less obvious, due to the irritation of the adjacent structures such as cranial nerves: trigeminal, glossopharyngeal, vagus, as well as carotid arteries. It may present as a unilateral neuralgia in the lateral neck and head regions, as unilateral dysphagia, transient lightheadedness, altered state of consciousness when assuming certain forced positions of the head and neck, and even as tinnitus.

The aim of the paper was to present an autopsy case of bilateral ossification of the stylohyoid ligament.

### Case report

The preparation was taken as a tissue block in an autopsy performed at the Institute of Forensic Medicine, Faculty of Medicine in Niš. It was a 50 years old individual who had died due to polytraumas as the consequence of falling from a building. Based on the retrospective patient history given by the relatives, the deceased had occasionally complained of mild discomfort in the neck region.

The above sample was fixated to the plate and became a part of the osteology collection of the Institute of Anatomy, Faculty of Medicine in Niš.



**Figure 1.** PP. Petrous pyramid of the temporal bone, AP. Apex of the petrous pyramid of the temporal bone, PM. Mastoid process, PS. Styloid process, LS. Loose connection with the styloid process, SB. Suprahyoid bone (ossified ligament), LH. Loose connection with the lesser horn.

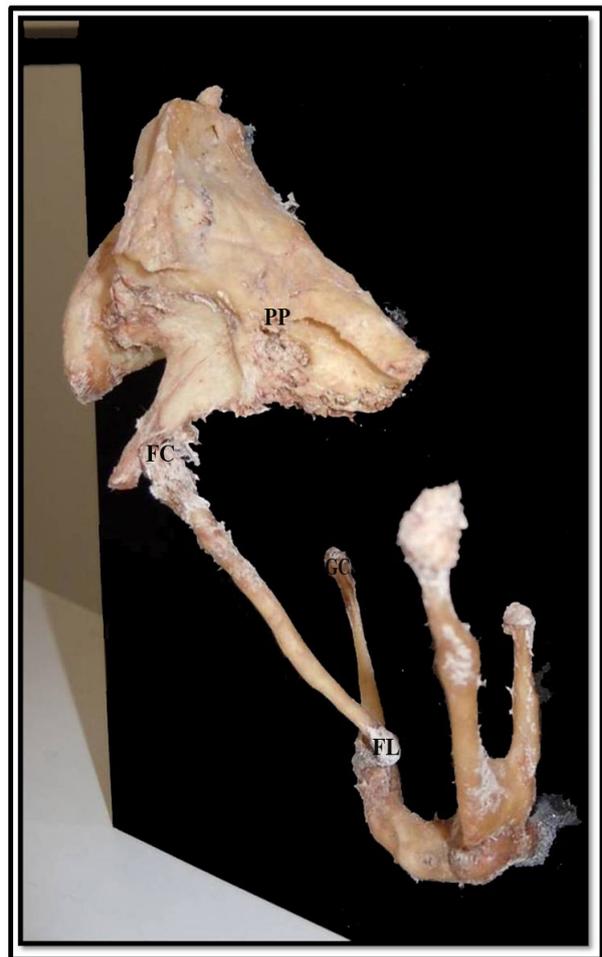
After sampling, the material was fixed in 10% formalin; after that, the soft tissue was carefully removed, and bony part was prepared, dried and fixed to a plate. Only a macroscopic examination of the structure was performed, and due to that only complete ossification of the stylohyoid ligament could be identified, while we were not able to establish the degree of ossification using this simple method.

On the right side, ossification of the stylohyoid ligament was partial, and on the left ossification was complete. The right stylohyoid ligament was only loosely attached to the styloid process, followed by a larger, ossified part of the ligament, finally attaching to the lesser horn of the hyoid bone in the form of a connective tissue bond. The ossified part was marked as a supernumerary suprahyoid bone (Figure 1).

On the left side, only the styloid process was present with its base, as well as the completely ossified stylohyoid ligament, all the way to the lesser horn of the hyoid bone. The attachments of the stylohyoid ligament to the styloid process and lesser horn of the hyoid bone were clearly visible (Figure 2, 3).



**Figure 2.** EC. Ear canal, PM. Mastoid process, PS. Styloid process, LC. Loose connection with the styloid process, SB. Suprahyoid bone (ossified ligament), LS. Loose connection with the lesser horn



**Figure 3.** PP. Petrous pyramid of the temporal bone, FC. Firm connection with the styloid process, GC. Greater cornu of the hyoid bone, FL. Firm connection with the lesser horn.

## Discussion

Styloid process, stylohyoid ligament, and lesser horn of the hyoid bone form the styloid apparatus, which originally derives from the Reichert's cartilage of the inferior branchial arch during embryogenesis. Styloid process, a thin and elongated bony part of the temporal bone, extends caudally, medially and anteriorly in the direction of the maxillo-vertebro-pharyngeal recess. Elongated styloid process or calcified stylohyoid ligament may exert pressure on the adjacent structures (i.e. on the carotid arteries, internal jugular vein, facial nerve, glossopharyngeal nerve, vagus, and hypoglossal nerve), producing various pressure symptoms. It is believed that around 4% of the human population have an elongated styloid process. Among these, it is thought that a small percentage (from 4% to 10.3%) have the symptoms suggestive of the anomaly. Most patients with a calcified stylohyoid ligament and symptoms of the Eagle syndrome are over fifty years of age (3, 4). There have been several theories attempting to explain etiopathogenesis of the syndrome, such as congenital elongation of the stylohyoid process and calcification of the stylohyoid ligament. The presence of an ossified stylohyoid ligament and elongated stylohyoid process, with or without symptoms, was reported by a number of authors in the late XIX and early XX century. The incidence of radiographic stylohyoid ossification ranged in the reports from 1.4% to 84.4%, probably as the result of different definitions used to describe the phenomenon. It is usually a bilateral condition, although unilateral cases have been described (5). Human stylohyoid chain is characterized by considerable anatomical variability. In the results of a study of 1.215 autopsy samples, in 11 cases complete ossification of the stylohyoid ligament was found (of which 7 male and 4 female; male-to-female ratio, 1.75); in 9 cases ossification was bilateral; and in 2 cases it was unilateral. In another case, a fractured ossified stylohyoid ligament was described (6). Age structure of the cases was as follows: two cases in their second decade of life, five cases in the fifth, three in fourth, and one case in the sixth decade of life.

The term calcification has been used originally, but it is nowadays considered incorrect. Ossification is the preferred, more precise term, indicating histologically throughout literature a hyperplasia of the styloid process or metaplasia of the stylohyoid ligament.

Concerning the association of the degree of ossification with age, conflicting information have been presented so far. Earlier studies have suggested that most of the ossified spots in the stylohyoid ligament occur in childhood and adolescence. The average length of the spots suggested a rapid, linear growth with advancing age up to the end of adolescent period, while subsequent growth was non-linear and much slower (7, 8).

Fractures of an ossified stylohyoid ligament

are most commonly encountered during autopsies. Generalizations about the fractures of an ossified stylohyoid ligament cannot be made due to a small number of cases reported in the available literature. A proximate cause can be as weak as, for instance, yawning, but blunt traumas of a more serious nature could occur, too.

An ossified stylohyoid ligament is also mentioned as an unforeseen cause of difficulties in performing tracheal intubation (9). An immovable larynx, as the direct result of stylohyoid ligament ossification and elevation of the epiglottis due to anterior and upward traction of the hyoid bone, makes direct laryngoscopy difficult, too. In the absence of an appropriate management, more serious traumatic consequences may ensue, as well as the risk of regurgitation and aspiration, especially in emergency conditions.

There are data in the available literature that an ossified stylohyoid ligament can be accompanied by an anomaly of the atlas (suboccipital) part of the vertebral artery. Any demonstration of an ossified stylohyoid ligament may signal the presence of arterial anomalies as well (10). Such individuals may be more susceptible to insults in the head and neck region due to disturbed blood flow. This information may have clinical and medicolegal implications for the therapists performing spinal manipulations in the region of the neck. Therapists should be able to identify the patients at risk of complications from minor traumas. Consequently, in the presence of any signs of vertebrobasilar insufficiency, such manipulations should be avoided (11).

In the case presented here, based on hetero-anamnestic data that the deceased had had discomforts in the cervical region, we may infer that these were most probably caused by compression of the carotid sinus by the calcified stylohyoid ligament. The compression could lead to low blood pressure causing a transient lapse of consciousness and balance, or a reflex cardiac inhibition mediated by the vagus nerve, that could cause falling from a height and consequently death.

## Conclusion

In our work, a very rare bilateral ossification of the stylohyoid ligament was presented. On the right side, there were two loose connections with the styloid process of the temporal bone and lesser horn of the hyoid bone, so that the middle ossified part represented a suprahyoid bone. On the left, the ossification was complete, with a firm connection with the styloid process of the temporal bone and lesser horn of the hyoid bone. In the absence of any external injury to the body, the concept of a calcified stylohyoid ligament should be borne in mind in case of a sudden, unexpected death, when the carotid sinus could have been stimulated and when reflex cardiac inhibition mediated by the vagus nerve could have occurred.

## References

1. Williams Pl. Gray s Anatomy.Churchill Livingstone. New York Edinburg London Tokyo Madrid an Melbburne: 1995.
2. García-Navalón C, Reboll-Ferrer RM, Armengot-Carceller M, Basterra-Alegria J. Stylohyoid syndrome. Acta otorinolaringologica Esp.2009; 60(6):459-60. [[CrossRef](#)] [[PubMed](#)]
3. Raina D, Gothi R, Rajan S. Eagle syndrome.Indian J Radiol Imaging. 2009;19(2):107-8. [[CrossRef](#)] [[PubMed](#)]
4. Rao PP, Menezes RG, Naik R, Venugopal A, Nagesh KR, Madhyastha S et al. Bilateral calcified stylohyoid igament:an incidental autopsy findingwith medicolegal significance.Leg Med (Tokyo). 2010;12 (4): 184-7. [[CrossRef](#)] [[PubMed](#)]
5. Vougiouklakis T. Overview of the ossified stylohyoid ligament based in more than 1200 forensic autopsies.J Clin Forensic Med. 2006; 13(5): 268-70. [[CrossRef](#)] [[PubMed](#)]
6. Murtagh RD, Caracciolo JT, Fernandez G. CT findings associated with Eagle syndrome.AJNR Am J Neuroradiol. 2001;22(7):1401-2. [[PubMed](#)]
7. O Carroll MK. Calcification in the stylohyoid ligament.Oral Surg Oral Med Oral Pathol. 1984;58(5): 617-21. [[CrossRef](#)] [[PubMed](#)]
8. Krennmair G, Piehslinger E. Variants of ossification in the stylohyoid chain.Cranio. 2003;21(1):31-7. [[PubMed](#)]
9. Ames WA, McNiellis N. Stylohyoid ligament calcification as a cause of difficult intubation? Anaesthesia. 1998;53(4):415-6. [[PubMed](#)]
10. Balbuena L Jr, Hayes D, Ramirez SG, Johnson R. Eagle's syndrome (elongated styloid process). South Med J. 1997;90(3): 331-4. [[CrossRef](#)] [[PubMed](#)]
11. Gossman JR, Tarsitano JJ. The styloid-stylohyoid syndrome. J Oral Surg. 1977;35(7):555-60. [[PubMed](#)]

Prikaz bolesnika

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doi:10.5633/amm.2016.0208OBOSTRANA OSIFIKACIJA STILOHIOIDNOG  
LIGAMENTAMilorad Antić<sup>1</sup>, Vladimir M. Antić<sup>2</sup>, Braca Kundalić<sup>1</sup>, Dane Krtinić<sup>3</sup>,  
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Stilohioidni ligament se pruža od stiloidnog nastavka slepoočne kosti do malog roga hioidne kosti. U literaturi su opisani različiti oblici okoštavanja ove anatomske strukture. U našem slučaju, radi se o obostranoj osifikaciji stilohioidnog ligamenta, što se veoma retko sreće. Sa desne strane osifikacija je delimična, a sa leve potpuna. Desni stilohioidni ligament je labavom vezom pričvršćen za stiloidni nastavak, a zatim sledi veći, okoštali deo veze, da bi se u vidu vezivno-tkivnog spoja pripojio za mali rog hioidne kosti. Levo je prisutan stiloidni nastavak sa svojom osnovom i potpuno okoštali stilohioidni ligament sve do malog roga hioidne kosti. *Acta Medica Medianae* 2016;55(2):46-49.

**Ključne reči:** stilohioidni ligament, osifikacija

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