

MORPHOMETRIC STUDY OF STYLOID PROCESS OF THE TEMPORAL BONE AND ITS CLINICAL IMPORTANCE

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ABSTRACT

Background: Styloid process is a slender pointed piece of bone projecting downwards from the inferior surface of temporal bone and gives attachment to muscles and ligaments. An elongated styloid process can compress the vital vessels and nerves close to it. The aim of the present study was to study the morphometric data of various parameters of styloid process and clinical importance of elongated styloid process.

Materials and Methods: 73 dry skull bones with intact styloid process in the Govt Thiruvannamalai Medical college and Govt Mohan Kumaramangalam Medical college, Salem. Length more than 30mm was considered as an elongated styloid process. All measurements such as length of the styloid process, interstyloid distance, thickness at base of styloid process, distance between styloid process and stylomastoid foramen were measured using digital vernier callipers in millimetres.

Results: We found average length of styloid process was 18.2mm and 16.8 mm on the right side and left side respectively. Average distance between two styloid processes at base was 72.0 mm and at tip it was 64.4 mm. Average thickness at the base of styloid process on the right side 4.34 mm and on left side 4.47mm. The average distance between styloid process and the stylomastoid foramen was 3.74mm on right side and 3.43mm on left side.

Conclusion: Anatomical knowledge of the styloid process and elongated styloid process is clinically important because of its close proximity to important neurovascular structures. Our study enlightens the importance of styloid process in patients with symptoms of Eagle's Syndrome. These findings may be useful for physicians, surgeons, radiologists, otorhinolaryngologists, dentists and for anatomists as an academic interest.

KEY WORDS: Styloid process, Eagle syndrome, Elongated styloid process, Temporal bone.

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INTRODUCTION

The Styloid process is a slender, pointed piece of bone projecting downwards from the inferior surface of temporal bone. Its length ranges from a few millimetres to an average of 2.5cms. It can be straight or anteromedially curved. Its

proximal tympanohyal part is ensheathed by tympanic plate and its distal stylohyal part gives attachment to muscles and ligaments. It is related to important structures such as parotid gland laterally, facial nerve to its base, external carotid artery crossing its tip and the beginning of internal jugular vein medially [1].

Reichert's cartilage, the second arch cartilage ossifies to form upper part of body and lesser cornua of hyoid bone distally and styloid process proximally. The unossified cartilage disappears, its perichondrium persists as stylohyoid ligament [2].

The stylohyoid ligament which extends between the styloid process and hyoid bone is sometimes ossified at the proximal end to form an abnormally long styloid process. Incidence of elongated styloid process is 14% [3]. W.Eagle coined the term stylalgia to describe the pain associated with elongated styloid process.

The objective of present study is to analyse the morphometric data of various parameters of styloid process and clinical importance of elongated styloid process.

MATERIALS AND METHODS

Present study was conducted in 73 adult dry skulls with intact styloid process in the Govt Thiruvannamalai Medical college and Govt Mohankumaramangalam Medical college, Salem. Styloid process were studied under following parameters using digital vernier callipers with millimeter scale

- 1.Length of styloid process
- 2.Distance between the two styloid process at the base(Fig.2)
- 3.Distance between the two styloid process at the tip(Fig.3)
- 4.Thickness at base of styloid process(Fig.4)
- 5.Distance between the styloid process and Styломastoid foramen.

RESULTS

Table 1: Morphometric data of the styloid process of temporal bone.

Parameters	Right Side (mm)	Left side (mm)
Average Length of Styloid process	18.2mm	16.8
Average distance between two Styloid process at the base	72	
Average distance between two Styloid process at the Tip	64.4	
Thickness at the base of Styloid process	4.34	4.47
Distance between Styloid process and styломastoid foramen	3.74	3.43

Fig. 1: Lateral view of skull with arrow showing right elongated styloid process.



Fig. 2: Measurement between bases of the styloid process with the help of digital vernier callipers.



Fig. 3: Measurement between tip of the styloid process with the help of digital vernier callipers.

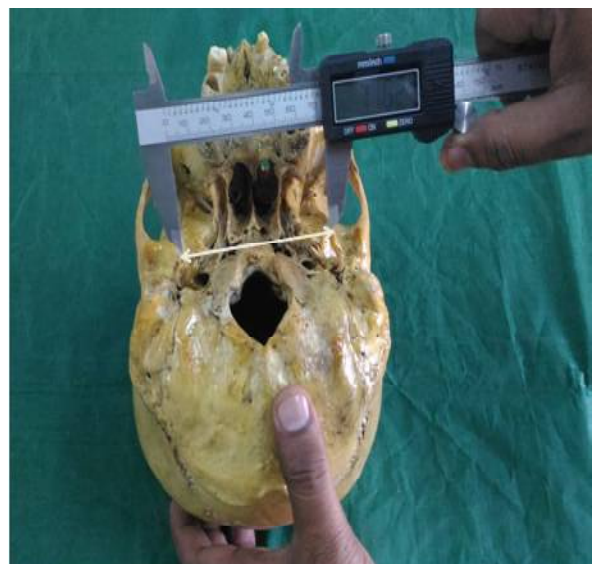
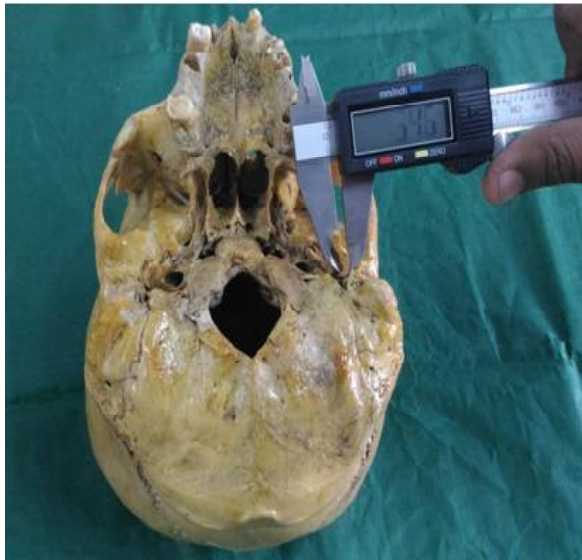


Fig. 4: Measurement of thickness at the base of Styloid process.



After studying 73 adult dry skulls the mean length of styloid process was 18.2 mm on right side and 16.8 mm on left side. Mean distance between the two styloid process at their base was 72.0 mm and at the tip it was 64.4mm. Mean thickness at the base of styloid process on right side 4.34mm and on left side 4.47mm. The mean distance between the styloid process and the stylomastoid foramen was 3.74mm on right side and 3.43 mm on the left side.

Two out of 73 skulls showed elongated styloid process with incidence of 2.7%.

DISCUSSION

Eagle stated that length of a normal styloid process is 2.5 – 3cm [12]. Moffat et al found that the styloid process vary from 1.52 cm to 4.77cm [5]. Kaufman et al mentioned that the length of styloid process was less than 3cm [6] and according to Lindeman the length of the styloid process ranges from 2cm to 3cm [7]. The length of styloid process may vary greatly on the right and left side in same individual [8]. In our present study the length of the styloid process ranges between 16.2mm and 45mm and the length of the styloid process vary in right side and left side in same individual.

There are very few studies on the interstyloid distance at base and tip. Patil et al (2014) stated that interstyloid distance at base was 6.9 cm and tip was 6.4cm [3]. Margam SR (2015) mentioned that distance between two styloid process at the base was 68mm in male and

67.4mm in female [19]. In present study the interstyloid distance was 72.0mm at base and 64.4mm at tip and our results coincides with Patil et al [18], Margam SR et al [19] and Rajanigandha Vadgaonkar [20]. Interstyloid distance is clinically important as this space accommodates important structure of neck like cranial nerves, larynx, oesophagus, arteries and veins. The average thickness at the base of styloid process in the present study was similar with Margam et al [19] and Rajanigandha Vadgaonkar [20]. The clinical significance of the base is if thickness at base increases it may compress the facial nerve.

The average distance between styloid process and stylomastoid foramen is 3.74mm and 3.43mm in right and left respectively and it coincides with standard text book of anatomy [1,9,21]. Because of the close proximity of the styloid process with stylomastoid foramen, styloid process may irritate facial nerve and care should be taken during surgical excision of the elongated styloid process.

Length more than 30mm was recorded as an elongated styloid process. In the present study the elongated styloid process in one right side of a skull measures 45mm (Fig.1) and one in left side of skull which measures and 36mm. Embryologically the styloid process, stylohyoid ligament and lesser cornua of the hyoid bone are developed from the second pharyngeal arch (Reichert's cartilage) because of its cartilaginous origin stylohyoid ligament has the potential to mineralize [9], so the length of styloid process is variable. Saheib et al mentioned that the incidence of the elongated styloid process is 3.87% [10] and according to Dhanalakshmi et al the incidence was 6.1%. In our study the incidence was 2.1%. Eagle syndrome is associated with unilateral or bilateral elongated styloid process or stylohyoid ligament calcification. Eagle described two types of syndrome, classic styloid syndrome occurring usually after tonsillectomy and characterized by dysphagia, odynophagia, increased salivary sensation, foreign body sensation and sometimes vocal cord changes. The second stylocarotid syndrome caused by compression of stylohyoid complex exerting pressure on carotid arteries regardless of

tonsillectomy and symptoms are caused by stimulation of sympathetic nerve plexus around the blood vessels. Parietal headache, orbital pain can occur and in severe case vision disturbances and syncopal attacks can also occur [12].

An elongated styloid process occur in about 4% of general population, only a small percentage (between 4% and 10.3%) of these patients is symptomatic with a female to male predominance of 3:1 [22]. The elongated styloid process syndrome is often observed in third and fourth decades of life and in women more frequently than in men [13]. The calcified stylohyoid complex correlates with serum calcium concentration and bone density [14]. Symptoms like pain on turning the head, discomfort on swallowing, pain on protrusion of tongue can occur and may be due to traumatic fracture of styloid process, compression of adjacent nerves [12]. The Calcified stylohyoid ligament felt as a solid mass in the tonsillar fossa and restricts the movement of the hyoid bone [12]. Calcified stylohyoid ligament may be a cause for difficult intubation [16].

Elongated styloid process can be diagnosed and confirmed by taking X-ray skull lateral view and skull base CT scan. The symptoms can be relieved by surgical excision, the elongation will be made short by cutting it with the trans tonsillar and external approaches, avoiding injury to the surrounding neurovascular structures.

CONCLUSION

Anatomical knowledge of the styloid process and elongated styloid process is clinically important because of its close proximity to important neurovascular structures. Any anatomical variations may present with compression symptoms, dysphagia and neck pain. The surgical anatomy of elongated styloid process is important for the neurosurgeons and radiologist while interpreting the computed tomogram scans and magnetic resonance images. This morphometric data of the styloid process is important to the physicians, neurosurgeons, otorhinolaryngologist and dentists for accurate diagnosis and treatment of dysphagia and chronic neck pain. In undiagnosed neck or facial intermittent pain and

dysphagia investigations should be done to rule out an elongated styloid process.

Conflicts of Interests: None

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