

# Morphological variations of styloid process

R Suneer<sup>1\*</sup>, V Anitha<sup>2</sup>

{<sup>1</sup>Associate Professor, Department of Otorhinolaryngology} {<sup>2</sup>Associate Professor, Department of Anatomy}  
Kanyakumari Medical College, Asaripallam, Tamil Nadu, INDIA.

Email: [entsuneer@gmail.com](mailto:entsuneer@gmail.com), [dranitharamesh@gmail.com](mailto:dranitharamesh@gmail.com)

## Abstract

The styloid process about 2.5cm long extends downwards and forwards and it is developed from the dorsal end of the cartilaginous part of second branchial arch. Anatomical variations of the styloid process and its ligament may be responsible in some patients for vague symptoms referable to the throat and neck. Eagle's Syndrome represents symptoms brought on by compression of regional structures by elongation of styloid process or ossification of the stylohyoid or stylomandibular ligament. Elongated styloid process results in a variety of symptoms which range from chronic facial pain, dysphagia, tinnitus, referred pain in ear, glossopharyngeal neuralgia, orbital pain and radiating pain in maxillary regions. Adequate knowledge about the anatomy of the styloid process, its morphological and related structures is essential for clinicians, surgeons and radiologists. The aim of this study was to investigate the morphological variations of styloid process with the available dry skulls and temporal bones.

**Key Words:** Styloid, stylohyoid, Eagle's syndrome.

## \*Address for Correspondence:

Dr. R. Suneer, Associate Professor, Department of Otorhinolaryngology, Kanyakumari Medical College, Asaripallam, Tamil Nadu, INDIA.

Email: [entsuneer@gmail.com](mailto:entsuneer@gmail.com)

Received Date: 13/07/2018 Revised Date: 10/08/2018 Accepted Date: 22/09/2018

DOI: <https://doi.org/10.26611/1016814>

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Accessed Date:  
09 October 2018

## INTRODUCTION

The word styloid process has been originated from the word called 'stylos' in Greek language. It means 'The Pillar'. Styloid process is a bony projection directed downwards between external and internal carotid arteries. It provides attachment to stylohyoid, styloglossus and stylopharyngeus muscles. It also provides attachment to stylohyoid and stylomandibular ligaments<sup>2</sup>. The stylohyoid chain extends between the temporal and hyoid bones and is generally divided into four sections as tympanohyal, stylohyal, ceratohyal and hypohyal<sup>1</sup>. Tympanohyal- base of styloid process, stylohyal-shaft of styloid process, ceratohyal- stylohyoid ligament, hypohyal- lesser cornua of hyoid bone.<sup>3</sup> The styloid process is related medially to internal jugular vein along with the

cranial nerves VII, IX, X, XI and XII<sup>4</sup>. Elongated styloid process is significant if either the styloid process or the adjacent stylohyoid ligament ossification shows an overall length of more than 30mm. Elongated styloid process accounts approximately to 4-7% of the population and 4% are symptomatic.<sup>5</sup>

## MATERIALS AND METHODS

The styloid processes of 50 dry skulls (34 full skulls and 16 bases) and 10 separate temporal bones of unknown age and sex were studied in Department of Anatomy, Kanyakumari Government Medical College, Asaripallam. The dried skulls which had damaged styloid processes were excluded from the study. The length of styloid process and interstyloid distance at three points (base, midpoint and tip) of the skulls were measured using vernier calipers. The parameters were compared with both sides. The length of styloid process of the separate temporal bones were measured using vernier caliper.

## OBSERVATION AND RESULTS

About 50 dry skulls were studied. mean length of styloid process in the skull (34 full skulls and 16 bases)

**Table 1: Mean interstyloid distance**

AT BASE	67.5±3.4mm
AT MIDPOINT	61.3±2.1mm
AT TIP	59.8±2.3mm

**Table 2:** Mean length of styloid process in the skull

Right Side	Left Side
2.304 cm (or) 23.04mm ± 4.36 mm	2.26 cm (or) 22.62mm ±3.86 mm

**Table 3:** Mean length of Styloid process in separate Temporal bones.

Right	Left
1.98 cm (or) 19.83mm	2.56 cm (or) 25.66 mm
2.275 cm (or) 22.745 mm	

One separate temporal bone had a styloid process measuring 45mm (4.5cm) Microsoft Excel and SPSS programs were used for Statistical analysis.

### DISCUSSION

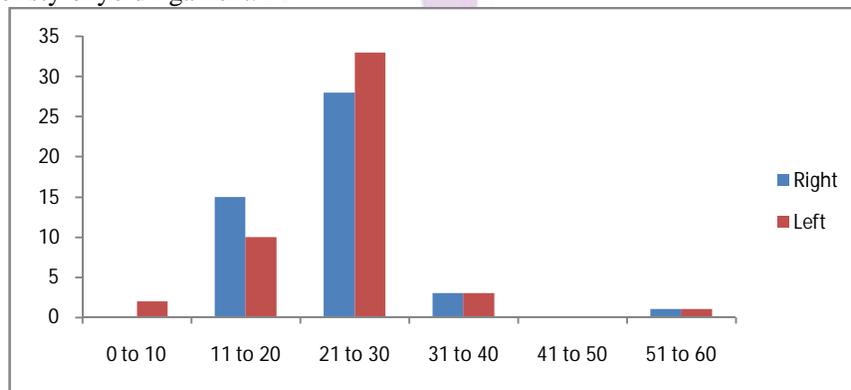
The hyoid apparatus is made up of three cartilaginous elements that go from the base of the cranium to the hyoid bone. The portions cranially to caudally are as follows stylohyal, ceratohyal and apohyal. Fusion and ossification of the three components will bring somewhat long stylohyoid processes, whereas the stylohyal portion is the one that gives rise to the authentic stylohyoid process<sup>6</sup> Steinman has quoted three theories of ossification.

1. Theory of reactive hyperplasia-trauma induces ossification at the end of styloid process down the length of styloid ligament since the styloid ligament contains remnants of connective tissue of fibrocartilaginous origin, the potential for ossification remains.
2. Theory of reactive metaplasia-an abnormal post traumatic healing restyloid process initiates the calcification of stylohyoid ligament.

3. Theory of anatomic variance-the early recognition of the styloid process and ossification of the styloid ligament are anatomical variations that occur without recognizable trauma<sup>7</sup>

Eagle reported that a normal styloid process measures between 25mm to 30mm and any length more than the above mentioned values is considered as the pathogenic factor for Eagle's syndrome<sup>8</sup>

Eagle has divided the syndrome into two categories. The classic styloid syndrome presents mainly after tonsillectomy and characterized by dysphagia,odynophagia, increased salivation and a sensation of foreign body in pharynx. The stylo carotid syndrome presents with a stylohyoid complex exerting pressure on internal and external carotid arteries regardless of tonsillectomy. It is mainly by stimulation of sympathetic nerve plexus around blood vessels<sup>9</sup> There are cases in which styloid process has reached 8 cm as stated by Chandler 1977, Glogoff et al 1981, Laufer and Ruf 1981 and O'Rahilly 1986<sup>10,11,12,13</sup>. Kaufman et al and Ferrario et al have stated that the styloid process has a length of about 2-3 cms<sup>14,15</sup>. Patil et al has quoted that anterior angulation and distance between bases and tips are decreased in elongated styloid process, while medial angulation showed no significant change<sup>16</sup>. Elongated styloid process is also responsible for the difficult endotracheal intubations which were experienced by anesthesiologists<sup>17</sup>. In our present study, the length of styloid process are.



**Figure 1:** Length in mm

Differential diagnosis of Eagle's Syndrome include unerupted molar tooth, dental prosthesis implantation, diseases of TMJ, tumours in oropharynx and laryngopharynx<sup>18</sup>.

### CONCLUSION

The symptoms of Eagle's syndrome can be easily confused with other types of craniomandibular disorders.

It can be diagnosed by a detailed history, physical examination and radiological investigations. Resection of the elongated styloid process is the treatment of choice. An awareness about the differential diagnosis is important to all the surgeons involved in treatment of head and neck pain to rationalize the line of management.



Figure 1



Figure 2



Figure 3



Figure 4

**Figure 1:** Temporal bone with styloid measuring 50 mm; **Figure 2:** Longest styloid measuring 52mm; **Figure 3:** Measurement of styloid process using vernier calliper; **Figure 4:** Measurement of interstyloid distance

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Source of Support: None Declared  
Conflict of Interest: None Declared