

## Study of Elongated Styloid Process in Dry Human Skulls of North Indian Population

Rakesh Kumar Diwan<sup>1</sup>, Archana Rani<sup>2</sup>, Arvind Kumar Pankaj<sup>3</sup>, Rakesh Kumar Verma<sup>4</sup>, Jyoti Chopra<sup>5</sup>, Navneet Kumar<sup>6</sup>

<sup>1</sup>Department Of Anatomy, King George's Medical University, Lucknow, UP, India)

<sup>2</sup>Department Of Anatomy, King George's Medical University, Lucknow, UP, India)

<sup>3</sup>Department Of Anatomy, King George's Medical University, Lucknow, UP, India)

<sup>4</sup>Department Of Anatomy, King George's Medical University, Lucknow, UP, India)

<sup>5</sup>Department Of Anatomy, King George's Medical University, Lucknow, UP, India)

<sup>6</sup>Department Of Anatomy, King George's Medical University, Lucknow, UP, India)

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**Abstract:** The aim of the present study was to analyze the incidence of elongated styloid process and determine the average length and width of styloid process. The present study was carried out on 70 dry human skulls of unknown age and sex, collected from the anthropology lab of anatomy department of King George's Medical University, Lucknow, UP. The length and width of styloid process on both right and left sides was measured by digital vernier caliper. The length of smallest styloid process was 11.85 mm on the left side while 12.15 mm on right side. The longest styloid process was 30.00mm on the left side whereas 29.85mm on the right side. The mean length of styloid process on left side was 22.89 mm whereas on right side was 21.93 mm. Seven skulls showed elongated styloid process. The length of elongated styloid process of left side was 44.94mm whereas of right side 42.08 mm. The thickness varied from 1mm to 4mm on both the sides. The knowledge of styloid process is beneficial to ENT surgeons, Neurologists and Radiologists in daily clinical practice for proper diagnosis and treatment of Eagle's syndrome.

**Keywords:** Skull, Elongated styloid process, Temporal bone, Eagle's syndrome.

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### I. Introduction

The styloid process is slender, pointed and projects anteroinferiorly from the inferior aspect of temporal bone. Its length varies, ranging from a few millimetres to average of 2.5 cm. Often almost straight, it can show a curvature, an anteromedial concavity being most common. Its proximal part (tympanohyl) is ensheathed by the tympanic plate, especially anterolaterally, while muscles and ligaments are attached to its distal part (stylohyal). In vivo, its relationships are important. The styloid process is covered laterally by the parotid gland, the facial nerve crosses its base; the external carotid artery crosses its tip, embedded in the parotid; and medially, the process is separated from the beginning of the internal jugular vein by the attachment of stylopharyngeus [1]. The stylohyoid ligament extends from the tip of the styloid process up to the lesser cornu of the hyoid bone and the stylomandibular ligament, commences under the attachment of styloglossus muscle and ends on the angle of mandible.

Eagle's syndrome (ES) was first documented by Watt W. Eagle an otorhinolaryngologist in the year 1937. ES occurs when an elongated styloid process or calcified stylohyoid ligament causes recurrent throat pain or foreign body sensation, dysphagia or facial pain. Eagle described the syndrome and stated that the normal styloid process is approximately 2.75 cm and any styloid process beyond that may be considered elongated [2].

The presence of an elongated styloid process is not usually a pathognomonic finding for Eagle's syndrome. There are previous reports showing that the abnormal angulation rather than the elongation of the styloid process might be responsible for irritating numerous structures surrounding the styloid process leading to Eagle's syndrome [3,4]. The aim of the present study is to know the incidence of elongated styloid process and determine the mean length of styloid process.

### II. Material And Methods

The present study was conducted on 70 dried adult human skulls of unknown age and sex obtained from the anthropology lab of Anatomy department of King George's Medical University, UP, Lucknow. Broken and damaged skulls were excluded from study. The length and width of styloid process on both right and left sides of dry human skulls were measured by using digital vernier caliper. Length was measured from the base of skull to apex of styloid process. Each skull was closely observed for presence of elongated styloid process.

### III. Observation And Results

The length of smallest styloid process was 11.85 mm on left side while 12.15 mm on right side. The longest styloid process was 30.00 mm on left side whereas 29.85 mm on right side. The mean length of styloid process on left side was 22.89 mm whereas on right side was 21.93 mm. The maximum length of elongated styloid process on left side was 44.94 mm whereas on right side was 42.08 mm. The width of styloid process was 1-4mm. The present study showed that the length of styloid process was more than 30 mm in 7 (10%) skulls (Table1-3, Fig. 1-3).

**Table 1:** Mean length of styloid process

Styloid process Length	Left (mm)	Right (mm)
Longest	30.00	29.85
Smallest	11.85	12.15
Mean	22.89	21.93

**Table2:** Length of elongated styloid process on right & left sides

No. of skull	Length of elongated styloid process on left side (mm)	Length of elongated styloid process on right side (mm)
Skull 1	36.88	41.24
Skull 2	44.94	39.18
Skull 3	38.64	42.08
Skull 4	34.26	39.88
Skull 5	43.08	33.28
Skull 6	40.82	36.35
Skull 7	35.45	37.56

**Table 3:** The incidence of variation in length of styloid process

Length of styloid process (mm)	Number of skull	Percentage (%)
0-10	0	0
11-20	25	35.72
21-30	38	54.29
>30	7	10



**Fig. 1:** Photograph showing smallest styloid process



**Fig. 2:** Photograph showing elongated styloid process (unilateral)



**Fig. 3:** Photograph showing elongated styloid process (bilateral)

### IV. Discussion

The stylohyoid chain components are derived embryologically from the first and second branchial arches in four distinct segments: tympanohyal, stylohyal, ceratohyal and hypohyal segments. These segments are derived from Reichert's cartilages that ossify in two parts; the styloid process develops from the tympanohyal and stylohyal segments that usually fuse at puberty. The lesser cornu of the hyoid bone arises from the hypohyal segment. Connecting these two structures, the stylohyoid ligament originates from the ceratohyal segment[5]. Excessive or abnormal ossification of stylohyoid complex components during development may result in abnormally elongated or angulated styloid process. Traumatic stimulus can also lead to multiple metaplastic alterations in the cells of the styloid ligament, which results in its total or partial ossification [6]. Finiet.al (2013) reported that post tonsillectomy is related to Eagle's syndrome[7].

Many previous studies have been done on length of styloid process and its relation to Eagle's syndrome. Generally, no correlation has been found between the severity of complaints and the length of stylohyoid chain ossification in symptomatic patients. It has been reported that abnormal angulations rather than elongation of the process is responsible for some concentrated symptoms. There have been studies investigating the angulation and length of the styloid process of the patients without symptoms of elongated styloid process

with radiological studies. According to one study, the anterior angulation and the length of the styloid process are responsible for the symptoms of Eagle's syndrome [8-11]. Promthale et al (2012) studied 176 Thai dry and 150 cadaveric skulls and found that the mean length of all styloid process was  $24.12 \pm 7.28$  mm. Out of all, 18.40% were elongated styloid process [12]. That et al (2000) reported that in Indian subjects, length of styloid process on the left side varied from 0.8 cm to 2.4 cm while average length of styloid process on the left and right side were 1.52 cm and 1.59 cm respectively [13]. Chauhan et al in their study observed that out of 110 skulls, in 16 skulls the length of styloid process was more than 30 mm [14]. Results of present study showed that out of 70 skulls, 7 (10%) skulls had length of styloid process more than 30 mm which is consistent with the study of Chauhan et al.

An elongated styloid process is clinically important as it leads to Eagle's syndrome. In this syndrome, the elongated styloid process causes recurrent throat pain, foreign body sensation, dysphagia and facial pain. Elongated Styloid process can also cause transient ischemic attack due to compression of internal carotid artery. Anatomical variation in length of styloid process and its stylohyoid chain is of profound anatomical, anthropological as well as clinical importance.

## V. Conclusion

The knowledge of styloid process may be beneficial to ENT surgeons, Neurologists, and Radiologists in daily clinical practice for proper diagnosis and treatment of Eagle's syndrome.

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