



MORPHOLOGICAL STUDY OF STYLOID PROCESS AND ITS VARIATIONS IN HUMAN SKULL

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ABSTRACT

Styloid process is a thin elongated piece of bone projecting downwards from the inferior surface of temporal bone and gives attachment to three muscles and two ligaments. The aim of this study was to know the morphometry of various parameters in styloid process and its clinical significance. In this study, 96 skulls were used out of which 11 skulls had length more than 3cm indicating elongated styloid process. The elongated styloid process had significant variations in anterior angle, distance from its tips and its bases. These variations can compress the important vessels and nerves around it. These may be useful for surgeons, radiologists, otorhinolaryngologists, and dentists for diagnosing these types of signs and syndromes.

KEY WORDS: *Styloid process, Eagle Syndrome, Carotid vessels, Headache*



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INTRODUCTION

Styloid process of temporal bone is a pointed projection from the petrous part of temporal bone which ranges with an average of 2.6mm in length. It has various muscle and ligament attachment¹. The muscles that are attached to styloid process are stylopharyngeus, stylohyoid and styloglossus. The stylohyoid and stylomandibular ligaments are also attached making a complex styloid apparatus.² The styloid process lies behind the pharyngeal wall between the internal and external carotid arteries in close proximity with glossopharyngeal nerve forming posterolateral wall of tonsillar fossa. Medial to styloid process lies the hypoglossal nerve, internal carotid artery, internal jugular vein and sympathetic chain^{3, 4}. Eagle's syndrome or styalgia occurs due to a long styloid process mostly due to calcification of stylohyoid ligament causing pharyngeal pain and ear pain. This syndrome can also occur due to abnormal angulations leading to irritation on nearby structures^{5, 6}. So the study of styloid process is very important in diagnosing and treatment for styalgia. The aim of this study is to do a complete morphometric analysis of styloid process and also to note any variations in the styloid process that can contribute to the Eagle's syndrome.

MATERIAL AND METHODS

The present study was conducted in 96 skulls with intact styloid process in department of Anatomy, Saveetha medical college and hospital, Chennai. The complete length from base to tip of the styloid process was measured using digital vernier calliper. The styloid process more than 3cm was identified as elongated styloid process. The anterior and medial angulations of

styloid process were also measured using goniometer. Also the styloid process was noted for any variations like calcification of stylohyoid ligament, bifid styloid process and absent styloid process. The readings are tabulated and analyzed using SPSS software version 22.0.

RESULT

The mean length of styloid process was 2.53 cm (Table: 1), the distance between the bases of styloid process was 6.55cm and distance between the tips of styloid process was 4.66cm (Table: 2). the means of medial and anterior angle was 74.1 degree (Table: 3) and 62.06 degree (Table: 4) respectively. Out of 96 skulls 85 skulls had length less than 3 cm (normal type) and 11 skulls had length more than 3 cm (elongated type). The length of styloid process varied from 0.5cm to 2.8cm in normal type and in elongated type the length ranged from 3.1 cm to 4.1 cm. The anterior angle ranged from 62.8 to 69.2 degree in normal type and 51.2 to 59.3 degree in elongated type. The medial angle ranged from 72.5 to 78.2 in normal type and 71.2 to 74.3 in elongated type. The mean of distance between the tips of styloid process was 6.33 cm in normal type but in elongated type it was 3.02cm. The mean of distance between the bases of styloid process was 6.62 cm in normal type while in elongated type it was 6.48 cm. This study showed the anterior angulations between normal and elongated type of the left and right side was statistically significant ($P \leq 0.05$) and the distance between the tips and bases of styloid process in elongated type was 0.03798 and 1.467 was not statistically significant. The medial with the p value- >0.05 and it is statistically significant. The anterior angle was less than pvalue so it is not statistically significant <0.05 .

Table 1
Length of styloid process in normal type and elongated type and its mean

Parameter	Normal type (cm)		Elongated type (cm)		Mean(cm)	P value
	Right	Left	Right	Left		
Length	1.41	1.38	3.79	3.54	2.53	>0.05

Table 2
Distance between the bases and tips of the styloid process and its mean

Parameters	Normal type (cm)	Elongated type (cm)	Mean (cm)	P value
Distance between the bases of styloid process	6.62	6.48	6.55	1.467
Distance between the tips of styloid process	6.3	3.02	4.66	0.03798



Figure1
Showing elongated styloid process

Table 3
Medial angle and its mean of styloid process

Parameter	Normal type (degree)		Elongated type (degree)		Mean (degree)	P value
	Right	Left	Right	Left		
Medial angle	74.20	75.43	73.23	73.54	74.1	>0.05



Figure 2
Measurement of medial angle of styloid process.

Table 4
Anterior angle and its mean of styloid process

Parameter	Normal type (degree)		Elongated type (degree)		Mean (degree)	P value
	Right	Left	Right	Left		
Anterior angle	66.46	66.19	57.66	57.96	62.06	<0.05

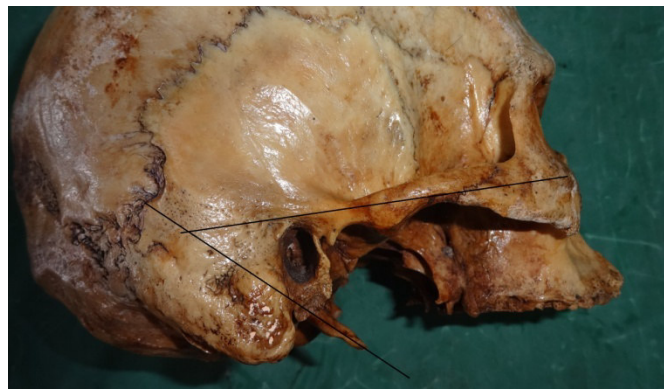


Figure 3
Showing anterior angle of styloid process

DISCUSSION

Styloid complex develops from Reicherts cartilage of second pharyngeal arch mesoderm. Styloid complex develops into styloid process along with lesser cornu of hyoid bone and stylohyoid ligament. Styloid complex has four developmental components a) Tympanohyal base of styloid process, b) Stylohyal → shaft of styloid process, c) Ceratohyal → stylohyoid ligament and d) Hypohyal → lesser cornu of hyoid bone⁷. There are several theories posted for the styloid process developmental abnormalities like excessive or abnormal ossification of this stylohyoid complex may lead to elongated and abnormally angulated styloid process. Also any injury to stylohyoid ligament can trigger stem cells within it leading to its abnormal growth^{8,9}. There are two types of Eagle syndrome a) classic type that occurs due to post-tonsillectomy characterized by dysphagia, odynophagia and sensation of irritation in pharyngeal wall. Another type is b) stylo-carotid syndrome that occurs due to irritation of carotid arteries stimulating sympathetic nerves around blood vessels¹⁰. It was reported that abnormal angulations of styloid process rather than elongation is responsible for some kind of 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 study the anterior angulation and the length of the styloid process are responsible for the symptoms of Eagle's syndrome^{11, 12, 13}. This study showed that the angulations and distance between the bases and tips of styloid process was decreased in elongated styloid process. Any pressure at the surrounding area of tonsillar fossa or manipulations around the neck area may lead to fracture of elongated and deviated styloid process leading to many clinical signs.

CONCLUSION

An elongated styloid process may develop inflammatory changes or impinge on the adjacent arteries and sensory nerve endings leading to different symptoms. The findings of our study highlight the importance of the examination of both angulation and length of styloid process in human skull which can be of great importance for oral and maxillofacial surgeon, anatomist and neurosurgeons during various surgical procedures.

CONFLICT OF INTEREST

Conflict of interest declared none.

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