

# Morphological Variation of Styloid Process and Its Clinical Significance

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**Abstract:** Styloid process is a part of temporal bone, located anterior to the Stylohyoid foramen and antero-medial to the mastoid process. It measures 2-3 cm in length. An elongated Styloid process is often asymptomatic, unless detected radiologically. An abnormally elongated Styloid process may compress the vital structures like blood vessels and nerves close to it. This can lead to Eagle's syndrome, which comprises recurrent throat pain, foreign body sensation in pharyngeal region, dysphagia and facial pain. During routine osteology discussion with undergraduate students, an adult dried skull showed abnormally elongated Styloid process on both sides. Awareness of such variations may be of clinical importance to Anaesthetists, Radiologists and ENT surgeons for accurate diagnosis and management.

**Keywords:** Dysphagia, Eagle's syndrome, Mastoid process, Skull, Styloid process

## 1. Introduction

The Styloid process is a spike-like projection in the base of skull. It arises from temporal bone, immediately in front of the stylohyoid foramen and lateral to jugular fossa(1). The Styloid process is located antero-medial to the mastoid process. The Styloid process is usually straight but, it may be occasionally curved. Its length is variable, ranging from few millimeters to centimetres(2). The normal length of the Styloid process ranges from 20 to 30 mm in adults. Its shape is cylindrical, tapering gradually toward the apex(3). The apex of the Styloid process is located between internal and external carotid arteries, just lateral to the tonsillar fossa within the lateral pharyngeal wall(1).

The tip of the Styloid process is of surgical importance because vital structures such as external carotid artery, internal jugular vein, Glossopharyngeal nerve, accessory nerve and Vagus nerve are in medial relation and facial nerve in lateral relation with the Styloid process(4). The tip of the Styloid process is continuous with the Stylohyoid ligament, which extend to the lesser cornu of the hyoid bone. Muscles and ligaments are attached at various parts of the Styloid process. The attached muscles are the Stylopharyngeus (arising from base), Stylohyoid (attached to the middle portion) and the Styloglossus (from the front of the lower part)(5).

Styloid process is a remnant of the second pharyngeal arch cartilage. The part of the second pharyngeal arch cartilage (Reichert cartilage) between Styloid process and hyoid bone regresses. Its perichondrium forms the Stylohyoid ligament. Hence the Styloid process is very variable in length, the ligament varying inversely with it(6). The ventral end of the second arch cartilage ossifies to form the lesser cornu and the superior part of the body of the hyoid bone(7). In the adult the Stylohyoid ligament is normally composed of dense fibrous connective tissue, it may retain some of its embryonic cartilage, and thus have potential to become completely or partially ossified(8).

The elongated Styloid process can lead to symptoms such as dysphagia,odynophagia, facial pain, ear pain, headache, tinnitus and trismus (2). This set of symptoms associated with the elongated Styloid process is called Eagle's syndrome. The clinical features of the elongated Styloid process were first described by Eagle. Later he described the two distinct syndromes associated with anomalous growth of the Styloid process: the Styloid process syndrome and the Carotid artery syndrome (9, 10).

The knowledge of the elongated Styloid process is of immense clinical importance to clinicians, radiologists and ENT surgeons.

The present study aims at highlighting the gross features of an anomalous Styloid process, and to discuss its embryology along with clinical implication.

## 2. The Case

During routine osteology discussion with undergraduate students, an adult dried skull showed abnormally elongated Styloid process on both sides (**figure 1**). The anomalous Styloid process was studied in detail. The length and thickness of the elongated Styloid process were measured using a sliding Vernier caliper. Measurements of Styloid process were tabulated (**table 1**).

**Table 1:** Measurements of the elongated Styloid process.

Sides	Length	Thickness		
		base	midway between base & tip	tip
Left	59.40mm	6.88mm	4.20mm	2.80mm
Right	55.20mm	5.90mm	3.90mm	2.30mm



**Figure 1:** Showing elongated Styloid process on both sides of the skull

### 3. Discussion

The Styloid process is a part of the temporal bone, and develops from the second pharyngeal arch cartilage. It gives attachment to ligaments- Stylohyoid and Stylomandibular and muscles- Stylopharyngeus, Stylohyoid and Styloglossus(11).

The length of Styloid process in various studies ranged from .7cm to 4cm(4). Jung et al suggested that the styloid process is elongated, when its length exceeds 45mm(12). Keur et al stated that, if the length of the process or the mineralised part of ligament as seen in radiographs was 30mm or more can be called as elongated styloid process(5). In a study on 2000 cases, there were only 11 cases (0.55%) of styloid process having length of more than 4cm(13). Harma gives an incidence of 4-7% of elongated styloid process(14).

Reichert's cartilage of second pharyngeal arch gives rise to the Styloid process, Stylohyoid ligament, lesser cornu and upper half of body of the hyoid bone(7). Elongated Styloid process can be congenital in origin. The mechanical stresses which occur during the fetal development cause stretching of the second pharyngeal arch cartilage (Reichert's cartilage), which leads to the elongation(2). Stylohyoid ligament has a potential for ossification. Varying degrees of ossification of the cartilage causes elongated styloid process. Trauma can cause ossification of varying length of Stylohyoid ligament. An abnormal healing after trauma can also initiate the calcification process(15).

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 (2). Most of the patients have classical symptoms of Eagle's syndrome but some patients may have localised pain or pain radiating to jaw and ear which simulate pain of dental origin. The symptoms sometime mimic those of facial neuralgia(16). Elongated Styloid process can also cause transient ischemic attack due to compression of Internal carotid artery (17). It has been reported that elongated Styloid

process can also cause difficulty during intubation (18).

Elongated Styloid process requires proper physical examination by digital palpation of the Styloid process in the tonsillar fossa. If digital palpation increases the pain, and injection of an anaesthetic agent provides relief, it is suggestive of Eagle's syndrome. It can be confirmed radiologically. The treatment of Eagle's syndrome is surgical removal of the elongated Styloid process (19).

The present study highlighted unusual Styloid process on both sides of an adult skull. The knowledge of anomalous 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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