



## Variations in styloid process

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### Abstract

**Background:** This study was conducted to evaluate the anatomical and congenital variations of styloid process of temporal bone in adult dry skull bones.

**Materials and Methods:** This investigation involved 100 dry human skulls of any age or gender. The styloid process of the temporal bone has been examined macroscopically for congenital and anatomical abnormalities.

**Results:** The analysis of 100 dried human skull bones revealed certain uncommon and unique mutations. In particular, we discovered one skull bone with unilateral triple styloid processes, which are extremely rare, another skull bone with unusual bilateral double styloid processes, whereas one skull bone having unilateral double styloid processes on the right side.

**Conclusion:** The current work has contributed some significant information to the scientific literature by revealing anatomical details on the styloid process of the temporal bone in the dried skull bones of adults. Correct understanding and diagnosis of anatomical and congenital variations of the styloid process of the temporal bone is essential for clinical anatomists, radiologists, forensic experts in architecture, and morphologists in addition to being enlightening for anaesthetists, dentists, neurosurgeons, and otolaryngologists and orthopaedic surgeons.

**Keywords:**styloid process, Eagle's syndrome

## **Introduction**

The word styloid process has been originated from the word 'stylos,' which means, the pillar, in Greek language. This process belongs to the temporal bone of the skull and it lies anterior to the stylomastoid foramen. Being cylindrical in shape, the styloid process gradually tapers towards the apex just like a pinnacle.<sup>1</sup> Its apex is located next to the tonsillar area in the lateral wall of pharynx, between external and internal carotid arteries. Its tip provides attachment to the stylohyoid ligament. There are few structures blended to the stylos process, which are in relation to the nerves and vessels.<sup>2</sup> The stylopharyngeus, stylohyoid and styloglossus are the muscles which attach to the base, middle part and tip of the styloid process respectively. These muscles get the innervations from the 9th, 7th, and 12th cranial nerves. Eagle's syndrome is diagnosed by both radiographical and physical examination. The SP palpation in the tonsillar fossa is indicative of SPE which are not normally palpable. Palpation of the tip of the SP should exacerbate existing symptoms. If highly suspicious for Eagle's syndrome, confirmation can be done by radiographical imaging.<sup>3</sup> More commonly; a panoramic radiography (PR) is used to determine whether the SP is elongated. Panoramic images are most useful clinically for diagnosing disorders related to facial structures including maxillary and mandibular bones and their supporting structures.<sup>4,5</sup>

Hence, this study was aimed to evaluate the anatomical and congenital variations of styloid process in dry adult skulls.

## **Material and methods**

This investigation involved 100 dry human skulls of any age or gender. The styloid process of the temporal bone has been examined macroscopically for congenital and anatomical abnormalities.

## **Results**

Among 100 dry human skulls bones the following anatomical and congenital variations of styloid process of temporal bone were noted-

The first incident featured the discovery of three triple styloid processes on the left side of a skull bone, which was a rare occurrence. The remaining 2 styloid processes, each expanded to a length of 7.5 cm, projected from the lower surface of the temporal bone, while one styloid process, measuring 2.2 cm in length, protruded from the front surface and lower edge of the tympanic segment. In the second situation, a single skull bone included a rare case of

bilateral double styloid processes. A styloid process that was 2.5 cm long protruded from the front surface and lower edge of the tympanic segment of each individual temporal bone, while a second styloid process that was 6.6 cm long protruded from the lower surface of each individual temporal bone. Finally, in the final case, a single skull bone's right side was found to have a unilateral twin styloid process. Both styloid processes were lengthy and protruded from the temporal bone's lower surface. The longer of the two styloid processes, measuring 5.1 cm, extended downward and forward. The shorter process, measuring 4.9 cm, was narrow and pointed and extended backward. Digital vernier callipers were used to calculate the length of each styloid process, which is determined by the separation between its base and tip.

## **Discussion**

The elongation of styloid process with or without ossified stylohyoid ligament is considered as Eagle's syndrome. This syndrome is also called as styloid neuralgia, elongated styloid syndrome, styloid-carotid syndrome and styloid-stylohyoid syndrome.<sup>6</sup> The stylohyoid chain extends between the temporal and hyoid bones and is generally divided into four sections as tympanohyal, stylohyal, ceratohyal, and hypohyal. Eagle, who described this syndrome complex, divided it into two categories. The classical type is presented as foreign body sensation in the throat, pain in the throat and the ear ache. The other type is the styloid process compressing the carotid arterial system and presenting as dizziness and headache.<sup>7</sup> A variety of head and neck signs and symptoms are related to the elongated styloid process and its stylohyoid chain component. The dimension of styloid process usually varies, ranging up to 25 mm. The elongated styloid process can be clinically detected by palpating the tonsillar fossa and is diagnosed by taking the X-ray lateral view of the neck, orthopantomogram (OPG) or a computerized axial tomogram (CT). Although there is no gender predilection for the elongated styloid process, the symptoms tend to be more common in the middle aged females.<sup>8,9</sup>

In this study, the first incident featured the discovery of three triple styloid processes on the left side of a skull bone, which was a rare occurrence. The remaining 2 styloid processes, each expanded to a length of 7.5 cm, projected from the lower surface of the temporal bone, while one styloid process, measuring 2.2 cm in length, protruded from the front surface and lower edge of the tympanic segment. In the second situation, a single skull bone included a rare case of bilateral double styloid processes. A styloid process that was 2.5 cm long

protruded from the front surface and lower edge of the tympanic segment of each individual temporal bone, while a second styloid process that was 6.6 cm long protruded from the lower surface of each individual temporal bone. Finally, in the final case, a single skull bone's right side was found to have a unilateral twin styloid process. Both styloid processes were lengthy and protruded from the temporal bone's lower surface. The longer of the two styloid processes, measuring 5.1 cm, extended downward and forward. The shorter process, measuring 4.9 cm, was narrow and pointed and extended backward. Digital vernier callipers were used to calculate the length of each styloid process, which is determined by the separation between its base and tip.

Kapur E et al<sup>10</sup> studied the morphometry of the styloid process of the temporal bone and the prevalence of an elongated styloid process in relation to side and gender. The study included 200 human skulls which were procured from the rich osteological collections of the Department of Anatomy, Faculty of Medicine, University of Sarajevo. The styloid process was observed macroscopically on both sides of all the skulls and elongations, if any, were noted. The lengths of the styloid processes were measured using digital vernier calipers. The measurements were taken from the point of emergence of the process (base) up to the tip. Out of 200 specimens, only 14 cases (7%) exhibited an elongated styloid process. The mean length of the styloid process was  $25.8 \pm 4.68$  mm and  $24.2 \pm 4.54$  mm for the right and left sides, respectively. The size of the styloid process did not differ significantly between the two sides ( $P=0.724$ ). The mean length of the styloid process was  $24.05 \pm 3.54$  mm in females and  $25.95 \pm 5.68$  mm in males, and the difference was statistically significant ( $P=0.023$ ).

Jung et al. suggested that the styloid process should be considered to be elongated when its length exceeds 45 mm.<sup>11</sup> Keur et al. stated that if the length of the process or the mineralised part of ligaments which appeared on radiography was 30 mm or more, this could be considered an elongated styloid process.<sup>2</sup> These different results may be due to the use of different methods for measuring the styloid process. Some authors suggest that measuring the styloid process using plain bones gives the best results compared to radiographs, but data on the osteometric values of the styloid process are scanty.

## **Conclusion**

The current work has contributed some significant information to the scientific literature by revealing anatomical details on the styloid process of the temporal bone in the dried skull bones of adult Indians. Correct understanding and diagnosis of anatomical and congenital

variations of the styloid process of the temporal bone is essential for clinical anatomists, radiologists, forensic experts in architecture, and morphologists in addition to being enlightening for anaesthetists, dentists, neurosurgeons, and otolaryngologists and orthopaedic surgeons.

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