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Original Research Article

A MORPHOMETRIC STUDY OF STYLOID PROCESS AND ITS FORENSIC IMPORTANCE

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Abstract

Background: Maxillofacial radiology plays a significant role in forensic anthropology for age and sex discrimination in case of mass disasters. Anatomically, Styloid process is bony structure, cylindrical in shape arises from the temporal bone which tapers gradually towards apex. In addition of clinical importance styloid process also having forensic importance, as elongated styloid process may result in blood flow disturbances in external carotid artery or internal carotid artery. **Materials and Methods:** Total 294 adult dry skulls used for study. Skulls were examined carefully, Vernier callipers scale was used to measure the length of styloid process. The skulls with elongated styloid process wee examined separately and measured the styloid process and observed for any other specific to be noted point. All measurements were recorded and tabulated. **Result:** Out of total skulls, male were 55.45% and 44.55% were female. The average length of styloid process was 24.30+4.36mm and in males it was 24.14+4.64mm and in females it was 22.46+3.12mm. The length of right styloid process in males was 25.76+4.02mm and left was 24.52+5.22mm. The length of right styloid process in females was 24.46+6.12mm and left was 23.72+3.96mm. Incidence of elongated styloid process was 3.06%. **Conclusion:** The results may be helpful in radiological practice and medicolegal cases. Styloid process elongation helps in identification of unknown individuals. The complete ossification of stylohyoid chain may have medicolegal implication for manipulations of cervical regions due to risk of fracture.

INTRODUCTION

Styloid process is derived from the Greekword 'Stylos' meaning a pillar. The styloid process is normally a cylindrical bone which arises from the temporal bone in front of the stylomastoid foramen. The styloid process is a thin, cylindrical, sharp osseous process, from the posterior part of lower surface of the petros part of temporal bone. The process is directed downwards to the front and slightly medially. The apex of the styloid process is connected with the ipsilateral lesser cornu of hyoid bone via stylohyoid ligament. The ligament represents from embryological view the continuation of the apex of styloid process. All the above the entire previous mentioned features constitute the stylohyoid chain. The whole chain derives embryologically from four cartilages: tympanohyale, stylohyale, ceratohyale, and hypohyale. The styloidprocess originates from the second branchial arch.

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. 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. 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. Spinal accessory and vagus nerves run medial to the styloid process. The facial nerve runs anteromedial to this process before piercing the substance of the parotid gland. Glossopharyngeal nerve curves in close proximity to the stylos process. The styloid process and the hyoid bone are connected by the stylohyoid ligament, which forms the anatomical basis for the glossopharyngeal neurological symptoms which are seen in styloid process syndrome. The clinical features and the patient complaints associated with the long styloid process are referred as Eagle's syndrome.[1-3]

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Eagle described the syndrome and stated that the normal SP is approximately 2.75 cm and any SP beyond that may be considered elongated. Eagle divided the syndrome into two categories. He described the classic syndrome as persistent pain in the pharynx, aggravated by swallowing with the pain frequently referred to the ear on the side of the elongated SP. He also noticed increased salivation, hesitancy and difficulty in swallowing, gagging and a foreign body sensation.[4-6] The morphometric data of the styloid process were collected and variations of the dimensions of styloid process are studied. The embryological and clinical implications of the elongated styloid process are discussed.

MATERIALS AND METHODS

The study was carried out in different medical institutions in Karnataka, total of 294 adult dry skulls were used for study. The present study included 294 human dried adult skulls, Out of 294, male were 163(55.45%) and 131(44.55%) were female. which were available in the department of anatomy and forensic medicine of different medical colleges in karnataka. The dried skulls which had damaged styloid process were excluded from the present study. The styloid processes were measured for their length. The skulls were macroscopically observed on both the sides for the elongation of the temporal bone, styloid process. Lengths of the styloid processes were measured by using the digital vernier caliper. The measurements were taken from the point of emergence of the process (base) until to the tip. The data were recorded and tabulated. The data were given as mean±standard deviation. The ossified stylohyoid ligament was also considered as the continuation of the styloid process. The process was considered elongated if its length is more than 30 mm.[2]

RESULTS

The study was carried out in different medical institutions in Karnataka, total of 294 adult dry skulls were used for study. Out of 294, male were 163(55.45%) and 131(44.55%) were female. The average length of styloid process was 24.30+4.36mm and in males it was 24.14+4.64mm and in females it was 22.46+3.12mm. The length of right styloid process in males was 25.76+4.02mm and left was 24.52+5.22mm. The length of right styloid process in females was 24.46+6.12mm and left was 23.72+3.96mm. The longest styloid process was 5.8mm and shortest was 15mm. Incidence of elongated styloid process was 3.06%.

Table 1:

Length styloid process	Mean+SD
Average Length	24.30+4.36mm
Male	24.14+4.64mm
Female	22.46+3.12mm
Male - Right Length	25.76+4.02mm
Male – Left Lenght	24.52+5.22mm
Female - Right Length	24.46+6.12mm
Female – Left Lenght	23.72+3.96mm

DISCUSSION

The length of styloid process of temporal bone varies from population to population. Eagle reported that a normal styloid process measures between 25 mm to 30 mm and any length more than the above mentioned values, is considered as the pathogenic factor for Eagle syndrome.[3,4] Keur et al. suggested that the styloid process length and its mineralized stylohyoid ligament, if appears more than 30 mm in a radiograph film, is considered as a significant predisposing factor.[6] However, Jung et al. suggested that, a styloid process of only more than 45 mm length should be considered to be elongated.[7]

The present study results includes the average length of styloid process was 24.30+4.36mm and in males it was 24.14+4.64mm and in females it was 22.46+3.12mm. The length of right styloid process in males was 25.76+4.02mm and left was 24.52+5.22mm. The length of right styloid process in females was 24.46+6.12mm and left was 23.72+3.96mm. In study of Rajanigandha V et al,[2] observed that the mean length of the styloid process was 17.8±9.3 mm and 18.2±5.6 mm for the right and left sides, respectively. In study of Rathva et al. reported that the length of styloid process was 43.8±11.1 mm and 43.5±10.4 mm for the right and left sides in their specimens.[8] This variation in the data from Indian samples may be because the difference in the method which was used to measure the parameter. In an another study by Patil et al., which used the Adobe photoshop for the measurements, the data were 13.9±8.1 mm and 12.9±8.7 mm for the right and left sides, respectively.[9]

The longest styloid process was 5.8mm and shortest was 15mm. Incidence of elongated styloid process was 3.06%.[9] Among all the skulls, seven of the styloid processes measured more than 30 mm and were considered as elongated. In study of Rajanigandha V et al. was observed in 5 among 110 skulls with a prevalence rate of 4.5%.[2] The prevalence of elongated styloid process in the earlier studies were 1%,[10] 4%,[11] 8.2%,[12] and 28%.[13] Other Indian studies by Rathva et al,[8] reported the prevalence of elongated styloid process as up to 2%.

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As elongated styloid process creates symptoms, it can be treated medically or with surgery. Medical treatment consists of use of steroids, local anesthesia, and oral carbamazepine. But medical treatment does not result well in the long term. Styloid process can be done via intraoral and extraoral approach based on surgery methods. In extraoral approach, a good view is obtained and vascular major complications are inhibited but this operation lasts long and cosmetic satisfaction is low on extraoral scar tissue. Intraoral approach lasts shorter when compared to extraoral approach and inhibits aesthetical problems and less dissection is needed during this procedure. As no symptoms were seen in patients with styloid process of huge size, no medical or surgical treatments were applied. The patient's routine follow-up has continued.[14-16]

CONCLUSION

The dimensions of the styloid process and its stylohyoid chain are essential to the anatomists, anthropologists, forensic experts and clinicians. We believe that the present study has provided additional information on the frequency of elongated styloid process in the Indian population. In the present study, the styloid process has been studied morphologically with emphasize on their embryological and clinical implications.

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