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Length Variations of the Styloid Process on Dry Human Skull – An Osteological Study

Dr. Inbamani .N[1], Dr. Prabhusankar.K[2], Dr.Palaniyappan[3], Dr.Rajimol[4], Dr. Priyadharsana.P.S.[5], Dr.Vignesh .K[6]

[1]*Post Graduate, Department of Oral and Maxillofacial Surgery, R.V.S. Dental college and Hospital, Coimbatore.*
[2]*Professor and Head of the Department, Department of Oral and Maxillofacial Surgery, R.V.S. Dental College and Hospital, Coimbatore.*
[3]*Senior lecturer, Department of Anatomy, R.V.S. Dental College and Hospital, Coimbatore.*
[4]*Senior lecturer, Department of Anatomy, R.V.S. Dental College and Hospital, Coimbatore.*
[5]*Reader, Department of Oral and Maxillofacial Surgery, R.V.S. Dental College and Hospital, Coimbatore.*
[6]*Senior Lecturer, Department of Oral and Maxillofacial Surgery, R.V.S. Dental College and Hospital, Coimbatore*
*Corresponding author: Dr. Inbamani .N**

Abstract:
Objective. *The primary objective of this study was to evaluate and measure the prevalence of elongated styloid processes in relation to right and left sides on dry human skulls.*
Materials and methods: *The study was conducted in the Department of Anatomy, RVS Dental College and Hospital, Coimbatore, Tamil Nadu. It included 200 dry human skulls of regular morphology without any deformities. The lengths of the styloid processes were measured using digital vernier caliper, from the base to the tip.* ***Results:*** *Out of 200 specimens, 9 skulls (4.5%) exhibited an elongated styloid process. The mean length of the styloid process was 24.27 mm on the right side and 24.46 mm on the left side. No statistically significant difference was observed between the two sides.*
Conclusion: *Understanding the length and anatomical variations of the styloid process is essential for clinicians in diagnosing Eagle's syndrome and differentiating it from other sources of orofacial pain. This knowledge may help prevent or alleviate symptoms associated with an elongated styloid process.*
Keywords: *elongated styloid process, dry human skulls, digital vernier caliper, eagle syndrome.*

I. Introduction:

The styloid process, named after the Greek word 'stylos' meaning "pillar," is a slender, pointed bony extension projecting downward, forward, and slightly medial from the temporal bone. Located posterior to the mastoid process, anteromedial to the stylomastoid foramen, and lateral to both the jugular foramen and carotid canal, it is surrounded by critical neurovascular structures, including cranial nerves V, VII, X, XI, XII and the internal jugular vein. (1)

The styloid process serves as an attachment site for three muscles—styloglossus, stylohyoid, and stylopharyngeus—as well as two ligaments: stylohyoid and stylomandibular. (3) Normally, the length of this structure ranges from 20 mm to 30 mm (2–3 cm). However, when the styloid process exceeds 30 mm in length, it is called as elongated styloid process. (4)

Watt W. Eagle first described the association between elongated styloid processes and pain in 1937, introducing the term stylalgia. While 4% of the population has an elongated styloid process, out of which only 4–10% of cases present with symptoms. Unilaterally elongated styloid process is more common than the bilaterally elongated styloid process, and women are affected more frequently than men. (1)

Aim:
To evaluate and measure the length variations of normal and abnormally elongated styloid processes using a digital vernier caliper on dry human skulls.

II. Materials and Methods

This study was conducted in the Department of Anatomy at RVS Dental College and Hospital. A total of 200 dry human skulls with regular morphology and no deformities were examined.
The distance between the base and the tip of the styloid process was measured using digital vernier caliper. All measurements were recorded by the authors, ensuring consistency in data collection.


Figure 1 and 2: Measuring elongated styloid process using digital vernier caliper


Figure 3 and 4: Bilaterally elongated styloid process

III. Observations:

Total skull included in study –200
Unilaterally elongated styloid process (Right side)-3 skulls
Unilaterally elongated styloid process (Left side)- 5 skulls
Bilaterally elongated styloid process –1 skull

IV. Results:

Out of 200 specimens, 9 skulls (4.5%) exhibited an elongated styloid process. The mean length of the styloid process was 24.27 mm on the right side and 24.46 mm on the left side. No statistically significant difference was observed between the two sides. An elongated styloid process was found in 4.5% dry human skulls examined. There were 3 skulls measured to have unilaterally elongated styloid process on right side (1.5%), 5 skulls had unilaterally elongated styloid process on Left side (2.5%) and only one skull had bilaterally elongated styloid process (0.5%).

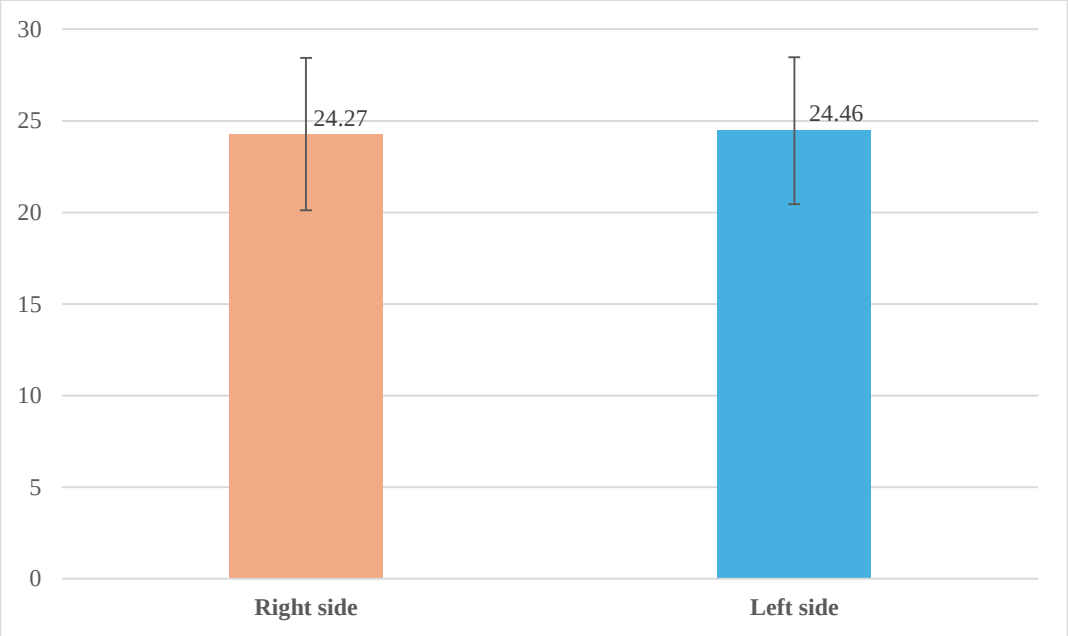

Figure 5: Bar diagram illustrating differences in measurements between right and left styloid process

	N	Minimum	Maximum	Mean	Std. Deviation
Right side	200	14.60	41.90	24.2715	4.15603
Left side	200	16.20	43.10	24.4620	4.01209

Table 1. *Measurements of the styloid processes.*

V. Discussion:

Elongation of the styloid process is a key feature of **Eagle's syndrome**, a condition that manifests in two primary forms:

1. **Classic Eagle's syndrome:** Ossified styloid processes may compress adjacent structures, causing pain along the distributions of cranial nerves V, VII, VIII, IX, and X. (1)
2. **Carotid artery syndrome:** Excessively long styloid processes can irritate or compress the sympathetic fibers of the internal and external carotid arteries, leading to pain in areas supplied by these vessels. (1)

Classic Eagle's syndrome is more frequently observed in individuals with a history of tonsillectomy. Symptoms of styloid process include dysphagia, sore throat, otalgia, facial pain radiating to the ear and jaw, and a foreign body sensation in the throat.

A condition known as **TMTH Syndrome**—affecting the temporal bone, mandible, tongue, and hyoid—shares symptom similarities with Eagle's syndrome and Costen's syndrome. (8)

Diagnosis and Differential Considerations

Patient history and clinical examination plays a vital role in the diagnosis of eagles syndrome. Palpation of the tonsillar fossa, lateral pharyngeal wall, and the region between the mandibular angle and mastoid process can elicit discomfort. Imaging modalities such as **panoramic radiography, 3D CT, 2D CT, and MRI** aid in confirming diagnosis. (3)

Common differential diagnoses include: (2)

- Trigeminal Neuralgia
- Glossopharyngeal Neuralgia
- Migraine
- Myofascial Dysfunction Syndrome
- Cervical Arthritis
- Cluster Headache
- Temporal Arteritis
- Pain from unerupted third molars

Management and Surgical Intervention:

Treatment for symptomatic cases involves **styloidectomy**, either through an intraoral or extraoral approach:

- **Extraoral Approach:** An incision is placed along the ascending ramus of the mandible, followed by blunt dissection through the subplatysmal plane to access the styloid process. After periosteal exposure, the styloid process is fractured and excised.
- **Transoral Approach:** An intraoral incision along the ascending ramus allows for blunt dissection between the medial pterygoid muscle and superior pharyngeal constrictor. Once exposed, the styloid process is removed by fracturing it. (6,11)

VI. Conclusion:

This study highlights variations in styloid process length and their clinical significance. Awareness on anatomy of the styloid process and its elongation is crucial for accurate diagnosis and management. Understanding these variations can assist clinicians in differentiating Eagle's syndrome from other causes of orofacial pain. Proper evaluation, including imaging, ensures timely intervention, and in severe cases, surgical removal restores quality of life.

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