Research Article

Styloid Process: Morphometric Parameters with Correlation to Side and Gender

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ABSTRACT

The term styloid process is acquired from the Greek word 'Stylos,' which means a pillar. The styloid process is a narrow and pointed bony extension connected to the lower surface of the petrous portion of the temporal bone. It lies in front of the stylomastoid foramen and its tip projects anteriorly and inferiorly between internal and external carotid arteries. The positioning of the styloid process holds significant importance due to its relation to critical neurovascular elements. To correlate the morphometric parameters of styloid process of temporal bone with side and gender. The study was conducted on skulls retrieved from Department of Anatomy, Pt. B. D. Sharma PGIMS, and Rohtak. Morphometric parameters of styloid process of both sides were studied in 120 adult dried human skulls of known gender. In the present study the mean length of styloid process was observed on right side 17.26±6.86 mm and on left side 17.74±7.16 mm in male skulls while it was observed on right side 15.92±5.68 mm and on left side 15.37±5.84 mm in female skulls. The length of styloid process was more in males than females. Distance between two styloid processes at base was observed slightly more in males than in females. The present study can provide valuable information to anatomists, otolaryngologists, forensic experts, anthropologists and other researchers in this field.

Keywords: Styloid process, temporal bone, morphometric parameters.

1. INTRODUCTION

The term Styloid process is acquired from the Greek word 'Stylos,' which means a pillar. The styloid process is a narrow and pointed bony extension connected to the lower surface of the petrous portion of the temporal bone. It is located anterior to the stylomastoid foramen, and its tip extends forward and downward between the internal and external carotid arteries. The positioning of the styloid process holds significant importance due to its relation to critical neurovascular elements, including the facial and hypoglossal nerves, the occipital artery, and the lateral posterior belly of the digastric muscle. The lingual, facial, superficial temporal, maxillary and internal carotid arteries, internal jugular vein and the stylomandibular ligament medially [1]. Elongation of this process can cause irritation to various structures related to it. The main objective behind this study was to assess the anatomical variations of styloid process of temporal bone with known gender in adult human dried skulls of North Indian population. So, this is worthwhile to study the morphometric parameters of styloid process with correlation to side and gender in human dried skulls.

2. MATERIALS & METHODS

The study was conducted on skulls retrieved from Department of Anatomy, Pt. B. D. Sharma PGIMS, Rohtak. Morphometric parameters of styloid process of both sides were studied in 120 human dried skulls of known gender. Out of 120 skulls, 80 skulls were of males and 40 skulls were of females. Skulls with broken or damaged styloid process were excluded from study.

The Morphometric Parameters studied were:

1. Length of the styloid process: from base to tip
2. Thickness of styloid process at the base.
3. Thickness of styloid process at the midpoint
4. Thickness of styloid process at the tip
5. Distance between two styloid processes at base
6. Distance between the bases of styloid processes and stylomastoid foramen
7. Anterior angulation of styloid process: anterior angle was measured between Frankfurt plane and long axis of the styloid process on its anterior side [3].
8. Medial angulation of styloid process: angle on the medial side of styloid process between its long axis and the line connecting the bases of both styloid process.

3. RESULTS

The following observations were made

TABLE- 1: The Length of Styloid Process

Parameters		Male		Female	
		Right	Left	Right	Left
Length Of Styloid Process (mm)	Number	N=77	N=78	N=40	N=39
	Mean	17.26	17.74	15.92	15.37
	SD	± 6.86	± 7.16	± 5.68	± 5.84
	Range	3.18-40.43	4.3-50.15	5.6-30.12	4.7-31.25
	p value	0.676		0.616	

TABLE- 2: The Thickness of Styloid Process

Parameters			Male		Female	
			Right	Left	Right	Left
Thickness of Styloid Process (mm)	At Base	Number	n=80	n=80	n=40	n=40
		Mean	3.92	4.21	3.80	3.81
		SD	± 1.24	± 1.24	± 1.27	± 1.27
		Range	1.6-7.7	1.4-7.3	2.03-7.52	2.09-7.3
		p value	0.156		0.968	
	At Midpoint	Number	n=77	n=78	n=40	n=39
		Mean	2.80	2.81	2.67	2.56
		SD	± 0.82	± 0.84	± 0.94	± 0.75
		Range	1.07-4.7	1.06-5.0	1.2-6.10	1.5-4.9
		p value	0.906		0.562	
	At Tip	Number	n=77	n=78	n=40	n=39
		Mean	1.83	1.93	1.60	1.60
		SD	± 0.86	± 0.83	± 0.82	± 0.77
		Range	0.67-5.14	0.79-5.1	0.49-3.54	0.64-4.1
		p value	0.586		0.998	

- It is evident from Table-2 that the mean of thickness of SP at the base, at the midpoint and at the tip was slightly more in males as compared to the females.
- However, the difference was not found to be statistically significant in all the groups.

TABLE- 3: The Distance between Styloid Process & Stylomastoid Foramen & Distance between Two Styloid Processes

Parameters		Male		Female	
		Right	Left	Right	Left
Distance Between Styloid Process And Stylomastoid Foramen (mm)	Number	n=80	n=80	n=40	n=40
	Mean	1.78	1.67	1.82	1.82
	SD	± 0.55	± 0.48	± 0.62	± 0.49
	Range	0.73-3.87	0.34-3.06	0.60-3.40	1.12-3.16
	p value	0.189		0.988	
Distance Between Two Styloid Processes (mm)	Number	n=80		n=40	
	Mean	76.74		75.43	
	SD	± 3.69		± 3.68	

The distance between styloid process & stylomastoid foramen was more in females than in males.

The distance between two styloid process at base was observed slightly more in males than females.

TABLE- 4: The Angulations of Styloid Process

Parameters		Male		Female	
		Right	Left	Right	Left
Anterior Angulation (Degree)	Number	n=77	n=78	n=40	n=39
	Mean	61.30	62.79	60.25	60.64
	SD	± 8.69	± 8.93	± 9.5	± 8.12
	Range	43-79	40-82	43-75	43-76
	p value	0.293		0.845	
Medial Angulation (Degree)	Number	n=77	n=78	n=40	n=39
	Mean	67.08	66.51	68.85	67.69
	SD	± 7.46	± 8.50	± 7.89	± 8.14
	Range	42-84	40-82	53-82	50-87
	p value	0.661		0.845	

The mean of anterior angulation of styloid process in males was slightly more than in females.

The mean of medial angulation of styloid process in females was slightly more as compared to males.

However the difference was not found to be statistically significant in these groups.

4. DISCUSSION

The length of styloid process may be different in different population. Eagle observed “a normal styloid process between 25 mm to 30 mm and when this was more than this value it was considered as elongated and one of the pathogenic factor for Eagle syndrome.” [1] Monsour *et al.*, [5] found that the length of styloid process was 29.20 mm in their specimens. The disparity in the data from Indian samples

may be for the reason that of the difference in the technique which was used to measure the parameter as they carry out the measurements by using digital image analysis using the adobe photoshop. In the present study we have used digital Vernier caliper to carry out the measurements. According to Patil *et al.,* [6]. the data were 13.9±8.1 mm of the right side and 12.9±8.7 mm of left side, However, Vadgaonkar et al[7] observed the length of the styloid process was 17.8±9.3 mm on the right side and 18.2 ±5.6 mm on left side.

The findings of length of styloid process of the present study are consensus with the study by Vadgaonkar *et al.,* [7].

TABLE 5-: Comparitive Analysis of Mean Length of Styloid Process

Author	Population	Mean length (mm)
Monsour et al[5]	-	29.20
Patil et al[6]	Indian	23.8
Patra et al [3]	Indian	21.90 (R), 20.80 (L)
Vadgaonkar et al[7]	Indian	17.8 (R), 18.2 (L)
Present study	Indian (North Indian)	17.26 (R), 17.74 (L) : (M) 15.92 (R), 15.37 (L) : (F)

In the present study, we observed maximum thickness of SP was 4.21 mm. Vadgaonkar *et al.,* [7] reported 4.5 mm as the maximum thickness. Vadgaonkar *et al.,* [7] reported the mean thickness of the styloid process at base was 4.4±1.2 mm on the right side and 4.4±0.9 mm on the left side. The similar parameters were 1.5±0.6 mm and 1.4±0.5 mm, 3.2±0.4 mm and 3.8±0.7 mm at the tip and mid-point of the styloid processes, respectively. The result of present study is similar to the study done by Vadgaonkar *et al.,* [7]

In the present study distance between two SP at the base was 76.74±3.69 mm in males and 75.43 ±3.68 mm in females. Margam et al[2] reported the distance between two SP at the base was 68.13 mm in males and 67.42 mm in females Patil *et al.,* [6] reported 6.9 cm as the mean distance between two styloid processes.

In the present study, the mean of distance between SP and stylomastoid foramen was 1.78±0.55 mm on right side and 1.67±0.48 mm and left side in males. In females while it was 1.82±0.62 mm and 1.82±0.49 mm on right side and on left side respectively. According to Margam *et al.,* [2] the distance between SP and stylomastoid foramen in males was 4.13 mm on right side and 4.21 mm and left side. In females it was 2.06 mm and 2.1 mm on right side and on left side respectively.

TABLE 6-: Comparative Analysis of Means of Angulations of Styloid Process

Author	Population	Mean of Anterior Angulations (degree)	Mean of medial Angulations(degree)
Patil et al[6]	Indian	62.45	74.15
Yavuz et al[8]	Turkish	19.90	16.40
Mazzetto et al[9]	Brazilian	20.89	19.04
Patra et al[3]	Indian	57.50(R), 59.30(L)	65.48(R), 63.80(L)
Present study	Indian (North Indian)	61.30(R),62.79(L):(M) 60.25(R), 60.24(L):(F)	67.08(R),66.51(L):(M) 68.85(R), 67.69(L):(F)

5. CONCLUSION

The knowledge of morphometric parameters of styloid process of temporal bone may provide valuable information to anatomists, otolaryngologists, forensic experts, anthropologists and other researchers in this field. It may also be important to the neurosurgeon and radiologist, while interpreting the computed tomogram and magnetic resonance image scans.

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CONFLICT OF INTEREST

We wish to confirm that there are no known conflicts of interest associated with this publication and there has been no significant financial support for this work that could have influenced its outcome.

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ETHICAL INFORMATION

No ethical information is involved in the research work.

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