The Journal of Anatomical Sciences
Email: journalofanatomicalsciences@gmail.com
J. Anat Sci 15(2)

Submitted May 30th, 2024
Accepted August 23rd, 2024
Published September 30th, 2024

Evaluating the Prevalence of Elongated Styloid Process in Dry Human Skulls

Ukpai C. J.[1], Eweoya O.[2], Abue A.[3], Okolo R. U[4], Onwih E.[2]

[1]Department of Human Anatomy, College of Medicine, Veritas University, Bwari, Abuja
[2]Department of Anatomical Sciences, University of Abuja, Abuja
[3]Department of Anatomy, Federal University Yola, Adamawa State
[4]Department of Anatomy, Baze University, Abuja, Nigeria.

Corresponding Author: Ukpai, Chinwe Jemimah

Email: ukpaichinwejim@gmail.com; ukpaic@veritas.edu.ng
Tel: 08138612159; 09134574736

ABSTRACT

Styloid process is a bony projection from the inferior part of the petrous temporal bone of the skull. The research aimed to study the styloid process structure and evaluate the prevalence of elongated styloid processes in dry skulls collated by the Department of Anatomical Sciences University of Abuja. A total of 120 dry skulls were used for the research. The length and Inter-styloid distance were measured using a digital Vernier's calliper. Data were analysed using the IBM SPSS version 23 and descriptive statistics were derived. Results for the mean lengths are as follows: 25.40 mm and 27. 50 mm for the right lateral and right posterior views of the male Styloid processes while 26.60 mm and 27.70 mm are the results for their left lateral and left posterior views. The mean lengths of the female Styloid processes are as follows: 29.67 mm and 26.67 mm for their right lateral and right posterior views while 39.33 mm and 37.00 mm are the values of their left lateral and left posterior views. The mean Inter-styloid distance for the male and female skulls are 77.16 mm and 68.20 mm respectively. Results revealed a prevalence of elongated styloid processes in the male and female skulls with a high prevalence in the female skulls. The Inter-styloid distance between both sexes showed a significant difference, this proposes that the Inter-styloid distance could be an integral measure for sexual dimorphism.

Keywords: anthropology, styloid process, elongated styloid process, inter-styloid distance

INTRODUCTION

The styloid process is a cylindrical, slender and needle-like projection from the inferior parts of the petrous temporal bone located bilaterally in the cranium[1]. The styloid process is composed of proximal and distal parts. The proximal part merges with the tympanic plate of the temporal bone while the distal end provides attachments to muscles and ligaments[2]. The word "styloid" is a derivative of the Greek word *stylos* meaning a pillar. The styloid process functions to aid the movement of the tongue, pharynx, larynx, hyoid bone and mandible because it offers attachment to the stylohyoid, stylopharyngeus and styloglossus muscles as well as the stylohyoid ligament[3].

The styloid process originates as a part of the Reichert's cartilage, it develops from the second pharyngeal arch (branchial arch) and undergoes ossification in the late stages of pregnancy through the first decade of life[4]. The Greek word meaning pillar describes its function as an important entity of the neck region[5]. The study aims to provide data on the prevalence of the elongated styloid process, the length of the styloid process and Inter-styloid distance within the Nigerian population.

The length of the styloid process is inconsistent across all individuals, with studies reporting average lengths anywhere from 1.52 cm to 8 cm[6,7]. It is also true that the length of the left and right styloid processes might differ within the same individual. The ossification and fusion of the styloid process also show variance. The stylohyal part might unite with the tympanohyal after puberty. If the stylohyal part successfully fuses with the tympanohyal part and the stylohyal aspect ossifies, it results in a long styloid process. However, if the stylohyal part fails to ossify, it results in a short styloid process[3].

The length of the left and right styloid processes might differ within an individual[8]. Although the length of the styloid process might vary from person to person,

lengths above 3 cm are considered to be elongated [9,10,11]. The styloid process is considered elongated if its length increases to 3 cm but normal if its length is 2.5 cm[12,10]. The length of the bony styloid process varies from 0 - 62 mm. The mean length of the styloid process is 26.8 ± 10.0 mm with the rate of elongated styloid process as 32% the longest at 62 mm[13]. The length of the styloid process ranges from 15.2 - 47.7 mm[14]. The length of the styloid process averages from 20 – 25 mm[15]. In a study carried out on the length of the styloid process and anatomical implications for Eagle's syndrome the mean length of the styloid process in males and females on the right and left sides were: 25.78 ± 5.68 mm; 22.6 ± 3.68 mm, 25.80 ± 5.75 mm; and 22.75 ± 3.65 mm respectively. In this study, the males had greater styloid process lengths than the females also the differences in length on both the left and right sides showed a statistical significance. The incidence of the elongated styloid process was 3.3% with a higher prevalence revealed in the females. The average length of the styloid processes: was 36.06 ± 6.12 mm while the average length of the subjects reporting Eagle's syndrome was 40 ± 4.72 mm[16]. Symptomatic subjects older than 40 years presented an elongated styloid process unilaterally[16]. A study presented the mean length of the male styloid process to be 28.59 mm and that of the female to be 25.47 mm. The researcher proposed that though the length of the styloid process was longer in males the findings were not significant clinically and can be accepted as normal between gender groups basically because male individuals tend to be bigger and more muscular than their female counterparts[17]. Notwithstanding, another study noted that there were considerable differences between the lengths of the styloid processes on the two sides[18,19]. When the length of the styloid process is presented with more than 45mm it is elongated[20]. At a length over 30 mm, the styloid process is considered elongated[21]. The elongation of the styloid process can irritate the various structures around it[9]. Elongation of the Styloid process or calcification of the styloid ligament causes styloid syndrome or Eagle Syndrome. This was first reported by "Eagle" through his publication in 1937 he was an Orthorinolaryngologist. Presented two cases showing symptomatology of elongated styloid process with symptoms presenting with ipsilateral cervicofacial pain which referred to the ear, the pain frequently focusing on the angle of the mandible which worsened when the head rotates, a feeling of protrusion upon palpation of the ipsilateral tonsillar fossa among some other similar pain related symptoms were the symptoms presented[22]. However, Eagle noted that the first descriptor of the elongated styloid process was by Weinlecher in 1872[17].

Research continues to birth knowledge of every existing issue. In a journal, The Journal of Contemporary Dental Practice an article reviewed that the case of an elongated styloid process was first described by an Italian surgeon by the name Pietro Marchetti in the year 1652[23]. Eagle syndrome is associated with glossopharyngeal neurological symptoms which occur as a result of the relationship between styloid process and the hyoid bone[10]. The abnormal association affects adults bilaterally but might also affect only one side of the head. Watt W Eagle coined the term "stylagia" in his attempt to describe the pain associated with the elongation of the styloid process. 4% of the general population's styloid process is grossly enlarged, although 4-10% of this group is symptomatic[24]. However, a small percentage shows symptoms which can present with one or two types of Eagles syndrome[25,26].

An elongated styloid process (Eagles Syndrome) could be detected via; the Licodine infiltration test[27]. panoramic radiographs, X-rays, lateral views of the neck, orthopantomograms and computed tomographies [28]. A physical examination by digital palpation of the styloid process in the tonsillar fossa can also reveal an elongated styloid process[28]. Although palpation leads to the increase in intensity of its symptoms [29]. According to Monsour, panoramic radiography is the most common projection to detect an elongated styloid process [21]. It has been estimated that the prevalence of the elongated styloid process is estimated around 4% of the general population. However, there remain variances between populations. The rural Indian population for example shows a high prevalence of elongated styloid process with a prevalence in women than men[27]. Variations of the styloid process might also occur as a result of the ossification and fusion process. If the stylohyal part of the Reichert's cartilage successfully unites with the tympanohyal part after puberty, it results in a long styloid process. However, if the stylohyal part fails to ossify it results in a short styloid process[3]. Individuals with an elongated styloid process can present with one or two types of Eagles syndrome[26].

In bilateral presentations, the left styloid processes are more elongated than the right styloid processes[23]. on the other hand, another study revealed that the elongated styloid process was dominant on the right side[30]. These diverse conclusions could be a result of differences in sample size among other reasons. However, a higher sample size would help assess the prevalence of the elongated styloid process also elucidating its pattern of occurrence[30]. The high prevalence of elongated styloid process in female could be as a result of related endocrine disorders of women at menopausal ages[31]. Bilateral elongation was seen predominantly in females at a percentage of 88.5 compared to males. This same study revealed unilateral elongation at 21.5% and bilateral elongation at 78.5% disassociating age, gender and type[23].

MATERIALS AND METHODS

A total of 120 dry human skulls were selected, 100 male skulls and 20 female skulls. These skulls met the selection criteria which included; the absence of any form of fracture, complete structures to be measured intact and the absence of artifacts. These dry skulls were obtained from the Department of Anatomical Sciences, College of Health Sciences, University of Abuja, F.C.T, Nigeria. Ethical approval was obtained from the office of the Chairman of the Medical Advisory Committee (CMAC) University of Abuja Teaching Hospital Gwagwalada, Abuja (UATH). Approval Number: UATH/HREC/PR/2024/02/144.

Inclusion criteria include known gender of skulls, presence of undamaged styloid processes and absence of artefacts. Exclusion criteria include broken styloid process, unknown skull gender etc. Measurements were carried out in the Gross Anatomy laboratory of the University of Abuja. The research was limited to the available dry skulls within the college.

The following dimensions were taken of the styloid process:

Figure 1: Measurement of the posterior view of the length styloid process

This was obtained by placing the extended points of the Vernier's calipers, one point on the tip of the styloid process and the other point on the base at the posterior side of the styloid process.

Figure 2: Measurement of the lateral view of the length styloid process

This was obtained by placing the extended points of the Vernier's calipers, one point on the tip of the styloid process and the other point on the base at the lateral side of the styloid process.

Figure 3: Measurement of the inter-styloid distance

This was measured by measuring the distance between the base of the medial aspects of the left and right styloid processes.

Measurements were taken under good lighting, seated in a comfortable position and the absence of noise and any form of distraction. Descriptive statistics were calculated from the measured parameters and were evaluated by the paired sample T-test to differentiate between the right and the left sides. The incidence of elongation was calculated as well.

RESULTS

Results from measurement and observation of the various parameters under study as analyzed by IBM SPSS Statistics are as follows: Table 1 presents results of the styloid process lengths of both male and female

skulls. 100 styloid process lengths were analyzed for the male. The result shows the posterior views of the male right styloid process lengths presented a mean length of 27.50 ± 4.65 mm, a standard error of 1.47 mm with a maximum length of 39.00 mm and a minimum length of 23. 00 mm. Results also presented a 10% elongated styloid process rate for the lateral views of male right styloid processes. The lateral views of the male right styloid processes analyzed presented a mean length of 25.40 ± 5.08 mm, a standard error of 1.61 mm with a maximum length of 37. 00 mm and minimum length at 18.00 mm. Results presented a 10% rate of the elongated styloid process.

For female styloid processes, 20 styloid process lengths were analyzed. Still, on the right styloid processes, the posterior views presented a mean length of 26.67 ± 1.53 mm, a standard error of 0.88 mm. Maximum length presented at 28.00 mm and minimum length presented at 25.00 mm. The result presented a 0% rate of elongated styloid process for the posterior views of female right styloid processes. Lateral views of female right styloid processes presented with a mean length of 29.67 mm ± with a standard error of 0.33 mm. The maximum styloid process length was 30.00 mm while the minimum length was 29.00 mm. The elongated styloid process rate was 0%

Posterior views of male styloid process lengths presented a mean length of 27.70 ± 6.43 mm, standard error of 2.03 mm, Maximum length was at 37.00 mm while the minimum length presented at 15.00 mm. There was a 30% rate of the elongated styloid process presented. Lateral views of male styloid process lengths presented a mean length of 28.60 ± 7.58 mm with a standard error of 2.40 mm. The maximum length was 38.00 mm and the minimum length at 17.00 mm. There was a 50% rate of elongated styloid process.

Posterior views of female left styloid process lengths presented mean lengths at 37.00 ± 7.55 mm, standard error was at 4.36 mm, Maximum length was at 45.00 mm while the minimum length was at 30.00 mm. Presented as a 100% rate of elongated styloid process. The mean length of lateral views of the female left styloid process presented as 39.33 ± 7.10 mm, standard error of 4.10 mm. The maximum length was at 47.00 mm while the minimum length was 33.00 mm. They also presented a 100% of the elongated styloid process.

Table 1: Length of styloid process

	Right Styloid Process				**Left Styloid Process**			
	Male (n = 100)		**Female (n = 20)**		**Male (n = 100)**		**Female (n = 20)**	
	Posterior views	**Lateral views**	**Posterior views**	**Lateral views**	**Posterior views**	**Lateral views**	**Posterior views**	**Lateral views**
Mean ± Std. Dev	27.50 ± 4.65 mm	25.40 ± 5.08 mm	26.67 ± 1.53 mm	29.67 ± 0.58 mm	27.70 ± 6.43 mm	28.60 ± 7.58 mm	37.00 ± 7.55 mm	39.33 ± 7.10 mm
Std. Error	1.47 mm	1.61 mm	0.88 mm	0.33 mm	2.03 mm	2.40 mm	4.36 mm	4.10 mm
Maximum	39.00 mm	37.00 mm	28.00 mm	30.00 mm	37.00 mm	38.00 mm	45.00 mm	47.00 mm
Minimum	23.00 mm	18.00 mm	25.00 mm	29.00 mm	15.00 mm	17.00 mm	30.00 mm	33.00 mm
Elongated Styloid Process	10%	10%	0%	0%	30%	50%	100%	100%

Table 2 presents the result of male and female inter-styloid distances. 100 male skulls analyzed presented a mean inter-styloid distance of 77.16 ± 4.90 mm with a standard error of 0.70 mm. Maximum inter-styloid distance presented at 87.00 mm and minimum inters-styloid distance presented at 67.00 mm. On the other hand, the table reveals that the mean inter-styloid distance of the 20 female skulls analyzed presented at 68.20 ± 2.78 with a standard error of 0.88 mm. Maximum inter-styloid distance presented at 71.00 mm while minimum inter-styloid distance presented at 63.00 mm for the female skulls.

Table 2: Inter-styloid distances

	Male (n = 100)	**Female (n = 20)**
Mean ± Std. Deviation	77.16 ± 4.90 mm	68.20 ± 2.78 mm
Std. Error	0.70 mm	0.88 mm
Maximum	87.00 mm	71.00 mm
Minimum	67.00 mm	63.00 mm

Table 3 presents p-values of the styloid process lengths and inter-styloid distances. P-value for the male styloid process lengths presented as 0.871 while that of the female presented as 0.901. P-values for the male and female inter-styloid distances presented as 0.001 and 0.002 respectively.

Table 3: P – Values of the styloid process lengths and inter-styloid distances

	Male	Female
Styloid Process Length	0.871	0.901
Inter-styloid Distance	0.001	0.002

Table 4 presents the result of T – test comparing means of male and female inter–styloid distances. The analysis presented a 95% confidence interval of the mean differences of both sexes.

Table 4: T – Test Comparing means of male and female inter-styloid distances

	Test Value = 0					
	T	Df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference Lower	Upper
Male	111.43	49.00	.00	77.16 mm	75.77 mm	78.55 mm
Female	77.55	9.00	.00	68.20 mm	66.21 mm	70.19 mm

DISCUSSION

The study presented normal and elongated styloid process lengths[14,33]. It also revealed that in an individual, the right styloid process length could be different from the left styloid process length[34]. It does not necessarily mean that a particular side either right or left is constantly longer amongst a population[41]. The study showed a prevalence of elongated styloid processes in both the right lateral and posterior views of the male styloid processes. The left styloid processes had more elongation. Female specimens presented unilateral elongation of the left styloid process[36,22]. Prevalence of elongated styloid process from earlier studies includes; 1%[37], 4%[38] and 8.2%[39]. In an Indian population, the prevalence of styloid process was 2%[40] and in the study done within a Brazilian population with a sample size of 15 dry skulls, the prevalence of elongated styloid process was 6.6%[8] Comparing values of the prevalence of elongated styloid process of previous research and the present research it could be noted that there is high prevalence of elongated styloid process among the population of the present study than those of studies cited. In another study carried out by an Indian population, the prevalence of elongated styloid read thus: Of the total 100 specimens, 19 skulls (19%) had elongated styloid process with 11 out of 65 skulls (16.92%) in male and 8 out of 35 skulls (22.85%) in female. Bilateral elongated styloid processes were found in 4 (4%) of the 11 male and 5 skulls (5%) of the total 8 female skulls. Unilateral elongated styloid processes were found in 3 skulls (3%) in males and 2 skulls (2%) in females on the right side and 4 skulls (4%) in males and 1(1%) in females on the left side. This is the result of the prevalence of the elongated styloid process as presented by[15]. Comparing the results of the cited study with that of the present study, it could be noted that both studies agree on the fact that the elongated styloid process occurs in both males and females. Another study presented the prevalence of the elongated styloid process in males to be 13.73% and 12.73% in females. The prevalence of unilateral and bilateral elongated styloid process was 7.84% and 5.88% respectively within the male specimen. The unilateral and bilateral elongated styloid process within the female specimen was 8.82% and 3.92% respectively[33]. The present study revealed that both male and female styloid processes presented a higher prevalence of unilateral elongated styloid processes.

In an evaluation of the elongated styloid process on digital panoramic radiographs, it was observed that 43% of the males had elongated styloid process and 57% of the females had elongated styloid process. They concluded that females showed elongated styloid processes more than males. Another study presented 2 out of 72 skulls that presented with elongated styloid process with an incidence of 2.7%. Results from the cited study do not resonate with the prevalence of the elongated styloid process in the present study[34]. Furthermore, it was recorded in another research that 55.5% of the styloid process presented with the elongated styloid process and all the cases were asymptomatic[41]. It could be assumed that specimens which presented with elongated styloid processes in the present research were also asymptomatic and did not present signs of Eagle syndrome in their lifetime. Tanaka presented a prevalence of elongated styloid process from his study thus: 29.5%, the female to male ratio of elongated styloid process is 1:2[35]. Results from the cited study do not entirely agree with the present study as the female specimen presented a higher prevalence of

elongated styloid process compared to the male specimen in the present study. Another study using radiographic examination results revealed the prevalence of the elongated styloid process as 27.3%. Out of the 34 females with elongated styloid processes, 78.60% of them exhibited symptoms, whereas only 21.40% of the 48 males with elongated styloid processes presented with symptoms[42]. It agrees with the fact that the elongated styloid process could be asymptomatic.

The study revealed greater inter-styloid distance among the male skulls compared to the female skulls. Results derived from comparing their means presented a statistical significance in their difference.

Conclusion

Results showed a prevalence of elongated styloid processes in the male and female skulls with a high prevalence in the female skulls. The Inter-styloid distance between the male and female skulls showed a significant difference, this proposes that the Inter-styloid distance could be an integral measure of sexual dimorphism, a statement recommended for further studies

Competing interests: There is no conflict of interest in connection with the study.

REFERENCES

1. Sakhdari S, Saberi S, Shamshiri AR. Prevalence and Pattern of Styloid Process Elongation and Calcification on Digital Panoramic Radiographs in an Iranian Population Spring. J Islam Dent Assoc Iran. 2018; 30: 44 – 51. http://dx.doi.org/10.30699/JIsdreir.30.2.44
2. Buyuk C, Gunduz K, Avsever H. Morphological assessment of the stylohyoid complex variations with cone beam computed tomography in a Turkish population. Folia Morphol. 2018;77 (1): 79 – 89. https://doi.org/10.5603/fm.a2017.0061
3. Abuhaimed AK, Alvarez R, Menezes RG. Anatomy Head and Neck, Styloid Process. Treasure Island: StatPearls Publishing; 2021.
4. Kamala A, Nazir R, Usman M, Salam BU, Sana F. Eagle syndrome; radiological evaluation and management. J Pak Med Assoc. 2014; 64(11):1315-7.
5. Pereira FL. Styloid-stylohyoid syndrome: literature review and case report. Journal of Oral and Maxillofacial Surgery. 2007; 65(7):1346 – 53. https://pubmed.ncbi.nlm.nih.gov/8535969/
6. Gözil R, Yener N, Calgüner E, Araç M, Tunç E, Bahcelioğlu M. Morphological characteristics of styloid process evaluated by computerized axial tomography. Ann Anat. 2001;183(6):527-35. https://doi.org/10.1016/s0940-9602(01)80060-1
7. Yavuz H, Caylakli F, Yildirim T, Ozluoglu LN. Angulation of the styloid process in Eagle's syndrome. Eur Arch Otorhinolaryngol. 2008; 265(11):3 – 6. https://doi.org/10.1007/s00405-008-0686-9
8. Custodio AL, Silva MR, Abreu MH, Araújo LR, De Oliveira LJ. Styloid Process of the Temporal Bone: Morphometric Analysis and Clinical Implications. Biomed Res Int. 2016; 8792725. https://doi.org/10.1155/2016/8792725
9. Patil S, Ghosh S, Vasudeva N. Morphometric study of the styloid process of temporal bone. Journal Clinical Diagnostic Research. 2014; 8(9): 4 – 6. https://doi.org/10.7860%2FJCDR%2F2014%2F9419.4867
10. Eagle WW. Elongated styloid process; symptoms and treatment. AMA Arch Otolaryngo. 1958; l67:172 – 6. https://doi.org/10.1001/archotol.1958.00730010178007
11. Palesy P, Murray GM, De Boever J, Klineber I. The involvement of the styloid process in head and neck pain: a preliminary study. J Oral Rehabil. 2000; 27:275–87. https://doi.org/10.1046/j.1365-2842.2000.00515.x
12. Eagle WW. Elongated styloid process; further observations and a new syndrome. AMA Arch Otolaryngo. 1948; 47(5): 630 – 640. https://doi.org/10.1001/archotol.1948.00690030654006
13. Onbas O, Kantarci M, Murat KR, Durur I, Basekim CC, Alper F, et al. Angulation, length and morphology of the styloid process of the temporal bone analyzed by multidetector computed tomography. Acta Radiol. 2005; 46(8): 881– 886. https://doi.org/10.1080/02841850500335085
14. Murtagh RD, Caracciolo JT, Fernandez G. CT findings associated with Eagle syndrome. American Journal of Neuroradiology. 2001; 22 (7) 1401–1402. PMID: 11498437; PMCID: PMC7975191.
15. Abhilasha M, Wahane RA. Study of Styloid Process in Dry Human Skulls: Identification of Sex from Interstyloid Distance in Central India Region. Sch Int J Anat Physio. 2019; 23: 102 – 107. DOI:10.21276/sijap.2019.2.3.4
16. Balcioglu HA, Kilic C, Akyol M, Ozan H, Kokten G. Length of the styloid process and anatomical implications for Eagle's syndrome. Folia Morphol. 2009; 68 (4) 265 – 270.
17. Jan HT, Smith H, Breen DR, Vogel AW, Mitchell AWM. The gender and side asymmetry of the length of the styloid process. Anatomy Journal of Africa. 2019; 8 (1): 1351 – 1357.
18. Worth HM. Principles and practice of oral radiologic interpretation. Year Book Medical Publishers, Chicago, 1963.

19. Salerno G, Daniels IR, Brown G, Heald RJ, Moran BJ. Magnetic resonance imaging pelvimetry in 186 patients with rectal cancer confirms overlap in pelvic size between males and females. Colorectal Disease. 2006; 8(9):772 – 6. https://doi.org/10.1111/j.1463-1318.2006.01090.x
20. Jung T, Tschernitschek H, Hippen H, Schneider B, Borchers L. Elongated styloid process: when is it really elongated? Dentomaxillofacial Radiology. 2004; 33 (2):119 – 124. https://doi.org/10.1259/dmfr/13491574
21. Monsour PA, Young WG. Variability of the styloid process and stylohyoid ligament in panoramic radiographs. Oral surgery, oral medicine, oral pathology. 1986; 61(5): 522 – 526. https://doi.org/10.1016/0030-4220(86)90399-3
22. Eagle WW. Elongated styloid process: report of two cases. Archives of Otolaryngology. 1937; 25: 584 – 586. http://dx.doi.org/10.1001/archotol.1937.00650010656008
23. Roopashri G, Vaishali MR, David MP, Baig M, Shankar U. Evaluation of Elongated Styloid Process on Digital Panoramic Radiographs. J Contemp Dent Pract. 2012; 13(5): 618 – 622. https://doi.org/10.5005/jp-journals-10024-1197
24. Dinkar Amonkar SS. Eagle's syndrome: Review of literature and case report. J Oral Maxillofac Surg. 2003;14: 162 –168. PMID: 15164659
25. Moon CS, Lee BS, Kwon YD, Choi BJ, Lee JW, Lee HW, et al. Eagle's syndrome: a case report. J Korean Assoc Oral Maxillofac Surg. 2014;40 (1):43 – 7. https://doi.org/10.5125%2Fjkaoms.2014.40.1.43
26. Badhey A, Jategaonkar A, Anglin KAJ, Kadakia S, De Deyn PP, Ducic Y, et al. Eagle syndrome A comprehensive review. Clin Neurol Neurosurg. 2017; 159:34 – 38. https://doi.org/10.1016/j.clineuro.2017.04.021
27. Piagkou M, Anagnostopoulou S, Kouladouros K, Piagkos G. Eagle's syndrome: a review of the literature. Clin Anat. 2009; 22 (5): 545 – 58. https://doi.org/10.1002/ca.20804
28. Antonio LG, Miranda MR, Abneu MH, Araujo LRA, Oliveira LJ. Styloid Process of the temporal Bone: Morphometric Analysis and Clinical Implications. Biomed Research International. 2016; 8792725: 2. https://doi.org/10.1155/2016/8792725
29. Diamond LH, Cottrell DA, Hunter M.J, Papageorge M. Eagle's syndrome: a report of 4 patients treated using a modified extraoral approach. J Oral Maxillofac Surg. 2001; 59: 1420 – 1426. https://doi.org/10.1053/joms.2001.28276
30. Chandramani MB, Mukesh AK. Evaluation of the styloid process on digital panoramic radiographs. Indian J Radiol Imaging. 2010; 20 (4):261 – 5. https://doi.org/10.4103%2F0971-3026.73537
31. Ferrario VF, Sigurta D, Daddona A, Dalloca L, Miani A, Tafuro F, et al. Calcification of the stylohyoid ligament incidence and morphoquantitative evaluations. Oral Surg Oral Med Oral Pathol. 1990; 69 (4):524 – 529. https://doi.org/10.1016/0030-4220(90)90390-e
32. Drake R, Vogel AW, Mitchell AWM. Gray's Anatomy for Students (2nd ed). 2010. Elsevier Churchill Livingstone: Toronto, Ontario, Canada.
33. Sakaew W, Arnanteerakul T, Somintara S, Ratanasuwon S, Uabundit N, Iamsaard S, et al. Sexual Dimorphism Using the Interstyloid Distances and Clinical Implication for Elongated Styloid Process in Northeastern Thailand. Int J Morphol. 2016; 34:1223 – 1227. http://dx.doi.org/10.4067/S0717-95022016000400008
34. Kumar DS, Merha S, Kumar, ASB. Morphometric study of occipital condyles in adult dry human skulls of Rajasthan population. International Journal of Scientific Research. 2019; 8 (12): 15 – 18. https://www.doi.org/10.36106/ijsr/8200763
35. Tanaka S, Terayama H, Miyaki Y, Kiyoshima D, Qu N, Umemoto K, et al. A gross anatomical study of the styloid process of the temporal bone in Japanese cadavers. Folia Morphol. 2021; 81 (2): 493 – 502. https://doi.org/10.5603/fm.a2021.0019
36. Prasad KC, Kamath MP, Reddy KJM, Raju K, Agarwal S. Elongated styloid process (Eagle's syndrome): a clinical study, Journal of Oral and Maxillofacial Surgery. 2002; 60 (2): 171 – 175. https://doi.org/10.1053/joms.2002.29814
37. Langlais RP, Miles DA, Van Dis ML. Elongated and mineralized stylohyoid ligament complex: A proposed classification and report of a case of Eagle's syndrome. Oral Surg Oral Med Oral Pathol. 1986; 61: 527 – 32. https://doi.org/10.1016/0030-4220(86)90400-7
38. Winkler S, Sammartino FJ, Sr Sammartino FJ, Jr, Monari JH. Stylohyoid syndrome. Report of a case. Oral Surg Oral Med Oral Pathol. 1981; 51: 215 – 217. https://doi.org/10.1016/0030-4220(81)90043-8
39. Kawai T1, Shimozato K, Ochiai S. Elongated styloid process as a cause of difficult intubation. J. Oral. Maxillofac. Surg. 1990; 48 (11): 1225 – 28. https://doi.org/10.1016/0278-2391(90)90544-c
40. Rathva A, Kubavat DM, Nagar SK. Study of styloid process: Anatomical variations in length, angulation and distance between the two styloid processes International Journal of Recent Trends in Science and Technology. 2013; 8 (2): 109 – 112.

41. Smit JHT, Breen H. The Gender and Side Asymmetry of Length of the Styloid Process. Anatomy Journal of Africa. 2019; 8 (1): 1351 – 1357. https://doi.org/10.4314/aja.v8i1.182599

42. Swapna LA, Almegbil NT, Almutlag AO, Koppolu P. Occurrence of the Elongated Styloid Process on Digital Panoramic Radiographs in the Riyadh Population. Hindawi Radiology Research and Practice. Radiol Res Pract. 2021: 6097795. https://doi.org/10.1155/2021/6097795