



Original article

The Length of Styloid Process and the Correlation between Lengths and Clinical Symptoms in the Turkish Population

Aysegul Apaydin^{1*}, Mustafa Senocak², Ozden Calay³, Gizem Ecem Kocak⁴, Deniz Yanik⁵

¹I.U. Faculty of Dentistry, Department of Oral & Maxillofacial Surgery, Istanbul, Turkey,

^{2&3}I.U Cerrahpasa Medical Faculty, Department of Biostatistics and Medical Informatics, Istanbul, Turkey,

^{4&5}I.U. Faculty of Dentistry, Department of Oral & Maxillofacial Surgery, Istanbul, Turkey.

ABSTRACT

Back ground: Elongated styloid (ES) (also known as Eagle's syndrome) is a rare condition causing pain and various symptoms in the maxillofacial region. **Purpose:** In our study we aimed to evaluate the length of the styloid process in the Turkish population and to assess the correlation between this length and clinical symptoms. **Method:** We measured the length of Styloid process (SP) on the randomly chosen Cone beam computerized tomographies (CBCT) of 530 patients. Arithmetic mean and Standard deviation as well as Ranges, medians and 95.percentile values were used for descriptive statistics. Regression models were evaluated for the relationships between age and SP length, student-t test was used to compare means. **Results:** Statistically significant differences have not been found between genders in SP lengths and ages. None of the results are powerful enough for a clinically meaningful relationship ($R^2 > 0.1$). **Conclusion:** Although many researchers worked on this subject so far but it still needs more investigation to understand fully this syndrome.

KEYWORDS: Cervicofacial pain, Eagle's syndrome. Otagia, Styloidprocess, Temporal bone.

INTRODUCTION

Eagle syndrome is a general term to cover the aggregate of chronic head and neck pain symptoms due to the presence of an elongated styloid process or a calcified styloid ligament [1,2] Styloid process (SP) is a cylindrical bony projection arising from the lower surface of the temporal bone. It is originating from Reichert cartilage of the second branchial arch in intrauterine life [3]. Eagle syndrome is a rare condition which is not commonly suspected clinical practice and only a small percentage (4%) of the population is believed to have an elongated styloid process and a calcified styloid ligament manifests the symptoms [4,5]. Numerous vital anatomical structures (carotid arteries, internal jugular vein, the facial, glossopharyngeal, vagus, hypoglossal nerve) are located in the vicinity of an elongated SP [3,6]. It is therefore likely that Eagle's syndrome symptoms are related to compression of the SP upon some neural and vascular structure. Foreign body sensations in the pharynx, earache (otalgia), tinnitus and difficulty in swallowing are also encountered as symptoms arising from an elongated SP. [5,7-10].

Eagle syndrome is diagnosed by both radiographic and physical examination and SP palpation is an indicative SP elongation which is not normally palpable [1]. Palpation of the tip of the SP should exacerbate existing symptoms [1,11]. Clinical suspicion of Eagle's syndrome can be verified by 3D or panoramic radiographic imaging. However many researches show that elongation of SP is not only reason of the symptoms. Mediolateral angling and anteroposterior angling is also important for developing the symptoms. 3D radiograph is the most sensitive available technique for the diagnosis of abnormal changes to bone structure. The origin of SP elongation remains unclear but possible causes include endocrine changes, surgical trauma, local chronic irritations, menopause, or growth of the osseous tissue [11-13].

In our study we aimed to evaluate the length of SP and the clinical symptoms in a group of Turkish population. These data were expected to provide insight into correlation between size and patients' complains.

MATERIALS AND METHODS

We measured the length of SP on the randomly chosen radiographs (Figure 1). Cone beam computerized tomographies (CBCT) of 530 patients (257 men, 273 women) were evaluated. 5 patients had cervico-pharyngeal

symptoms (pain, difficulty in swallowing etc.). The data were obtained using “On-demand 3D volumetric tomography program”, by measuring the both size of process in two dimensions (mediolateral and posteroanterior aspects).

Figure 1: Measurements of styloid process of one of the symptomatic cases



Arithmetic mean and Standard deviation as well as Ranges, medians and 95th percentile values were used for descriptive statistics. Quadratic, cubic, linear, and logarithmic regression models were evaluated for the relationships between age and SP length, student-t test was used to compare means. All analysis was performed using SPSS version 18. A *p*-value <0.05 was considered to be statistically significant. Patients were divided into 9 age sub-groups for each gender. Minimum and maximum amounts of measurements were used to evaluate each group in regressions analysis.

RESULTS

The ages, SP length ranges, SP lengths in both sides according to genders are shown in Table 1. 36 (16 women, 20 men) of 530 patients had elongated styloid process (6.79%) (Measurements were over the 2,5 cm) and 26 of them had bilateral elongation. Statistically significant differences have not been found between genders in SP lengths and ages. The percentile levels of our 5 Symptomatic patients - % 0.94 of all patients - are : 75., 95., 95., 95., and 85. These results show that symptomatic patients' SP measurements were longer than the average lengths.

Table 1: Range, Right and left Mean length and age of gender groups.

	Men (n=257)	Women (n=273)	p	Total (n=530)
Range	4.73 – 63.76	1.45 - 48.00		1.45 – 63.76
Left (Mean ± SD) mm	19.92 ± 8.6	19.90 ± 8.6	0.991	19,91 ± 8,64
Right (Mean ± SD) mm	21.31 ± 9.0	20.78 ± 8.9	0.500	21,04 ± 8,98
age	41.87 ± 11.2	42.17 ± 12.2	0.732	42,03 ± 11,73

Results (R²) of Quadratic, cubic, linear and logarithmic regressions (age-SP length) models are shown in Table 2. None of the results are powerful enough for a clinically meaningful relationship (R²> 0.1). We also identified no significant differences in the mean length and percentile SP values between across age groups Mean, median and 95th percentile SP length values of age sub-groups in genders are listed in Table 3. 5 of 530 patients were symptomatic mild to moderate level. One of them had surgical shortening

procedure. Other symptomatic patients were managed with conservative treatment such as; nonsteroidal anti-inflammatory administration, local anesthetic injection and also physiotherapy. Complaints of patients healed after the treatment without any permanent complication yet patients had suffered difficulty in swallow and discomfort after surgery for a short period.

Table 2: Regression analyzes according to gender

Regression Model	R ² (Female)	R ² (Male)
Linear	0.00482	0.002
Quadratic	0.00552	0.006
Cubic	0.03373	0.002
Logarithmic	0.00490	0.0017

Table3: Mean and Percentile values of SP length for age among sub groups of genders

Age	Mean ± Standard deviation		50 th percentile		95 th percentile	
	M	F	M	F	M	F
18-21	21.03 ± 5.38	26.95 ± 11.84	21.35	23.86	32.05	46.46
21-25	21.35 ± 5.39	20.39 ± 7.2	23.41	19.26	63.045	35.56
26-30	25.60 ± 14.24	20.1 ± 10.73	20.94	18.51	30.36	42.43
31-35	19.40 ± 7.77	20.27 ± 5.19	21.78	20.45	39.51	31.37
36-40	22.96 ± 10.64	17.34 ± 7.11	22.42	18.63	49.69	30.91
41-45	21.10 ± 7.9	24.65 ± 10.71	20.61	21.95	35.56	51.84
46-50	23.23 ± 10.06	24.01 ± 9.94	21.44	22.33	45.97	55.06
51-55	23.89 ± 9.94	24.52 ± 8.79	21.56	23.9	48.15	42.07
55-67	23.96 ± 10.01	21.18 ± 9.41	23.19	19.49	43.54	45.17

DISCUSSION

Elongated styloid process or Styloid syndrome documented by Eagle [4]. Patients were divided two groups by Eagle. First group is, has foreign body sensation in throat with a palpable mass in the tonsillar region and the second type is, has pain in the neck following the carotid artery distribution. These are classical symptoms of ES [1,12,14].

Eagle claims that normal length of SP is 2.5 cm [4] but Kaufman et al and Lindeman reported same average length for SP which was 2-3 cm [15,16]. These measurements are congruent with our results. Elongated SP has been measured by different systems radiographs and cadavers in literature [2,17,18]. However only radiography doesn't adequate for diagnose to elongated styloid process. Because many researches show that there is no correlation between length and symptoms. And many patients with ossified styloid complex are asymptomatic [15,18-21]. Steinmann reported a series of 30 patients with symptoms of eagle's syndrome in which only %20 exhibited elongated process or ossified stylohyoid ligaments [23].

Eagle's findings according to incidence of elongation of SP were %4 while Kaufman et al found that %7 [4,16]. However, just a very low percentage of those had complained of pain. Corell et al examined the 1771 radiographs and found the incidence to be %18.2, with about %93 of these exhibiting bilateral elongation however only 8 of 1771 patients reported symptoms that could be associated with Eagle's syndrome, and the symptoms were usually unilateral [7]. In our study 36 patients have elongated SP (6.79%) and 10 of them have unilateral elongation in 530 patients. Our findings were similar to the result of Kaufman et al. also no statistically differences were observed with gender and also there were not meaningful difference between right or left SP. These results were support with initial reports in this field [20,22].

Head and neck pain one of the most important complaints in these groups of patients. SP can cause leading to transient ischemic attack may pose a threat due to compress upon the internal carotid artery. Beyond these measurements patients

can be symptomatic or asymptomatic. When patients are symptomatic, it can be treated conservatively or surgically. If decided the conservative treatment, more than one options exist such as transpharyngeal injection of steroids and lignocaine, nonsteroidal anti-inflammatory drugs, diazepam, the application of heat and traditional Chinese medicines however surgically treatment is still notable way [5,24-27].

ES can be diagnosed by a detailed history, physical and radiological examination. Awareness of pain syndrome is important to clinicians involved in the head and neck pain to rationalize the line of management to clinical proper results. Although many researchers worked on this subject so far but it still needs more investigation to understand fully this syndrome.

Acknowledgement

We would like to thank language editor Kevin Smyth, for the revision of spelling and grammar.

Role of the funding source

No funding to disclose.

Competing interests

We disclose any financial and personal relationships with other people or organizations that could inappropriately influence our work.

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*Corresponding author: Prof. Dr Aysegul Apaydin
E-Mail: apaydin@istanbul.edu.tr