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### The Evaluation of Variation in the Length of Styloid Process of Indian Population and Its Applied Importance

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#### ABSTRACT

The styloid process has variable length with average of 25mm. Its length  $\geq 30$  mm is termed as elongated. The variation in the length may produce wide variety of symptoms in head and neck region as it is approximated to important neurovascular structures. This study is designed to evaluate the significant variability of length of styloid process in the study sample and the value mentioned the anatomy text books and to know the bilateral relationship between them. Materials & methods: random sampling of 98 (n) styloid processes from 49 dry adult human skulls of Indian origin was used in this study. The student t-test, Scatterplot and Pearson's correlation coefficient were used to analyze the data. Result: The mean length in the study sample was  $24.05 \pm 4.8$ mm [range: 9.12mm to 36.13mm]. Significant difference was not found ( $p > 0.05$ ) between sample and text book value (25mm). Strong Positive linear correlation ( $r = 0.99$ ) was observed between the pairs. More incidence was found (78.57%) in the 20mm to 30 mm category. The length is important in diagnosis, anatomy and anthropology. Conclusion: Length of styloid process in sample was not significantly different from the value mentioned in the text book. Bilateral Positive linear correlation was observed.

**Key Words:** Styloid processes, Syndrome, Styloidectomy, Frequency, Eagle's syndrome.

#### INTRODUCTION

Styloid process is elongated bony projection having variable length. Average length is [1] 25mm. It forms styloid apparatus with muscles and ligaments. It is approximated to important nerves and blood vessels [2, 3] of head and neck region. So any unilateral or bilateral variation of styloid process can produce wide variety of symptoms in head and neck. Its

length more than or equal to ( $\geq$ ) 30 mm is termed as elongated [4]. Aim of this study is determination of the significant variation in the length of styloid process of the study sample (n=98) with the value mentioned the anatomy text books [1] and to know the bilateral strength of relationship between them.

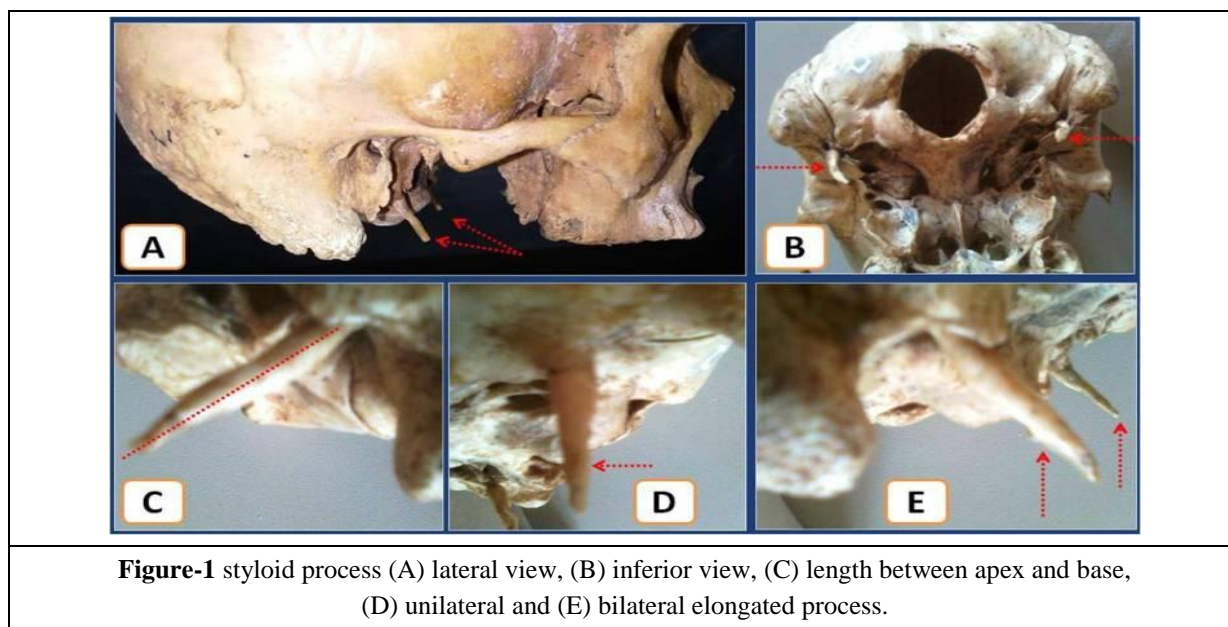
## MATERIALS AND METHODS

This primary research study was done on ninety eight (n=98) styloid process from forty nine dry adult human skulls of Indian origin. The study was

performed in the Department of Anatomy, Malabar Medical College and Research Centre, Modakkallur, Calicut, Kerala, India, during March 2014 to April 2015. The criteria for study was as follows

Table-1 summary of methods and materials

|    |                            |   |
|----|----------------------------|---|
| 1  | Sample size (n)            | 98  |
| 2  | Unit of Investigation      | Intact styloid processes  |
| 3  | Study population           | Indian  |
| 4  | Pilot study                | On twenty five dry skulls   |
| 5  | Calculation of Sample size | With 1.5mm precision and 80% power  |
| 6  | Inclusion criteria         | Styloid processes in regular form   |
| 7  | Exclusion criteria         | Deformed and fractured styloid processes  |
| 8  | Instruments & materials    | Vernier caliper, magnification hand lens, divider, camera, tables of random digits. |
| 9  | Selection method           | Simple random sampling  |
| 10 | Parameter                  | Length: the distance between the base and apex of styloid processes.                |



## PROCEDURE

After careful inspection the measurement (Fig-1, C) was done by single investigator. Average of two readings was recorded and the master table was prepared. Data analysis was done. Frequency distribution was observed. Based on the length, the styloid process were categorized and arranged in class interval frequency table in three categories as: 0 to < 20 mm, 20 to < 30 mm and 30 to < 40 mm.

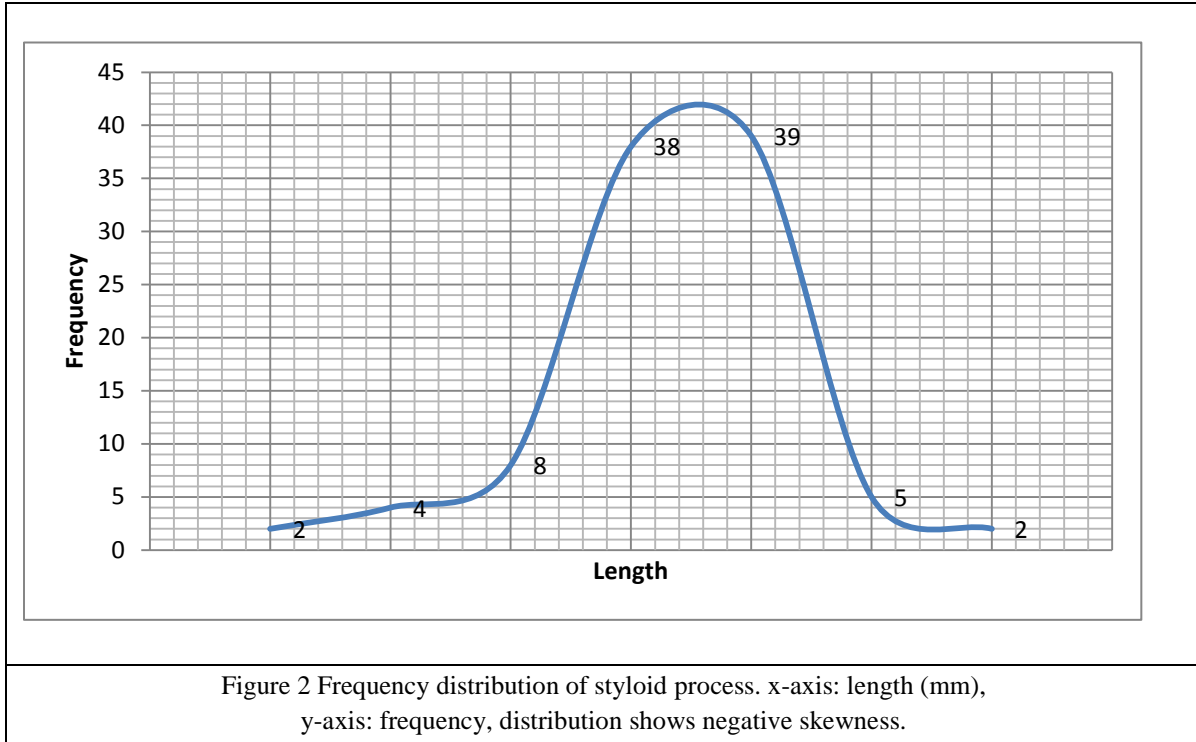
## STATISTICAL ASSESSMENT [5, 6]

The descriptive measures [table-2] and inferential calculations were done manually. Data Exploration

was done. The student t-test and Pearson's correlation coefficient was used. Relationships between the bilateral sides and its strength was analysed with construction of Scatterplot and correlation coefficient. Variability of length was assessed by student's t test. Statistical assessment with p-values < 0.05 was considered significant.

## RESULT

The observations in the present study were given in the following tables and figures.



**FREQUENCY DISTRIBUTION**

The symmetry of the curve for frequency distribution (Figure-2) of length of styloid process shows that the values are arranged around the mean (24.05mm), the midpoint of the distribution with normal distribution. Slight horizontal stretching to left or the longer left sided tail shows that the distribution does not vary

from the normal. The values of mean (24.05mm) and median (23.58mm) are approximate with each with location at 23.38mm [table-2]. The values were spread from 9.12mm to 36.13mm having 4.8mm standard deviation.

**Table-2** Descriptive Measures.

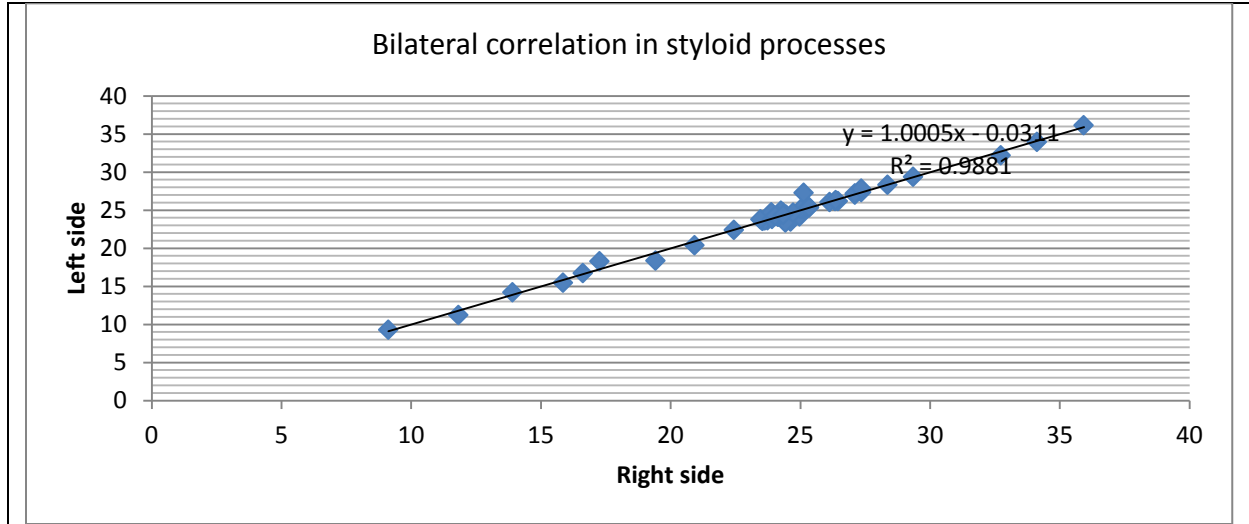
|   |                         |       |                          |
|---|-------------------------|-------|--------------------------|
| 1 | Sample size (n)         | 98    | p value>0.05,            |
| 2 | Mean (mm)               | 24.05 | (0.10>p>0.05).           |
| 3 | Standard deviation      | 4.80  |                          |
| 4 | Standard error          | 0.48  |                          |
| 5 | Median                  | 24.38 |                          |
| 6 | Mode                    | 23.64 |                          |
| 7 | Minimum (mm)            | 9.12  |                          |
| 8 | Maximum (mm)            | 36.13 |                          |
| 9 | Pairs [Right-Left side] | 49    | r=0.994,<br>p value<0.05 |

r= correlation coefficient, p value=significance (at  $\alpha=0.05$ )

**COMPARISON OF VALUES**

On comparing the study sample values with the text book value [1], the p value was more than 0.05 ( $p>0.05$ ). Which is not significant at  $\alpha=0.05$ . The 95% confidence interval for the sample mean was

from 22.78mm to 25.34mm. This interval covers value mentioned in the text book (25mm) and value obtained in the present study (24.058mm). Hence significant difference was not found.



**Figure -3** Scatter diagram of bilateral styloid process. Regression model and least squares regression line are shown on the figure.

**Table-3** Bilateral relationship of styloid process

|   |                              |   |
|---|------------------------------|---|
| 1 | Correlation coefficient      | 0.994                                     |
| 2 | Regression model             | Y=1.000x-0.031                            |
| 3 | Coefficient of determination | 98.8%                                     |
| 4 | Impression                   | Strong positive linear correlation exists |

Strong relationship (r=0.99) was observed between the bilateral sides [table-3].

**Table -4** Classification of styloid process

| - | Categories         | Frequency | Relative frequency | Cumulative frequency |
|---|--------------------|-----------|--------------------|----------------------|
| 1 | Less than 20mm     | 14        | 14.29%             | 14.29%               |
| 2 | 20 to 30 mm        | 77        | 78.57%             | 92.86%               |
| 3 | Greater than 30 mm | 07        | 7.14%              | 100 %                |

Frequency is more (78.57%) in 20mm to 30 mm category.

**DISCUSSION**

The mean length of styloid process in the present study was 24.05±4.80 mm. strong Positive linear correlation (r=0.99) was found between the pair of styloid processes of skull. More frequency was found (78.57%) in the 20mm to 30 mm category.

**COMPARISON**

The Present study is compared with previous study in the following table-5.

**Table -5** Comparisons of different research studies.

| Researches                   | Sample size (n) | Populations | Mean length (mm)                    |
|------------------------------|-----------------|-------------|-------------------------------------|
| Present study                | 98              | India       | 24.05                               |
| Ajay Rathva et al [7]        | 150             | India       | 23.20±13.13 [R],<br>23.17±12.99 [L] |
| H.A. Balcioglu et al [8]     | 227             | Turkey      | 22.54 ± 4.24                        |
| Phennapa Promthale et al [9] | 326             | Thailand.   | 24.12 ± 7.28                        |
| da Costa RS et al [10]       | 160             | Brazil      | 27.6 mm                             |

The variation can be observed between the population and within the population [table-3].

### **EMBRYOLOGICAL EVIDENCE [1]**

Development: The stylohyoid complex [7, 11] is derived from the 2<sup>nd</sup> bronchial arch. After ossification, the part of- dorsal end of arch forms styloid process and part of ventral end forms lesser cornua of the hyoid bone. The part between them regresses and its perichondrium forms the stylohyoid ligament.

Four Parts: It contains the four parts [4]. 1). Tympanohyal- forms proximal part of styloid process, 2). Stylohyal-forms distal part of styloid process, 3). Ceratohyal- forms stylohyoid ligament and 4). Hypohyal- forms lesser horn of hyoid bone. The ligament may calcify and alter the length of the styloid process, either unilaterally or bilaterally [12].

### **APPLIED SIGNIFICANCE**

If the length of styloid process exceeds 30 mm, it is considered [13] as elongated. It can cause wide variety of manifestations in head and neck region as it is closely related with multiple vital structures. These symptoms depend on angulations, length of process and ossification [14].

1. Classic styloid syndrome, and stylocarotid syndrome, [14, 15, 16, 17]. These two syndromes described by Eagle, an Otorhinolaryngologist are called as Eagle's syndrome. The classic styloid syndrome manifests during post tonsillectomy period by stretch of scar tissue which moves across the tip of the elongated styloid process. The stylocarotid syndrome is not related with tonsillectomy. The compression of the carotid arteries and sympathetic nerve fibers results the symptoms, as the apex of styloid process is located between carotid arteries.

2. A styloid process of normal length is usually non palpable. Digital examination and radiograph or CT is indicated for most accurate [18] diagnosis.

3. The most satisfactory and effective treatment [19] is shortening the styloid process by surgery [Styloidectomy] through either an intraoral or external approach.

### **FOOTNOTES**

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### **REFERENCES**

- [1]. Standring S. *Gray's Anatomy, The anatomical basis of clinical practice*, 40<sup>th</sup> edition. Churchill livingstone, Elsevier. 2008. Page 416-418,610-614,617-618.

4. It will be recognised in the patients approaching by departments of surgery, ENT, neurology and dentistry.

5. Length of styloid process is important in clinical, anatomical, anthropology fields.

### **PRECIPITATING CAUSES FOR ELONGATION [14, 20, 21, 22, 23]**

1. Injury,
2. Mesenchymal or cartilage component,
3. Calcification of the stylohyoid ligament [partial or complete]
4. Osseous tissue growth,
5. Ossification tendons attached,
6. Granulation tissue
7. Genetic factors
8. Early onset of the menopause,
9. Endocrinal problems.

### **CONCLUSION**

The mean length of styloid process in the present study sample is not significantly different from the mean value mentioned in the text book [1]. Positive linear correlation was observed between the pair of styloid processes in the present study.

### **LIMITATIONS OF STUDY**

The age and gender wise groups were not done. CT and Radiographs were not utilized.

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- [2]. 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.
- [3]. Eagle WW. The symptoms, diagnosis and treatment of the elongated styloid process. *Am Surg.* 1962; 28:1-5.
- [4]. Keur JJ, Campbell JPS, McCarthy JF, Ralph WJ. The clinical significance of the elongated styloid process. *Oral Surg Oral Med Oral Pathol.* 1986; 61:399-404.
- [5]. Carol E Osborn. *Basic Statistics for health information management technology.* Johnes and Bartlett publications, Inc. Sudbury, Massachusetts. 2008; 109-137,143-158,166-180, 174-185, 193-202.
- [6]. B.Burt Gerstman. *Basic Biostatistics: Statistics for public health practice.* Johnes and Bartlett publications, Inc. Sudbury, Massachusetts .2008; Page 35-56, 63-83, 129-138, 214-233,295-332.
- [7]. Ajay Rathva, Dharati M. Kubavat, Shaileshkumar K. Nagar. 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; Volume 8, Issue 2,109-112.
- [8]. H.A. Balcioglu, C. Kilic, M. Akyol, H. Ozan, G. Kokten. Length of the styloid process and anatomical implications for Eagle's syndrome. *Folia Morphol.* 2009; Vol. 68, No. 4:265-270.
- [9]. Phennapa Promthale, Vipavadee Chaisuksunt, Thanaporn Rungruang, Wandee Apinhasmit, Supin Chompoopong. Anatomical Consideration of Length and Angulation of the Styloid Process and Their Significances for Eagle's Syndrome in Thais. *Siriraj Med J.* 2012; Volume 64 (1), January-February, 30-33.
- [10]. Da Costa RS, Camargo Fontanella VR (2014) Anatomical Changes of the Styloid Process in a Brazillian Subpopulation. *J Dent Health Oral Disord Ther.* 1(1): 00006. DOI: 10.15406/jdhodt.2014.01.00006.
- [11]. Camarda AJ, Deschamps C. Stylohyoid chain ossification: a discussion of etiology. *Oral Surg Oral Med Oral Pathol.* 1989; 67:515-20.
- [12]. Keur JJ, Campbell JPS, McCarthy JF, Ralph WJ. The clinical significance of the elongated styloid process. *Oral Surg Oral Med Oral Pathol.* 1986; 61:399-404.
- [13]. Vougiouklakis T: Overview of the ossified styloid ligament based in more than 1200 forensic autopsies. *J Clin Forens Med* 2006; 13:268-270.
- [14]. W. W. Eagle, "Elongated styloid process. Report of two cases." *Archives of Otolaryngology.* 1937; vol- 25, page 584–587.
- [15]. Eagle, W.W. Symptomatic elongated styloid process: report of two cases of styloid process-carotid artery syndrome with operation. *Arch. Otolaryngol.* 1949; 49, 490–503.
- [16]. Eagle WW. Elongated styloid process: further observations and a new syndrome. *Arch Otolaryngol.* 1948; 47(5):630-40.
- [17]. 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.
- [18]. Ferrario VF, Sigurta D, Daddona A, et al. Calcification of the stylohyoid ligament: incidence and morphoquantitative evaluations. *Oral Surg Oral Med Oral Pathol.* 1990; 69:524–529.
- [19]. Bafaqeeh SA. Eagle syndrome: classic and carotid artery types. *J Otolaryngol.* 2000; 29: 88–94.
- [20]. A. Lentini. Gli aspetti clinici e radiologici delle anomalie dell'apparato stiloioideo. *Radiology Medical.* 1975; (61), 337– 364.
- [21]. G. Epifanio, "Processi stiloidei lunghi e ossificazione della catena stiloioidea." *Radiologia Pratica.* 1962; (12), 127–132, 1962.
- [22]. Prasad KC, Kamath MP, Reddy KJ, Raju K, Agarwal S. Elongated styloid process (Eagle's syndrome): a clinical study. *Journal of Oral and Maxillofacial Surgery.* 2002; 60:171–175.
- [23]. Humberto Ferreira Arquez. Morphological alterations of the styloid process and the clinical significance. *Int J Pharm Bio Sci.* 2014; Oct; 5(4):(B)992–999.

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