

Elongated Styloid Process: A Retrospective Panoramic Radiographic Study

Shreyas Predeepkumar Shah, NB Praveen, Vaseemuddin Syed, AR Subhashini

ABSTRACT

The styloid process is a cylindrical, long cartilaginous bone which arises from the temporal bone in front of the stylomastoid foramen. In the present study, our aim is to investigate the number of asymptomatic styloid process elongation (SPE) in relation to gender, type of elongation and calcification pattern in patients visited to maxillofacial radiology department. We have investigated styloid process using panoramic radiographs taken of 517 patients referred to our hospital. A total of 80 patients (15.47%) had elongated styloid processes (ESPs); 31 patients were female (38.75%) and 49 were male (61.25%). Among the ESPs Type I was the most frequent pattern of SPE (65.85%), then Type II (18.29%) and Type III (15.85%) pattern of elongation. The most frequent pattern of calcification was calcified outline (40.64%) then partially calcified (29.14%), nodular calcification (17.11%) and completely calcified (13.10%). From this study it was concluded that the panoramic radiography can be used for diagnosis of ESP but the norms which explain ESP are needed to be re-evaluated.

Keywords: Eagle's syndrome, Styloid process, Calcification patterns, Panoramic radiographs.

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INTRODUCTION

The name styloid process (SP) was derived from the Greek word '*stylos*' meaning a pillar. Embryologically SP, the stylohyoid ligament and the lesser cornu of hyoid bone are developed from the second brachial arch called Reichert's cartilage. Because of the cartilaginous origin the ligament has the potential to mineralize. The SP is a cylindrical, long cartilaginous bone which arises from the temporal bone in front of the stylomastoid foramen. The attached structures include stylopharyngeus, stylohyoid and styloglossus muscles and stylohyoid and stylomandibular ligaments. Many nerve and vessels, such as carotid arteries are adjacent to the SP.¹⁻³ The normal SP length is approximately 20 to 30 mm. The SP length which is longer than 30 mm is considered to be styloid process elongation (SPE).⁴

The SPE may cause symptoms like dull aching pain localized in either or both the sides of the throat. The pain may be referred to the ear or mastoid region of the affected side. It may cause pain on swallowing (dysphagia) or an

abnormal sensation of foreign body in the pharynx. More uncommonly symptoms, such as tinnitus or otalgia may occur. When these symptoms are present it is called Eagle's syndrome (ES).⁴ It is assumed that these symptoms and signs are due to compression of SP on some neural and vascular structures. In rare instances it may cause stroke due to compression of carotid arteries.⁵

The ES is diagnosed by both radiographical and physical examination. The radiographs used were lateral skull radiograph, Towne's radiograph, panoramic radiograph, lateral-oblique ramus view, anteroposterior head radiograph and computed tomography. In addition, barium swallow studies can show the indentation of the elongated styloid process (ESP) as a filling defect. More commonly panoramic radiography is used to determine SPE. Computed tomography is useful for complimentary information to that provided by panoramic radiography.⁶ In the present study, our aim is to investigate the number of asymptomatic SPE in relation to gender, type of elongation and calcification pattern in patients visited to maxillofacial radiology department.

MATERIALS AND METHODS

The study is based on 517 digital panoramic radiographs consecutively retrieved from the archival records. All the panoramic radiographs were taken in between 2006 to 2009 at the Department of Oral Medicine and Radiology, KLE Society's Institute of Dental Sciences, Bengaluru. The panoramic radiographs of the 517 patients with dental problems had originally been taken for routine examination and not for the investigation of the SPEs and none of the patient had any complaint of ES. All panoramic radiographs were taken using a Planmeca Promax (Finland). The following were measured or determined for each SP identified: Length, type and the pattern of calcification and left and right side SPs were analyzed independently. The measurement of the length was initiated proximally at the point where the SP extended from the temporal bone using Dimax Pro digital radiography software. Langlais¹⁶ et al classification of ESP (Tables 1 and 2, Figs 1 to 3) was used during this study.

RESULTS

A total of 517 panoramic radiographs were evaluated. Eighty patients (15.47%) had ESPs; 31 patients were female

Type	Description
Type I	Elongated
Type II	Pseudoarticulated
Type III	Segmented

Letter	Description
A	Calcified outline
B	Partially calcified
C	Nodular
D	Completely calcified

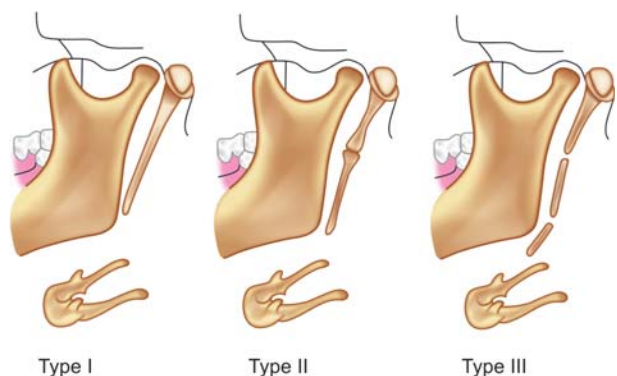
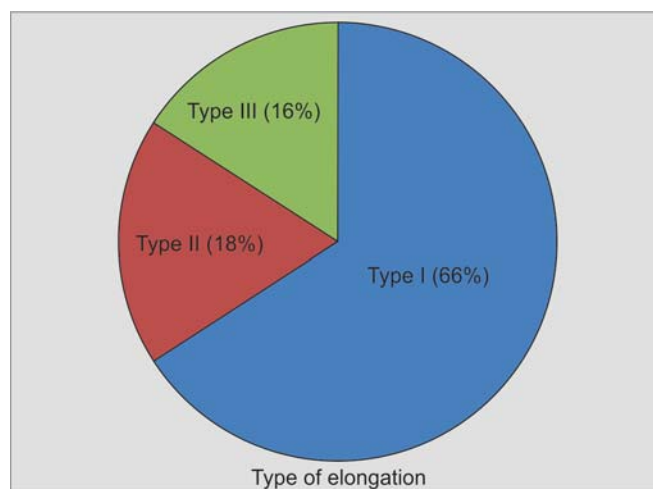


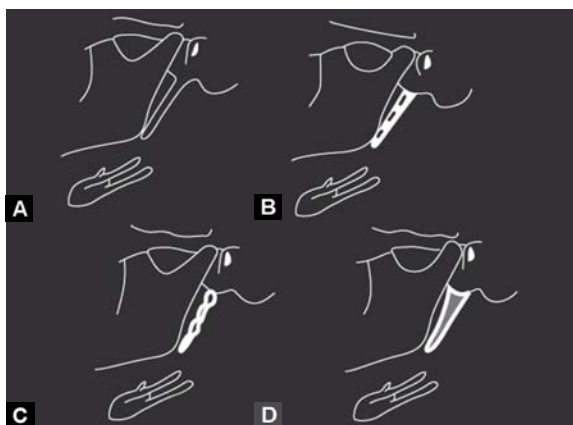
Fig. 1: The classification of ESP. Type I: Elongated; type II: Pseudoarticulated; type III: Segmented

Type of elongation	Incidence (%)
Type I	65.85
Type II	18.29
Type III	15.85

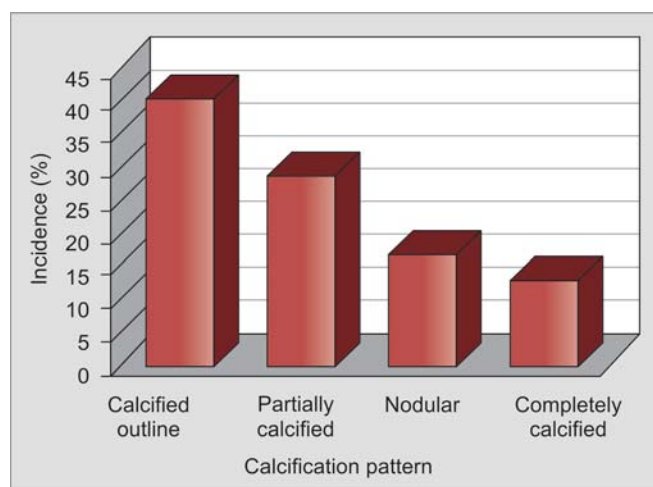
Calcification pattern	Incidence (%)
Calcified outline	40.64
Partially calcified	29.14
Nodular	17.11
Completely calcified	13.10



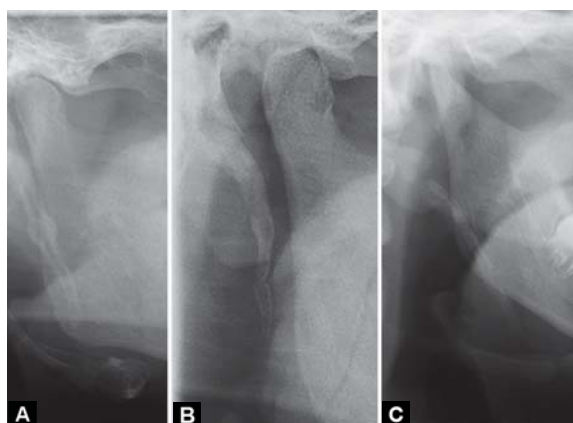
Graph 1: Incidence of elongation



Figs 2A to D: Pattern of the calcification of ESP: (A) Calcified outline, (B) partially calcified, (C) nodular, (D) completely calcified



Graph 2: Incidence of calcification pattern



Figs 3A to C: Radiographs of different types of elongation and calcification patterns: (A) Type I elongation with nodular calcification, (B) type II elongation with partial calcification, (C) type III elongation with calcified outline

(38.75%) and 49 were male (61.25%). Among the ESPs Type I was the most frequent pattern of SPE (65.85%), then Type II (18.29%) and Type III (15.85%) pattern of elongation (Table 3, Graph 1). The most frequent pattern of calcification was calcified outline (40.64%) then partially calcified (29.14%), nodular calcification (17.11%) and completely calcified (13.10%; Table 4, Graph 2). Considering the side of elongation, the left side was more

commonly affected (32.5%) than right side (16.25%) and the elongation present on both the sides was the commonest finding (51.25%).

DISCUSSION

The ES is characterized by recurrent pain in the oropharynx and face due to an ESP or calcified stylohyoid ligament. The SP is a slender outgrowth at the base of the temporal bone, immediately posterior to the mastoid apex. It lies caudally, medially and anteriorly toward the maxillo-vertebro-pharyngeal recess (which contains carotid arteries, internal jugular vein, facial nerve, glossopharyngeal nerve, vagal nerve and hypoglossal nerve).

Eagle considered tonsillectomy responsible for the formation of scar tissue around the styloid apex, with consequent compression or stretching of the vascular and nervous structures contained in the retrostyloid compartment (in particular, the glossopharyngeal nerve and perivascular carotid sympathetic fibers).⁷ However, ES is also discovered in patients who have never been subjected to tonsillectomy. So, many other factors have been considered, such as the following:

- The ossification of the stylohyoid ligament complex, causing contraction of the stylopharyngeal muscle and stretching of the XII cranial nerve.
- The fracture and medialization of the ossified stylohyoid ligament, with incomplete repair due to continuous hyoid bone movements and formation of excessive granulation tissue.
- The ossification of muscular tendons leading to irritation of the structures nearby.
- The abnormal length associated with abnormal angulation of the SP.

An ESP occurs in about 4% of the general population, while only small percentages (between 4-10.3%) of these patients are symptomatic. So, the true incidence is about 0.16%, with a female-to-male predominance of 3:1. Bilateral involvement is quite common but does not always involve bilateral symptoms. No significant difference is detectable between the right and left sides.⁷

'Elongated styloid process' is a term used since the publication by Eagle in reports concerning findings in both dentomaxillofacial and ear-nose-throat patients. This term denotes a SP exceeding its normal length. Eagle's definition was: 'The normal SP measures between 2.5 and 3 cm.' His method of measurement was not described, but his examples showed lateral radiographs of the skull.⁸ Today, reports concerning the SP and measurements of its length are mostly based on panoramic radiographs. However, the geometry does not correspond to that in Eagle's method, yet the values

given in these studies relating to anatomy, clinical epidemiology or anthropology for normal and ESPs are similar to those proposed by Eagle. For example, in a paper presented by Gulnara Scaf titled 'diagnostic reproducibility of the elongated styloid process' the ESP was considered to be present when the measurements were 30 mm or more. In this study the prevalence of ESP was 12.6%.⁹ Bozkir et al¹⁰ also considered the measurement of 30 mm or more as ESP in 100 panoramic radiographs of edentulous patients. In our study the prevalence of ESP was 15.47% and all the patients were asymptomatic. Many other studies had also used similar criterion for ESP.^{6,11-13} Image magnification and distortion ultimately limit dimensional accuracy in panoramic radiography. Patient head positioning is important in panoramic radiography because poor positioning techniques may result in structures lying outside the focal trough, causing images to be blurred and distorted with lack of definition.¹⁴ The distortion can create images that are either too wide or too narrow, depending on whether the structures are on the film or source side of the focal trough.¹⁵ This highly suggests the re-evaluation of standards which explain the elongation of SP on panoramic radiography.

CONCLUSION

The panoramic radiography can be used for diagnosis of ESP but the norms which explain ESP are needed to be re-evaluated.

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