Anatomical-Clinical Consequences of the Variations Observed in Styloid Processes

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Abstract
The styloid processes are located halfway down the base of the skull. These processes can be viewed easily by way of X-ray of the cervicofacial area. Depending on the symptoms in question, one of two syndromes can be singled out: Classic Eagle syndrome or Stylocarotid syndrome. In order to investigate the possible relationship between these variations in styloid processes and the potential symptoms involved, a study was conducted at Federico Henriquez y Carvajal University’s Postgraduate Dental Clinic, on 140 patients. We have concluded that a styloid process of abnormal length and with abnormal angulations, does not explain the pathogenesis of both syndromes.

Keywords: Styloid Processes; Eagle Syndrome; Stylocarotid Syndrome; Abnormal Length; Abnormal Angulations; Symptoms; Computed Tomography

Introduction
The styloid processes are located halfway down the base of the skull. They are situated on the inferior surface of the temporal bone, where the petrous part meets the tympanic part. Riolan’s bouquet can be found below, and is made up of stylohyoid, styloglossus and stylopharyngeus muscles. Each process also contains stylohyoid and stylomandibular ligaments [1,2]. These processes can be viewed easily by way of X-ray of the cervicofacial area (Figures 1-4). On occasion, the morphological variations of this structure can lead to various symptoms [3].
Depending on the symptoms in question, one of two syndromes can be singled out:

a) Classic Eagle Syndrome: Associated with patients who present elongated styloid. This occurs following a tonsillectomy, when the scar tissue present in the tonsillar fossa compresses the mucous membrane found around the process. Sore throat is a result of stretching and compression of cranial nerves V, VII, IX and X in the tonsillar fossa [4-9].

b) Stylocarotid Syndrome: In patients with no history of tonsillectomy, but with one or two elongated processes. On occasion presents abnormal angulations that put pressure on the external/internal carotid arteries, producing localized carotidynia due to irritation of the carotid sympathetic plexus [5-8, 10, 11].

In order to investigate the possible relationship between these variations in styloid processes and the potential symptoms involved, a study was conducted at Federico Henriquez y Carvajal University’s Postgraduate Dental Clinic, on patients randomly selected between the months of September and December 2018. Patients with odd medical histories were chosen, out of all of those who had undergone a computed tomography for any sort of pathology. A final sample of 140 patients was obtained, 44% of whom were men and 56% of whom were women. Their ages ranged from 21 to 85 years, with the median age being 51.27 years. All patients were informed about the evaluation and their consent was obtained.

All patients were asked to fill out a survey regarding possible symptoms, particularly those typical of Classic Eagle syndrome and Stylocarotid syndrome:

a) Classic Eagle Syndrome: Sensation of a foreign body in the throat, sore throat with no apparent cause, difficulty swallowing, earache, pain when moving the jaw.

b) Stylocarotid Syndrome: Pain in the back of the neck, pain in the orbital region, pain when turning head, pain when pressing down on neck, feeling faint when rotating head.

Patients were asked to rate their pain in accordance with the following scale: none, a little, quite a bit, a lot, for each of the symptoms mentioned above. The styloid processes of each patient were studied by way of CT scan, from the emergency point located in the temporal bone, and all the way down. The processes were classified according to their lengths and angulations, from both a frontal and sagittal perspective, using Icat Vision software. Through the multiplanar reconstruction window, axial, sagittal and frontal slices were generated. To measure length, a ruler built into the software was used. To measure the sagittal and frontal angulations, a line was drawn the length of the process, from the base to the bottom. The angle formed with the cranial base was measured using a protractor. Employing Başekim et al. [12] classification, 22.85% of the processes were elongated. When associating these elongations with the presence of symptoms, it was observed that 11.4% of patients with elongations presented at least one of the symptoms, although this figure is not statistically significant when compared to patients presenting no symptoms at all.

Given that process angulations may or may not be associated with symptoms, these were viewed and measured from different angles, as previously mentioned. Firstly, those viewed from a frontal perspective obtained a value of 67°, within normal limits as per Ramadan et al. [13], with the scale being 58-70°. In addition, it was observed with a statistical significance of 0.001 that the higher values corresponded to men (68.48°) versus women (65.49°), with the difference being most noticeable in the age group of 40-60 years. Seventeen point eight percent of patients with abnormal angulations (below 58° or above 70°) presented symptoms, in comparison to only 10% of patients with angulations falling within normal limits. However, these figures are not statistically relevant. As for the sagittal perspective, average angulations obtained a value of 70°, within the normal parameters as outlined by Ramadan et al. (67-70°). Of the abnormal angulations, 14.2% presented symptoms, although the results were not statistically significant.
When reviewing these variables, one can observe, by way of the Pearson correlation, a positive relationship between them: the greater the angulations from a frontal perspective, the greater as well from a sagittal perspective, and vice versa.

**Conclusion**

For these reasons, we have concluded that a styloid process of abnormal length and with abnormal angulations, does not explain the pathogenesis of both syndromes.

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