Three-dimensional computed tomography and surgical treatment for Eagle’s syndrome

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Abstract
Eagle’s syndrome represents a group of symptoms that includes recurrent throat pain, globus pharyngeus, dysphagia, referred otalgia, and neck pain possibly caused by elongation of the styloid process or ossification of the stylohyoid or stylomandibular ligaments. The medical history and physical and radiologic examinations are the main guides to the precise diagnosis. The radiologic diagnostic modality of choice is three-dimensional computed tomography (3-D CT). We describe a case of bilaterally symptomatic Eagle’s syndrome that was diagnosed by 3-D CT of the styloid processes and successfully treated with surgery via a transoral approach.

Introduction
Symptoms of Eagle’s syndrome include recurrent throat pain, globus pharyngeus, dysphagia, referred otalgia, and neck pain. Two possible causes of the syndrome are elongation of the styloid process and ossification of the stylohyoid or stylomandibular ligaments. Eagle considered any styloid process greater than 25 mm—the approximate length of the normal styloid process in adults—to be elongated. The reported prevalence of elongated styloid process ranges between 1.4 and 30%. X-rays are still used to diagnose Eagle’s syndrome, but a new and preferred modality is three-dimensional computed tomography (3-D CT), which can definitively measure the length of the styloid process.

The primary treatment modality for Eagle’s syndrome is surgery. The elongated styloid process can be resected surgically via a transoral or extraoral approach. The choice of surgical approach is usually based on the surgeon’s experience.

In this article, we present a case of Eagle’s syndrome that was caused by bilaterally elongated styloid processes. We describe our use of 3-D CT and surgery via the transoral approach.

Case report
A 46-year-old woman presented to us with a chief symptom of a foreign-body sensation in her throat. She also reported a sore throat and bilateral pain in the neck that was aggravated by swallowing. Earlier, she had been prescribed corticosteroid and analgesic treatment by a neurologist, and she had been subsequently referred to a gastroenterologist and a psychiatrist. Because a detailed gastroenterologic examination, including 24-hour pH monitoring, had detected no evidence of a gastrointestinal disease (gastroesophageal reflux or laryngopharyngeal reflux in particular), no medication had been recommended. The psychiatrist had prescribed an antidepressant drug, but the patient’s symptoms persisted.

The patient’s medical history was negative for recurrent tonsillitis, true foreign bodies, coexisting systemic diseases, and surgery, and her family history was negative for craniofacial syndromes. On routine physical examination, no otologic or rhinologic abnormality was found. No visible mass or true foreign body was observed during endoscopic examination of the nasopharynx, hypopharynx, larynx, and tongue base. No palpable mass was present in the neck. Suspecting an elongated styloid process, we palpated the tonsillar fossa bilaterally at the level of the anterior pillar, which elicited a very painful response. Lateral neck rotations to both sides also caused severe pain in the neck. The pain was relieved bilaterally by application of 1% lidocaine to both tonsillar fossae, a finding that suggested a diagnosis of Eagle’s syndrome.

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Findings on a laboratory work-up—which included a complete blood count, measurements of the erythrocyte sedimentation rate and anti-streptolysin O titer, and hepatic and renal function tests—were all normal. No microorganism was demonstrated in cultures of sputum. However, a panoramic radiograph demonstrated bilateral radiopaque bodies extending from the origin of the styloid process to the angle of the mandible. We established a presumptive diagnosis of Eagle’s syndrome and initiated conservative treatment with the application of heat to the neck and analgesic and myorelaxant therapy. However, the patient’s symptoms failed to respond. We then obtained 3-D CT, which revealed that both styloid processes were elongated. The styloid process on the left was 41.5 mm (figure 1, A), and the styloid process on the right was 42.5 mm (figure 1, B). Based on these findings, the patient was scheduled for resection of the styloid processes via a transoral approach.

Following the administration of general anesthesia and intravenous antibiotics, we performed a bilateral tonsillectomy. Next, we located by digital palpation the protuberance of the styloid process at the superolateral corner of the tonsillar fossa. The styloid process was skeletonized, and the attaching ligaments were separated from it (figure 2). The naked and free styloid process was removed from the temporal bone at its origin. The same procedure was then performed on the other side. Intraoperatively, the length of both styloid processes was 40 mm.

The patient was discharged 6 hours after surgery with no medication other than an analgesic. During monthly postoperative follow-up examinations, she reported that her symptoms had progressively eased, and by the end of the third month, they had disappeared. At the 18-month follow-up, she remained symptom-free.

Discussion

Only a small percentage of elongated styloid processes cause symptoms, and only a small percentage of symptomatic patients have true Eagle’s syndrome.\textsuperscript{1-4} Based on their study of 4,200 panoramic radiographs, Gossman and Tarsitano reported that the prevalence of elongated styloid process was 1.4%.\textsuperscript{5} Keur et al found a much higher prevalence—30%—in their radiographic study of 1,135 patients.\textsuperscript{8}

Camarda et al reached four conclusions about Eagle’s syndrome in their review.\textsuperscript{14} First, most persons with radiologic evidence of an elongated styloid process or ossified stylohyoid ligament are asymptomatic. Second, when symptoms do exist, their severity does not correlate closely with the extent of the ossification. Third, patients with symptomatic manifestations are generally older than 40 years, while those with only radiologic evidence are generally younger. Fourth, most symptomatic persons do not have a history of recent tonsillectomy.

Some patients with Eagle’s syndrome undergo unnecessary pharmacologic or surgical treatment because their condition has been misdiagnosed.\textsuperscript{14-16} Therefore, the extensive differential diagnosis should include every condition that can cause cervicofacial pain. Eagle’s syndrome should be suspected in the presence of persistent throat pain that is triggered or exacerbated by head rotations, lingual movements, swallowing, or chewing. The neck or throat pain may be accompanied by hypersalivation, a foreign-body sensation on the affected side and, in some rare cases, a change of voice lasting for a few minutes. Reproduction of pain during palpation of the lateral tonsillar fossa should alert the clinician to the possibility of Eagle’s syndrome. A diagnostic local anesthetic block can be injected into the tonsillar fossa to localize the site of the pain.

Radiologic investigation should be conducted to confirm the diagnosis. Several imaging modalities of the cervical region have been used to identify an elongated styloid process.\textsuperscript{7,8} However, 3-D CT is the most advanced technique, and it allows the physician to quickly make an exact diagnosis by definitively measuring the length of a styloid process.\textsuperscript{9,10}

Eagle’s syndrome can be successfully treated by surgery.
Several transoral and extraoral-cervical approaches to styloidectomy have been described.\textsuperscript{11-13} Transoral resection of the styloid process is relatively easy to perform, it can be done with local anesthesia, it involves no extensive fascial dissection, and it causes no external scars; also, the length of both the operation and the recovery period is short.\textsuperscript{12,13} The risks of the transoral approach, which are low, include the possibility of a deep cervical infection and the possibility of a neurovascular injury during an attempt to leave as little remnant of the styloid process as possible; also, visualization of the surgical field is poor.\textsuperscript{15,16}

Our patient had been medically treated by a neurologist for a vague diagnosis, probably neuralgia. She had also been referred to a gastroenterologist and a psychiatrist to no avail. Our physical examination revealed that the lateral tonsillar fossae were painful during palpation but not after 1% lidocaine injection, which led us to consider a diagnosis of Eagle’s syndrome. This case also featured two of the four circumstances that characterize Eagle’s syndrome according to Camarda et al\textsuperscript{14}: (1) our patient was symptomatic and older than 40 years, and (2) she had no history of recent tonsillectomy.

The estimated length of the styloid processes on preoperative 3-D CT in this case correlated well with the actual length measured intraoperatively. At 40 mm, the length of our patient’s styloid processes greatly exceeded the 25-mm threshold of normal. The great length placed her at a higher risk for symptoms, and indeed she was symptomatic. Our treatment of choice was resection via a transoral approach, and the patient did not experience any neurovascular complication.

In conclusion, we consider 3-D CT to be the radiologic investigation of choice for Eagle’s syndrome because it is the most advanced technique available for definitively measuring the length of the styloid process. We also recommend a transoral approach to surgical resection as a safe and effective option because of its acceptable level of morbidity.

\textbf{References}