

Surgical Treatment of Elongated Styloid Process: Experience of 61 Cases

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ABSTRACT

Aim: To describe the management of patients with elongated styloid process syndrome (Eagle's syndrome). **Materials and Methods:** Sixty-one patients with elongated styloid process were treated between 2000 and 2005. Computed tomography examination defines those whose symptoms suggest the diagnosis. Patients with styloid processes longer than 25 mm were treated by surgical resection. **Results:** Fifty-seven (93.4%) of 61 patients treated for Eagle's syndrome became asymptomatic after resection. There were no serious complications. **Conclusion:** Patients with clinically and radiologically established elongated styloid process can be managed successfully by surgical resection using an external approach.

KEYWORDS: Elongated styloid process, Eagle's syndrome, surgical treatment, external approach

The styloid process of the temporal bone is an elongated, conical projection that lies anterior to the mastoid process. In the neck, it is situated between the internal and external carotid arteries and is lateral to the tonsillar fossa.¹ Although the reason for its variable development is not clear, elongation of the styloid process is recognized as one of the numerous causes of pain in the cranio-cervical region.²

The clinical features of the elongated styloid process were first described by Eagle.³ He

identified two distinct syndromes associated with anomalous growth of the styloid process: the styloid process syndrome and the carotid artery syndrome.^{4,5} Surgical shortening of the process can alleviate pain in many patients. This can be undertaken through both intraoral or extraoral approaches. Several alternative nonsurgical treatment modalities have been suggested but none are satisfactory.

The aim of this study was to describe our clinical and surgical experience with 61 patients

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with Eagle's syndrome and to evaluate their outcome.

MATERIALS AND METHODS

Sixty-one patients with symptomatic elongated styloid processes underwent surgical treatment between 2000 and 2005. A detailed medical history and clinical examination of the head and neck were undertaken on all patients. Physical examination included careful palpation of the tonsillar fossa, lateral pharyngeal wall, and the area between mastoid apex and mandibular angle in an attempt to precipitate the patient's discomfort. Both three-dimensional (3-D) and two-dimensional computed tomography (CT) was acquired (Figs. 1 and 2). Symptomatic patients having a styloid process longer than 25 mm underwent surgical treatment bilaterally or unilaterally as appropriate. An external approach was used on all patients. All patients were hospitalized at least 2 days, and prophylactic antibiotics were given for 10 days. Patients were followed up for at least 12 months.

SURGICAL TECHNIQUE

Surgery was performed under general anesthesia with the patient lying supine with their head rotated



Figure 1 Two-dimensional computed tomography section of styloid process.

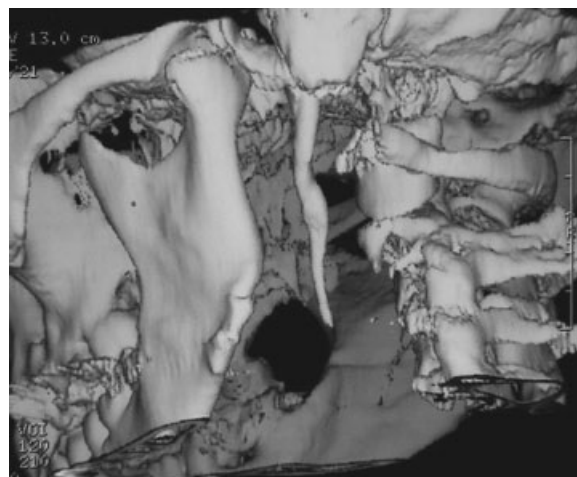


Figure 2 Three-dimensional computed tomography of styloid process.

away from the surgeon. A 3- to 4-cm skin crease skin incision was made one finger's breadth below the angle of the mandible. After incising the platysma muscle and the cervical fascia, the submandibular gland and the anterior border of the sternocleidomastoid muscle were exposed. The stylohyoid muscle and the posterior belly of the digastric muscle were identified and retracted posterosuperiorly to expose the styloid process. The styloid process was then denuded of its muscles, then fractured and resected using a rongeur. Figure 3 shows the resected portion of a styloid process. The wound was closed in layers.

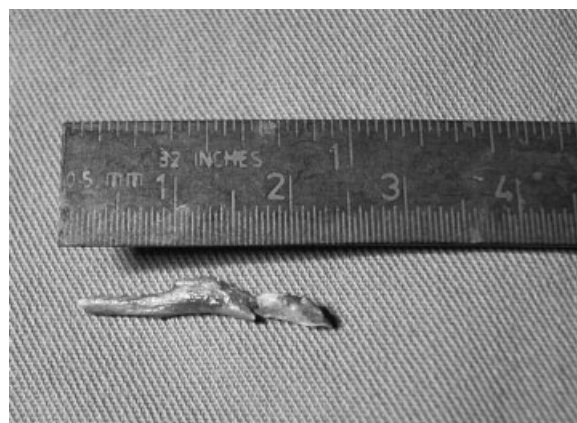


Figure 3 Surgically resected portion of the styloid process.

RESULTS

Sixty-one patients with clinically and radiologically established elongated styloid process have been treated. There were 19 men and 42 women with ages that ranged from 23 to 66 years (mean, 41). Twenty-three patients (37.7%) had bilateral symptoms and underwent bilateral styloid process resection. Thirty-eight patients (62.3%) had unilateral symptoms, and a unilateral styloid process resection was performed. Four patients (6.5%) had unilateral symptoms prior to initial surgery, and unilateral styloid process resection was performed, although both styloid processes were found to be elongated on CT examination. All of these patients had similar symptoms on the nonoperated side after surgical shortening of the previously symptomatic side, and a second procedure was then performed to resect the other styloid process. In total, 88 styloid processes from 61 patients were resected. The length of styloid processes ranged from 25.1 to 61.1 mm (mean, 35.1 mm).

Pain on swallowing was the most common complaint. The other prominent symptoms were cervical pain, otalgia, facial pain, and the globus sensation. Table 1 shows the distribution of symptoms. Duration of patients' symptoms ranged from 8 months to 37 months (mean, 14 months).

The postoperative follow-up period ranged from 12 to 60 months (mean, 29.6 months). Fifty-seven (93.4%) of 61 patients were asymptomatic after a minimal follow-up period of 12 months. Among 23 patients who underwent bilateral surgical resection, 20 patients were completely free of symptoms and three patients remained symptomatic. Patients who underwent unilateral surgical

shortening were all asymptomatic after a follow-up period of 12 months. Of the four patients who underwent staged resections, three were asymptomatic after the second resection and the other remained symptomatic. This patient and one of the patients who had undergone a synchronous bilateral resection and remained symptomatic were thought to have a tendonitis at the insertion into the hyoid bone. Subsequent partial resection of the hyoid was unsuccessful, and all patients obtained relief when prescribed antidepressant medication.

Two patients who underwent bilateral resection sustained unilateral temporary paresis of marginal mandibular branch of the facial nerve. Both resolved within 2 weeks of surgery.

DISCUSSION

The stylohyoid chain consists of the styloid process of the temporal bone, the lesser cornu of the hyoid bone, and the connected stylohyoid ligament.⁶ The styloid process originates from two separate embryological parts: (1) the tympanohyal, which represents the upper part of the Reichart's cartilage and forms the part embedded in the temporal bone, and (2) the stylohyal, which forms the principal part of the process. These parts are united by cartilage, which undergoes ossification, often as late as middle age.² It lies just behind the pharyngeal wall in the area of the palatine fossa, between the internal and external carotid arteries. The internal jugular vein, accessory, hypoglossal, vagus, and glossopharyngeal nerves, the internal carotid artery, and sympathetic chain are located medial to the process.⁷ Three muscles originate from the styloid process: the styloglossal, stylohyoid, and stylopharyngeous. The styloid and the stylomandibular ligaments are also attached to the styloid process.

Eagle⁸ reported that the normal styloid process was ~2.5 cm in length, and any process longer than 2.5 cm might be considered to be elongated, which was found in 4% of the patients. Kaufman

Table 1 Distribution of the Symptoms

Complaints	Number and % of Cases
Pain on swallowing	52 (85.2%)
Otalgia	47 (77%)
Foreign body sensation	37 (60.6%)
Cervical pain	35 (57.3%)
Facial pain	22 (36%)

et al,⁹ Chandler,¹⁰ Ferrario et al,¹¹ Zaki et al,¹² and Palesy et al⁷ reported that the average length of the styloid process was 2 to 3 cm. In a postmortem study of 80 cadavers, the length of the styloid process was found to range from 1.52 to 4.77 cm.¹³ Lengele and Dhem¹⁴ measured 404 styloid processes from 206 macerated skulls and found that 29% of the styloid processes were longer than 3 cm. We measured 88 styloid processes in 61 symptomatic patients using 3-D CT. The mean length of the styloid processes ranged from 2.51 to 6.11 cm (mean: 3.51 cm).

The actual cause of elongation of the styloid process or the calcification of the stylohyoid ligament is unclear, but several theories have been proposed. It may be entirely genetically determined with partial or complete calcification of the stylohyoid ligament and growth of osseous tissue at the insertion of the stylohyoid ligament. It has also been suggested that it may be caused by trauma, and some have suggested that it is associated with early onset of the menopause.¹⁵

Eagle syndrome, sometimes called styloid or stylohyoid syndrome, is a symptom complex associated with elongation of the styloid process or ossification of the stylohyoid ligament.⁶ The syndrome is more frequent in women than in men. Patients are usually older than 30 years and rarely younger.¹⁶ A wide variety of symptoms have been attributed to elongated styloid process, including cervical pain, otalgia, foreign body sensation in throat, pain on changing head position, cervicofacial pain, and pain on swallowing.¹⁵ Eagle described two forms based on the symptoms.¹⁷ The first group consisted of patients suffering from pharyngeal pain localized in the tonsillar fossa that sometimes radiated to the hyoid bone. Their symptoms were attributed to scarring around the styloid tip following tonsillectomy. The second group was characterized by persistent pain caused by impingement of the styloid process on the carotid territory. These patients had not undergone tonsillectomy. In our patients, pain on swallowing and a foreign body sensation were the most common symptoms.

Several mechanisms for the pain of Eagle's syndrome have been proposed. These include:

1. Compression of the neural elements, the glossopharyngeal nerve, lower branch of the trigeminal nerve, and/or the chorda tympani by the elongated styloid process¹⁸;
2. Fracture of the ossified stylohyoid ligament, followed by proliferation of granulation tissue that causes pressure on surrounding structures and results in pain¹⁹;
3. Impingement on the carotid vessels by the styloid process, producing irritation of the sympathetic nerves in the arterial sheath²⁰;
4. Degenerative and inflammatory changes in the tendinous portion of the stylohyoid insertion, a condition called insertion tendinosis;
5. Irritation of the pharyngeal mucosa by direct compression by the styloid process;
6. Stretching and fibrosis involving the fifth, seventh, ninth, and tenth cranial nerves in the posttonsillectomy period.

The cause of onset of pain in patients previously free of symptoms is unknown, but several mechanisms have been proposed that include rheumatic styloiditis caused by pharyngeal infections, trauma, tonsillectomy, and involutional changes associated with aging (e.g., degenerative cervical discopathy, which may shorten the cervical spine and alter the direction of the styloid process).^{2,18}

The diagnosis of Eagle's syndrome must be based on a good medical history and physical examination. It should be possible to feel an elongated styloid process by careful intraoral palpation, placing the index finger in the tonsillar fossa and applying gentle pressure.²¹ If pain is reproduced by palpation and either referred to the ear, face, or head, the diagnosis of an elongated styloid process is very likely.^{22,23} A styloid process of normal length is usually not palpable. The diagnosis of elongated styloid process should then be confirmed by imaging. Several methods of imaging have been used that vary in complexity, but CT is without doubt the best and most accurate.^{11,21,24,25} 3-D CT reconstruction of the

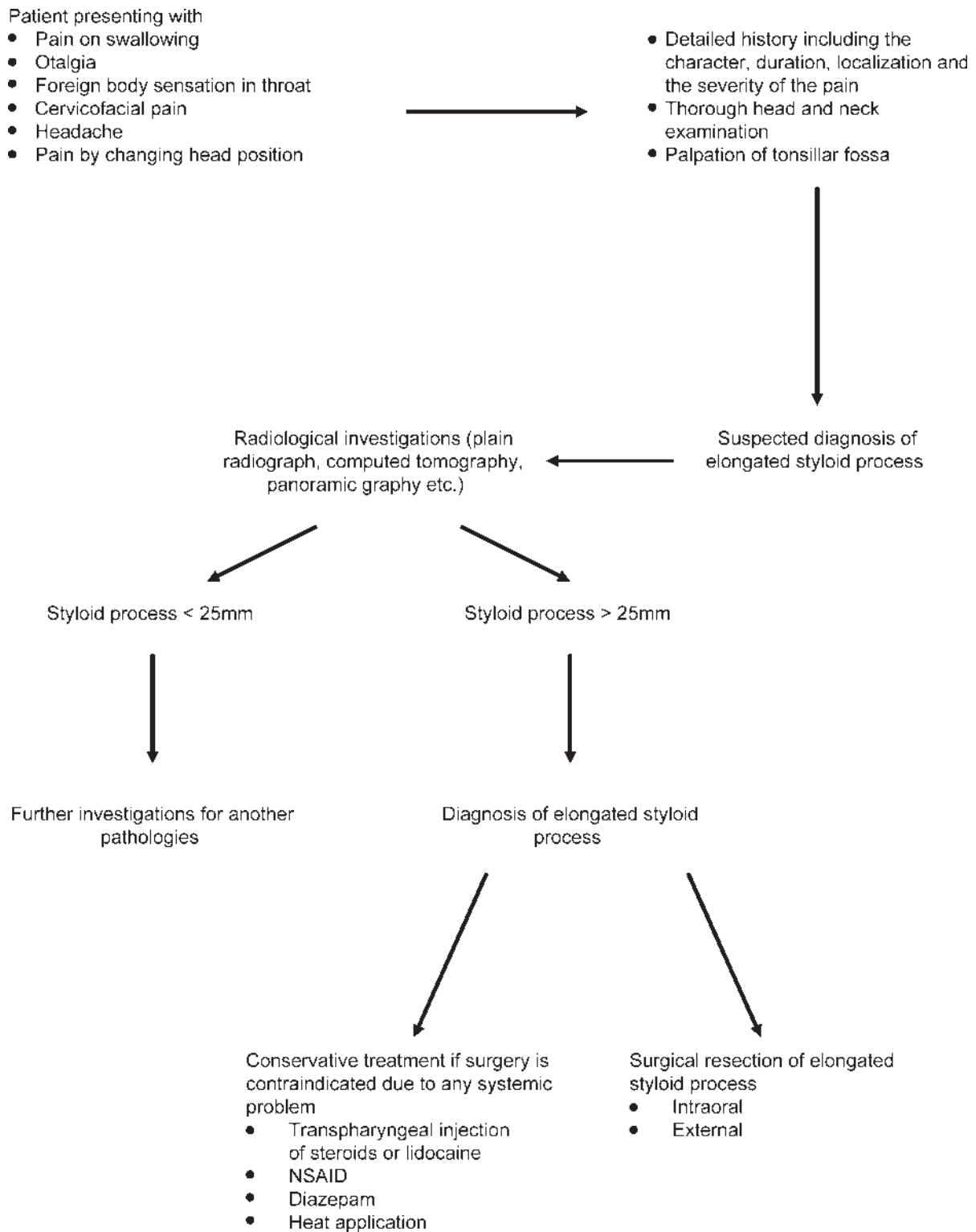


Figure 4 Management algorithm of elongated styloid process.

neck allows precise measurement of length of the styloid process and the ossified stylohyoid ligament.¹⁶

Pain in the throat that radiates to the neck, ear, or face is often difficult to diagnose and can be caused by several conditions, for example upper aerodigestive tract malignancies, neuralgia, and temporomandibular joint dysfunction.¹ These have to be excluded before considering Eagle's syndrome. The characteristic dull and nagging pain of an elongated styloid process that becomes worse during deglutition and can be reproduced by palpation of the tonsillar fossa is the hallmark.²⁶ Insertion tendonitis can mimic Eagle's syndrome, but in this condition there is tenderness over the greater horn of the hyoid bone.²⁷ Figure 4 shows a management algorithm for elongated styloid process syndrome.

The elongated styloid process syndrome can be treated conservatively or surgically. Conservative treatments have included transpharyngeal injection of steroids and lidocaine, nonsteroidal anti-inflammatory drugs, diazepam, the application of heat, traditional Chinese medicines, and transpharyngeal manipulation with manual fracturing of the styloid process.²⁸⁻³¹ It should be noted that blind fracture of the styloid process does not usually relieve symptoms and risks damage to nearby neurovascular structures.

The most satisfactory and effective treatment is surgical shortening of the styloid process through either an intraoral or external approach.¹⁶ The advantages of an intraoral approach are that it is simple, is less time-consuming, is possible under local anesthesia, and avoids a visible external scar.² However, the main disadvantage is lack of access, particularly if there is a hemorrhage and subsequent deep neck infections have been reported.^{15,30} The most significant advantage of an external approach is enhanced exposure of the styloid process and the adjacent structures,³¹ and this outweighs all other considerations. It also facilitates the resection of a partially ossified stylohyoid ligament.

Surgical failures have been reported despite the removal of significant lengths of the styloid process. Up to 20% of patients may not have com-

plete relief or may experience a recurrence of their symptoms.¹⁸ We believe that this may be due to intraoperative injury, subsequent fibrous entrapment syndrome, or inadequate shortening of the process, assuming that the diagnosis was correct in the first place.³² Our experience was very different, 57 out of 61 patients were asymptomatic 12 months after surgery and we only failed to relieve four patients.

CONCLUSION

The elongated styloid process syndrome can be diagnosed by a detailed history, physical examination, and radiological investigations. It can be confused or mistaken for many other conditions that must be excluded. Resection of the elongated styloid process is the treatment of choice. In this study, successful outcomes have been achieved using an external approach. No serious complications were encountered in our series.

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