

# Eagle's Syndrome: A Novel Surgical Approach to the Styloid Process Using a Preauricular Incision

*John V. Williams, MFDS RCS (Eng),\**  
*Richard M. McKearney, BSc (Hons),† and*  
*Peter J. Revington, FRCS (Eng)‡*

Structural anomalies of the styloid chain were described more than 300 years ago by anatomists. In 1937, the American otolaryngologist Watt W. Eagle<sup>1</sup> wrote a series of reports on this subject and its clinical significance. Because of his interest, the symptoms related to the anomalies of the stylohyoid chain became known as Eagle's syndrome. Eagle himself acknowledged 3 other surgeons who identified these anomalies and treated them surgically to alleviate the symptoms. The first of these predated Eagle by 65 years. The present report refers to the anomalies of the stylohyoid chain as Eagle's syndrome.

## Symptoms

Patients will present complaining of pain in the throat or a sensation of a foreign body lodged in their throat. On describing the discomfort experienced, they have classically pointed to and palpated the sub-mandibular triangle on the affected side to indicate where they perceive the problem. Pain will be experienced with head rotation, swallowing, tongue movements and speech, and can be referred to the ipsilateral ear. It is believed that the pain results from direct irritation of the glossopharyngeal nerve by the elongated styloid process and ossified stylohyoid ligament. An association has also been noted with a

history of tonsillectomy, probably due to the underlying fibrosis that occurs as a part of the postoperative healing process.

## Clinical Signs

An elongated styloid process can be palpated intraorally by way of the tonsillar fossa on the affected side. Styloid processes of normal length (ie, within 25 mm) should not be palpable. Palpation should elicit the same pain and discomfort that the patient reports and is pathognomonic of Eagle's syndrome. In contrast, infiltration of local anesthetic around the tonsillar fossa should resolve the pain and can be useful diagnostically.

## Carotid Artery Syndrome

The styloid-stylohyoid syndrome consists of 2 syndromes.<sup>2</sup> First is the "classic" Eagle's syndrome, as we have described, due to direct irritation of the soft tissues and glossopharyngeal nerve around the stylohyoid chain. Second is the so-called carotid artery syndrome, caused by pressure of the stylohyoid chain on the external or internal branches of the carotid artery. Pressure on the external carotid artery can lead to pain at those sites supplied by the artery (eg, the periorbital region), and pressure on the internal carotid can lead to parietal headaches. These symptoms can be exacerbated by head turning. Although the present report concentrates on the "classic" syndrome, in reality, the symptoms related to an elongated styloid process are varied and can involve both of these pathological processes.

## Radiographic Signs

The normal styloid process will be visible on an orthopantomogram. If the styloid process is elongated and accompanied by an ossified stylohyoid ligament, it will be obvious as a radiopaque band extending toward the angle and posterior ramus of the mandible (Fig 1). A posteroanterior radiographic view of the

\*Specialty Doctor in Oral and Maxillofacial Surgery at Frenchay Hospital and Undergraduate Student of Clinical Medicine, University of Bristol, UK.

†Undergraduate Student of Clinical Medicine, University of Bristol, UK.

‡Consultant Oral and Maxillofacial Surgeon, Frenchay Hospital, Bristol, UK.

Address correspondence and reprint requests Dr Williams: Department of Oral and Maxillofacial Surgery, Frenchay Hospital, Frenchay Park Rd, Bristol BS16 1LE, United Kingdom; e-mail: [j.v.williams@doctors.org.uk](mailto:j.v.williams@doctors.org.uk)

© 2011 American Association of Oral and Maxillofacial Surgeons. Published by Elsevier Inc. All rights reserved.

0278-2391/11/6906-0022\$36.00/0

doi:10.1016/j.joms.2010.11.023



**FIGURE 1.** Orthopantomogram showing elongated styloid processes (arrows).

*Williams, McKearney, and Revington. Eagle's Syndrome. J Oral Maxillofac Surg 2011.*

skull can also help to determine its length and angulation. More recently, 3-dimensional computed tomography scans have been used to accurately determine the length and angulation.<sup>3</sup>

## Management of Eagle's Syndrome

A significant proportion of patients can be treated conservatively. Simple explanation and reassurance will be sufficient in many cases. A combination of steroid and local anesthetic injections to the tip of the styloid process by way of the tonsillar bed has been previously described.<sup>4</sup> Additionally, indirect digital manipulation of the styloid process by way of the tonsillar bed to fracture the styloid process has been reported.<sup>5</sup> However, neither of these techniques have been fully substantiated in the published data. For those whose symptoms persist, surgery has been the treatment of choice. The styloid process can be approached intraorally or extraorally.

### INTRAORAL APPROACH

Eagle described the intraoral approach in 1937. It involves a combination of sharp and blunt dissection of the tonsillar fossa.<sup>1</sup> If the tonsils are present, a tonsillectomy should be performed concurrently. The patient's mouth should be propped open and hyperextended. The styloid process is palpated deep to the tonsillar bed, and a 1 cm incision is made over it. The styloid process should be identified and denuded of its ligament and muscular attachments. The styloid process tip can then be sectioned and removed, and the soft tissues closed in the traditional manner. The benefits of this approach include the avoidance of an

extraoral scar and a shorter procedure. However, the technique suffers from limited access and visibility, the risk of damage to adjacent structures such as nerves and blood vessels, and the risk of deep cervical infection, given the high load of intraoral flora.

### EXTRAORAL APPROACH

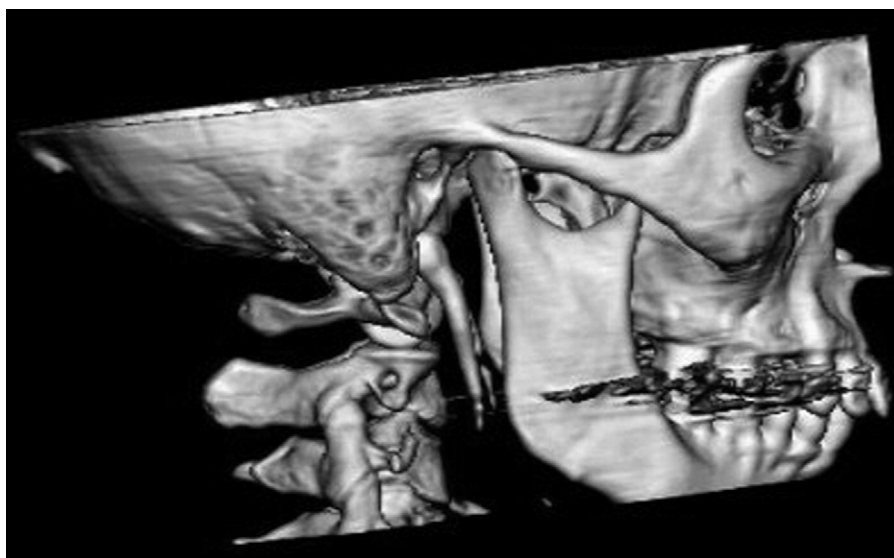
The extraoral approach was first described by Loeser and Cardwell.<sup>6</sup> The classic approach has been transcervical and involves an incision at the anterior margin of the sternocleidomastoid muscle. Alternatively, it can be approached using a submandibular incision. The advantage of the extraoral approach is the wide surgical field with good access and visibility. Furthermore, unlike the intraoral method, it affords excellent asepsis, reducing the likelihood of infection. The disadvantages include visible scarring and the potential for trauma to the facial and auriculotemporal nerves.

We describe a novel extraoral approach that uses a preauricular incision. This has been outlined in the first case and is supported by 2 additional cases that were successfully treated using the same technique.

## Clinical Cases

### CASE 1

A 47-year-old man was referred to the maxillofacial surgeons by his general medical practitioner. His chief complaint was of an irritating and painful sensation of a hard foreign body in the right side of his throat that was exacerbated by swallowing. He was also experiencing vague dull pains around the right



**FIGURE 2.** Three-dimensional computed tomography scan of right head and neck.

*Williams, McKearney, and Revington. Eagle's Syndrome. J Oral Maxillofac Surg 2011.*

side of his face and head, although he had never previously experienced such pains or even headaches. These symptoms had been present for 1 year and were nonresponsive to simple analgesics. He had previously been investigated by other disciplines without result before referral to our department. His symptoms of pain had been attributed to temporomandibular joint (TMJ) dysfunction syndrome.

On examination, his symptoms could be elicited by digital palpation of the right tonsillar fossa. It was noted that he had undergone tonsillectomy in his second decade. Radiographically, his orthopantomogram demonstrated the presence of elongated styloid processes bilaterally, extending inferiorly toward the angles of the mandible (Fig 1). His left side, however, remained entirely asymptomatic. Dental and TMJ causes of his symptoms were excluded.

A computed tomography scan at the level of the stylohyoid chain revealed elongation of the processes. The radiologist reported that both were longer than 65 mm, with the right process somewhat bulkier than the left (Fig 2). On the basis of these clinical and radiographic findings, Eagle's syndrome was diagnosed.

On discussion of the management options, the patient elected to have the right styloid process surgically removed because he deemed his symptoms to be sufficiently severe to justify its removal. An extraoral approach was proposed, and the patient gave his informed consent. This approach was decided on for several reasons. First, the surgeon had previous experience of the regional anatomy, having performed TMJ surgery on numerous occasions. Second, the approach offered several advantages, including an

aseptic field with clearer visibility and a cosmetically acceptable result for the patient.

#### *Surgical Procedure*

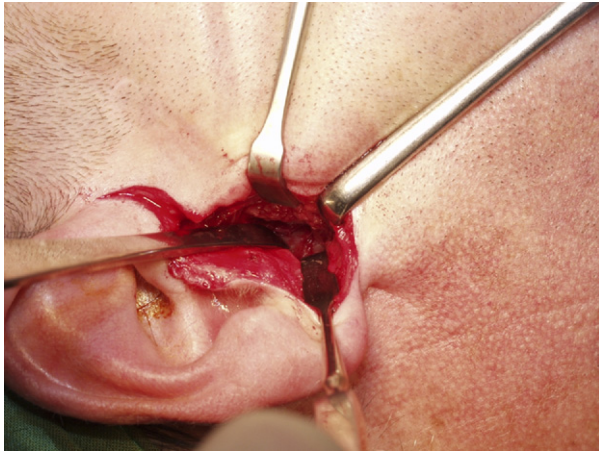
With the patient under general anesthesia, a 35-mm-long preauricular incision was made (Fig 3). This was extended along the internal aspect of the tragus to optimize the cosmetic outcome. This incision also avoided trauma to the greater auricular nerve, which supplies sensation to the pinna. The tragal cartilage was identified and a surgical plane established anterior and deep to this, extending toward the mastoid process. The styloid process was then visualized and traced inferiorly (Fig 4). Its soft tissue attachments were stripped off, and the process was sectioned with



**FIGURE 3.** Preauricular incision line.

*Williams, McKearney, and Revington. Eagle's Syndrome. J Oral Maxillofac Surg 2011.*





**FIGURE 4.** Styloid process in situ.

*Williams, McKearney, and Revington. Eagle's Syndrome. J Oral Maxillofac Surg 2011.*

a bur at its most superior aspect. The inferior end was stripped of its soft tissue attachments to free it, and the sectioned styloid process was removed (Fig 5). The wound was repaired using deep resorbable sutures and nonresorbable sutures to the skin.

#### *Postoperative Phase*

The next morning, it was noted that the patient had developed a slight (House-Brackmann grade II) right-sided facial nerve weakness affecting all 5 branches. This was attributed to iatrogenic facial nerve neuropraxia, because the soft tissues of the face had been retracted firmly throughout the procedure. He was able to report that the pain he had previously experienced had virtually disappeared, and he was discharged home later that day with simple oral analgesics.

He was examined at 1-month intervals for 3 months. At 3 months postoperatively, the facial scar was healing well. The right-sided facial weakness had resolved fully within 2 months. Throughout that period, he was pleased to report that his previous symptoms of pain and dysphagia had resolved, and he was subsequently discharged.

#### **CASE 2**

A 77-year-old woman was referred to our department for the management of what was thought to be symptoms of right-sided TMJ dysfunction syndrome. On examination, it was thought that her symptoms were consistent with this diagnosis, and she was treated conservatively. On subsequent outpatient review appointments, her symptoms of pain had localized to the right submandibular region.

A differential diagnosis of styloid-stylohyoid syndrome was made. On discussion with the patient of the management options for the symptoms, she even-

tually elected to undergo excision of the styloid process, because she believed her symptoms were sufficiently severe enough to warrant it. A 20-mm-long section of the elongated right styloid process was excised with the patient under general anesthesia using the same preauricular approach. She made an uneventful recovery without any facial weakness. She was relieved of her symptoms of pain and subsequently discharged.

#### **CASE 3**

A 64-year-old woman was referred to our department by her general dental practitioner regarding intermittent discomfort in the right submandibular region. Dental, TMJ, and submandibular salivary gland causes were all excluded. Her symptoms of pain were elicited by firm digital pressure to the right submandibular region and over the tonsillar fossa on the same side. Her orthopantomogram demonstrated an elongated styloid process on the same side. After some discussion, the patient elected to have the styloid process excised using the preauricular approach. She made an uneventful recovery and was pain free before being lost to follow-up.

## **Discussion**

Although both intraoral and extraoral approaches to the styloid process have been described and used over the years, currently, no consensus has been reached in published studies regarding which is superior. We found only 2 reports comparing the intraoral and extraoral approaches, both of which were more than 20 years old.<sup>5,7</sup> Both reports advocated the latter approach. A review of the published data on the surgical management of Eagle's syndrome was conducted. Cases in which the investigators advocated a particular surgical approach were noted. We have summarized the surgical preferences<sup>1,2,7-22</sup> in Table 1. These data demonstrate that overall no particular



**FIGURE 5.** Excised styloid process.

*Williams, McKearney, and Revington. Eagle's Syndrome. J Oral Maxillofac Surg 2011.*

**Table 1. SURGICAL PREFERENCES FOR THE MANAGEMENT OF EAGLE'S SYNDROME FROM 1937 TO 2009**

Investigator	Year	Cases (n)	Approach	
			Transcervical	Intraoral
Eagle <sup>1</sup>	1937	2		X
Eagle <sup>2</sup>	1949	2		X
Marano et al <sup>11</sup>	1972	1		X
Moffat et al <sup>12</sup>	1977	4	X	
Strauss et al <sup>7</sup>	1985	8	X	
Chase et al <sup>5</sup>	1986	2	X	
Jones et al <sup>13</sup>	1999	1		X
Fini et al <sup>14</sup>	2000	11		X
Diamond et al <sup>15</sup>	2001	4	X	
Prasad et al <sup>16</sup>	2002	58		X
Buono et al <sup>9</sup>	2005	5	X	
Beder et al <sup>17</sup>	2005	19		X
Zhibin et al <sup>18</sup>	2006	9		X
Nayak et al <sup>19</sup>	2006	18		X
Pereira et al <sup>20</sup>	2007	1	X	
Martin et al <sup>21</sup>	2008	6	X	
Ceylan et al <sup>22</sup>	2008	61	X	
Kim et al <sup>8</sup>	2008	1	X	
Chrcanovic <sup>10</sup>	2009	5		X
Total	—	218	9	10

Williams, McKearney, and Revington. *Eagle's Syndrome. J Oral Maxillofac Surg* 2011.

preference exists for one approach over another, with 9 reports advocating the extraoral approach and 10 the intraoral approach. However, since 2007, more reports have favored the extraoral approach.

The intraoral approach has the advantage of being a simpler surgical technique than the extraoral approach, making the procedure quicker to perform. It can also be performed using local anesthesia,<sup>7,8</sup> avoiding the complications of a general anesthetic. Because the surgery is intraoral, an external scar will be avoided. One disadvantage of the intraoral approach is the nonsterile operating field, which could predispose to deep cervical infection.<sup>8</sup> Additionally, visualization and access to the styloid process are suboptimal, risking trauma to the surrounding anatomy and difficulty in controlling subsequent hemorrhage.<sup>9</sup> It has also been suggested that edema of the tonsillar fossae leads to speech and swallowing difficulties.<sup>5</sup>

In contrast, the extraoral approach offers a better exposure of the styloid process and surrounding structures through an aseptic field. However, the procedure takes longer and necessitates the use of a general anesthetic, with its associated risks. Unlike the intraoral approach, however, the extraoral method will leave an undesirable cervical scar.<sup>10</sup>

The preauricular approach we have described offers the existing advantages of the extraoral approach, with the added benefit of a more discrete preauricular scar. The scar will largely be camouflaged within the tragus and could also be hidden by the hair.

On balance, we believe that the intraoral approach has significant limitations that the extraoral approach avoids. However, the preauricular approach has led to a superior cosmetic result that our patients have been pleased with.

The elongated styloid process is an uncommonly diagnosed cause of head and neck pain. The symptoms can include neck and throat pain, dysphagia, a sensation of a foreign body lodged in the throat, and otalgia. Patients can be treated conservatively or surgically. Awareness of these signs and symptoms is essential for patients to be treated appropriately. The extraoral surgical approach to the styloid process has been favored by us over the intraoral approach, because it offers a relatively clean surgical field with good visualization and minimal transient morbidity. The preauricular approach used in the presented cases has demonstrated that it is a viable and attractive alternative to the existing surgical techniques, given its superior cosmetic outcome.

## References

1. Eagle WW: Elongated styloid processes: Report of two cases. *Arch Otolaryngol* 25:584, 1937
2. Eagle WW: Symptomatic elongated styloid process: Report of two cases of styloid process-carotid artery syndrome with operation. *Arch Otolaryngol* 49:490, 1949
3. Nakamaru Y, Fukuda S, Miyashita S, et al: Diagnosis of the elongated styloid process by three-dimensional computed tomography. *Auris Nasus Larynx* 29:55, 2002
4. Evans JT, Clainmont AA: The nonsurgical treatment of Eagle's syndrome. *Ear Nose Throat J* 55:44, 1976
5. Chase DC, Zarmen A, Bigelow WC, et al: Eagle's syndrome: A comparison of intraoral versus extraoral surgical approaches. *Oral Surg Oral Med Oral Pathol* 62:625, 1986
6. Loeser LH, Cardwell EP: Elongated styloid process. *Arch Laryngol* 36:198, 1942
7. Strauss M, Zohar Y, Laurian N: Elongated styloid process syndrome—Intraoral versus external approach for styloid surgery. *Laryngoscope* 95:976, 1985
8. Kim E, Hansen K, Frizzi J: Eagle syndrome: Case report and review of the literature. *Ear Nose Throat J* 87:631, 2008
9. Buono U, Mangone GM, Michelotti A, et al: Surgical approach to the stylohyoid process in Eagle's syndrome. *J Oral Maxillofac Surg* 63:714, 2005
10. Chrcanovic BR, Custodio ALN, de Oliveira DRF: An intraoral surgical approach to the styloid process in Eagle's syndrome. *Oral Maxillofac Surg* 13:145, 2009
11. Marano PD, Gosselin CF, Fenster GF: Eagle's syndrome necessitating bilateral styloid amputation. *Oral Surg Oral Med Oral Pathol* 33:874, 1972
12. Moffat DA, Ramsden RT, Shaw HJ: Styloid process syndrome—Etiological factors and surgical management. *J Laryngol Otol* 91:279, 1977
13. Jones SEM, Hartley BEJ, Dhillon RS: Eagle's syndrome: Unilateral pharyngeal pain due to calcification of the stylohyoid ligament. *Otorhinolaryngol Head Neck Surg* 3:15, 1999
14. Fini G, Gasparini G, Filippini F, et al: The long styloid process syndrome or Eagle's syndrome. *J Craniomaxillofac Surg* 28:123, 2000
15. Diamond LH, Cottrell DA, Hunter MJ, et al: Eagle's syndrome: A report of 4 patients treated using a modified extraoral approach. *J Oral Maxillofac Surg* 59:1420, 2001
16. Prasad KC, Kamath MP, Reddy KJM, et al: Elongated styloid process (Eagle's syndrome): A clinical study. *J Oral Maxillofac Surg* 60:171, 2002

17. Beder E, Ozgursoy OB, Ozgursoy SK: Current diagnosis and transoral surgical treatment of Eagle's syndrome. *J Oral Maxillofac Surg* 63:1742, 2005
18. Zhibin W, Min J: Design and clinical application of the "styloidectomy" styloid process cutter. *J Laryngol Otol* 120:753, 2006
19. Nayak DR, Pujary K, Aggarwal M, et al: Role of three-dimensional computed tomography reconstruction in the management of elongated styloid process: A preliminary study. *J Laryngol Otol* 121:349, 2007
20. Pereira FL, Iwaki L, Pavan AJ, et al: Styloid-stylohyoid syndrome: Literature review and case report. *J Oral Maxillofac Surg* 65:1346, 2007
21. Martin TJ, Friedland DR, Merati AL: Transcervical resection of the styloid process in Eagle syndrome. *ENT Ear Nose Throat J* 87:399, 2008
22. Ceylan A, Koybasioglu A, Celenk F, et al: Surgical treatment of Elongated styloid process: Experience of 61 cases. *Skull Base* 18:289, 2008