

# Piezoelectric surgery and navigation: a safe approach for complex cases of Eagle syndrome

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**Abstract.** Eagle syndrome was first described by Eagle in 1937. It is associated with an elongated styloid process and/or calcification of the stylohyoid ligament, mainly resulting in pain in the orofacial region. The treatment of Eagle syndrome includes conservative treatment with physical therapy supported by medication, or surgical removal of the styloid process. Two different surgical approaches are described in the literature: the transoral and transcervical approaches. Both have their limitations and specific intraoperative risks. A modification of the transcervical approach that adds an extra security measure to the treatment of complex cases of Eagle syndrome is presented herein. The styloid process was removed by combining piezoelectric surgery, preoperative digital planning, and surgical navigation. No complication was noted, and the patient recovered quickly after surgery. A follow-up visit 2 months later showed no remaining symptoms of Eagle syndrome on the treated side. Therefore, digital planning and surgical navigation could add valuable safety measures to the treatment of complex cases of Eagle syndrome.

**Key words:** facial pain; eagle syndrome; navigation; piezoelectric surgery; transcervical approach.

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In 1937, Eagle described a syndrome associated with facial pain and a foreign body sensation arising from an elongated stylohyoid process. Later on, he distinguished between two different subtypes: classic stylohyoid syndrome and stylocarotid artery syndrome. Eagle reported a 4% incidence of styloid elongation.<sup>1–3</sup> However, in 1970, Kaufman et al., in a study of

484 patients, found that the incidence of styloid elongation was much higher at about 7%.<sup>4</sup> In 1978, Massey reported that in a study performed by Guthrie in 1924 in which 2000 human skulls were examined, 11 (0.55%) elongated styloid processes of over 40 mm were found.<sup>5</sup> Thus, the variation in incidence is notable. Monsour and Young found that 86% of patients

examined in their study who had a styloid process longer than 40 mm and/or partial ossification of the stylohyoid ligament showed clinical symptoms of Eagle syndrome.<sup>6</sup>

As described by Eagle, there is the classic syndrome that often follows tonsillectomy. Typical symptoms include a foreign body sensation and pain causing

dysphagia and odynophagia. Sometimes cranial nerves, including V, VII, IX, and X, are involved because of their close relationships to the elongated styloid process. Stylocarotid syndrome has no link to prior pharyngeal surgery. Mechanical irritation of the sympathetic plexus of the carotid arteries by the styloid tip or ossified ligament can cause different symptoms, for example pain when turning the head and constant neck pain. When the internal carotid artery is involved, some patients even complain of a severe, constant headache.<sup>7</sup>

Two different methods for the surgical treatment of Eagle syndrome are commonly described: the transcervical and transoral approaches. The cervical approach provides better visualization of the surrounding structures, but has the major disadvantage of an external scar. The intraoral approach is easy to perform and can be completed under local anaesthesia. Its major disadvantage is the risk of deep infection and compromised vision, which can result from neurovascular injury or styloid process residue.<sup>8</sup>

Surgical treatment is usually performed by drilling or cutting with a reciprocating saw; as mentioned above, it is not free from complications.<sup>9</sup> Therefore, several modifications to the transcervical and transoral approaches have been reported in recent years with the aim of improving surgical outcomes and reducing morbidity. Hoffmann et al. in 2013 and Bertossi et al. in 2014 described the combination of a transcervical approach with piezoelectric surgery as a safe and effective way to treat Eagle syndrome.<sup>10,11</sup> In 2012, Matsumoto et al. reported on an endoscopically assisted transoral approach to lessen the chance of intraoperative complications due to a restricted surgical view.<sup>12</sup> A recent publication by Al Weteid and Miloro supports this method to overcome the potential disadvantages of limited exposure and visibility.<sup>13</sup>

The present report adds another aspect to the treatment possibilities for Eagle syndrome. The case of a 55-year-old woman who had been experiencing typical symptoms of Eagle syndrome for a number of years is reported. Preoperative computed tomography (CT) showed bilateral elongated styloid processes with very close relationships to several branches of the carotid artery. Therefore, it was decided to use a transcervical approach in conjunction with piezoelectric surgery, surgical planning, and intraoperative navigation to reduce the risk of complications. This adds another safety measure to the treatment of Eagle syndrome in complex

cases and may help to avoid serious complications.

### Materials and methods

A 55-year-old woman was referred to hospital with constant pain in the head and neck region mainly affecting the right side. She had various symptoms including dysphagia, a foreign body sensation, and increased pain when turning her head. She had been treated by several specialists in previous years, including an otolaryngologist, a neurologist, and a pain specialist, mainly with various drugs, but without any success. At presentation, she was in constant pain and had sleeping problems because she could no longer sleep on her right side. She reported a tonsillectomy at

the age of 20 years with severe postoperative bleeding.

After clinical examination and basic radiological diagnostics, an elongated styloid process was suspected as the cause of her problems. A closer look at a panoramic radiograph (Fig. 1) proved the presumption of Eagle syndrome. The patient was referred for CT of the head and neck, which showed an elongated styloid process of about 4 cm on each side (Fig. 2). An investigation of the cervical blood vessels on the right side showed very close relationships between the styloid process and the internal and external carotid arteries (Figs 3 and 4).

To minimize the risk of vascular damage, preoperative digital planning was performed for computed navigation.

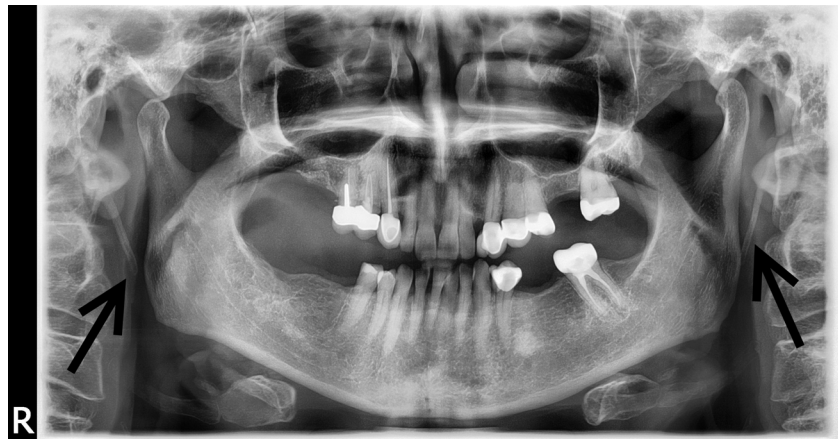


Fig. 1. Preoperative panoramic radiograph: the arrows point to the elongated styloid processes.



Fig. 2. Preoperative computed tomography (coronal plane) showing styloid processes of about 40 mm in length.

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