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Eagle Syndrome: Innovative Approaches to Diagnosis and Management - A Narrative Review

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ABSTRACT

Eagle Syndrome (ES) is a condition caused by elongation of the styloid process or deformity of the stylohyoid ligament. This abnormal process disrupts the function of adjacent anatomical structures. The symptoms of the disease are diverse and nonspecific. Patients commonly experience recurrent pain in the neck and face, dysphagia, and temporomandibular joint dysfunction. Clinicians diagnose using three-dimensional computed tomography (3D CT). Therapeutic management involvement includes pharmacological and surgical treatment options. The most effective treatment is styloidectomy via an intraoral approach or external access. This review summarises existing knowledge on Eagle syndrome, including anatomical features, pathophysiology, clinical presentation, diagnostic approaches, and treatment options.

Keywords: Eagle Syndrome, Styloid Process Elongation, Headache, Cervical Pain

1. INTRODUCTION

Eagle (1937) described Eagle Syndrome (ES) in detail and named the condition after himself. It is a condition resulting from anatomical abnormalities of the stylohyoid apparatus. Pathologically elongated styloid process (SP) (Badhey et al., 2017) or ossified stylohyoid ligament (Galletta et al., 2019) irritates or compresses neurovascular structures in the peripharyngeal space. The SP comes out of Reichert's cartilage of the second branchial arch. It extends from the lower part of the petrous part of the temporal bone. It moves downward and anteriorly towards the stylomandibular and pharyngeal recess, which contains the carotid arteries, internal jugular vein, and the glossopharyngeal, facial, accessory, hypoglossal, and vagus nerves (Czako et al., 2020). From this process, three muscles originate: styloglossus, stylopharyngeus, and stylohyoid, and three ligaments: stylopharyngeal, stylomaxillary, and stylohyoid (Mudry et al., 2020). The length of the SP varies in the general population, but most commonly ranges from 20mm to 30mm (Galletta et al., 2019). Asymptomatic patients often have an elongated styloid process (de Ruiter et al., 2024). The prevalence of this anatomical variant has been

reported to range from 3.3% to 84.4% (Triantafyllou et al., 2025). However, symptoms of Eagle Syndrome occur in patients with abnormal styloid process morphology at a rate of 4% to 10.3% (Czako et al., 2020). The condition is more common in women (ratio 2:1), and the risk increases after age 50 (Searle and Searle, 2021). A high proportion of cases remain undiagnosed. Time from symptom onset to correct diagnosis often spans several years. Researchers have proposed several pathomechanisms for the development of Eagle's syndrome. The first suggests a role for local trauma near the process and associated chronic tension exerted by the stylohyoid ligament, which may induce reactive ossifying hyperplasia of the process. Some authors suggest that persistent embryonic remnants of Reichert cartilage, as well as inflammation related to endocrine dysfunctions, could underlie the development of changes in the ossified stylohyoid ligament (de Ruiter et al., 2024; Albayat et al., 2023; Pagano et al., 2023).

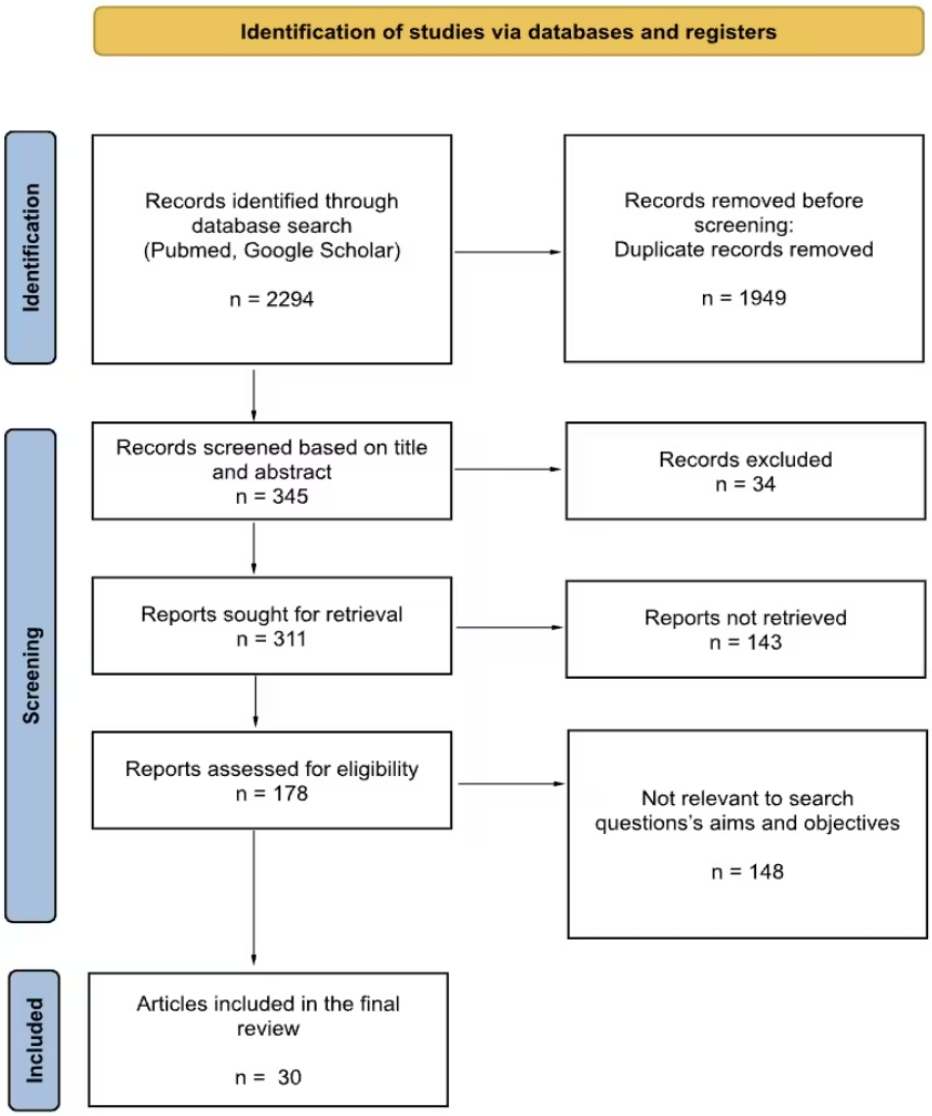

Figure 1. PRISMA flow diagram illustrating the literature selection process.

Researchers have identified several types of Eagle's syndrome. Neuropathic Eagle syndrome (NES), the classic variant of this condition, is distinguished by an elongated styloid process that compresses cranial nerves and neighbouring soft tissues. This form frequently arises following trauma, regardless of whether a fracture of the styloid process occurs, which may result in focal neuropathic compression. Symptoms include odynophagia, dysphagia, otalgia, tinnitus, recurrent pain in the anterior-lateral neck, mandibular angle, and facial pain. Neck pain worsens with head rotation, tongue movements, chewing, yawning, and swallowing (Czako et al., 2020). Patients frequently mention previous tonsillectomy or trauma in this area. In the vascular type, called carotid eagle syndrome (CES), sympathetic fibres running along the internal carotid arteries are irritated by the elongated SP. Symptoms include periorbital

and parietal pain, dizziness, transient visual loss, fainting, transient ischaemic attack (TIA), ischaemic stroke as a consequence of carotid artery dissection (CAD), and embolic thrombosis (Nastro Siniscalchi et al., 2022).

Recently, the medical community recognised an additional type of ES: Jugular Eagle Syndrome (JES), also known as styloidogenic jugular vein compression syndrome (SJVCS). In this type, the SP compresses the superior jugular vein, causing intracranial hypertension. As a result, patients may experience positional dizziness, migraines, Meniere's syndrome, blurred and double vision, visual field defects, and pulmonary embolism of unknown origin (Chung et al., 2010; Galletta et al., 2019).

In many cases, JES symptoms only appear with specific head movements. Additionally, similar symptoms can result from conflict between the SP and the transverse process of C1, even when SP length is normal (Galletta et al., 2019).

2. REVIEW METHODS

We reviewed studies from major scientific databases, such as PubMed and Google Scholar, focusing on recognition, diagnosis, and nutrition ES. We use Medical Subject Headings and keywords: Eagle Syndrome, elongated styloid process, stylohyoid ligament calcification, diagnosis, treatment, management, surgery, conservative therapy, telemedicine and patient-centred care. The screening process followed the PRISMA guidelines (Figure 1). The search included articles published between January 2015 and June 2025, written in English. Two co-authors assessed the scope of the review and critically evaluated the articles, selecting those that were applicable. The final full-text was reviewed and edited by all co-authors.

3. RESULTS & DISCUSSION

The diagnosis of Eagle Syndrome (ES) requires a high degree of suspicion and a close correlation between clinical and radiological data. Physical examination is supportive, and palpation of the palpable styloid process (SP) in the tonsillar fossa can sometimes elicit pain in patients with an elongated SP. The lidocaine infiltration test consists of injecting a local anaesthetic into the lower tonsillar fossa to relieve pain (Piagkou et al., 2009). Imaging studies are fundamental to establishing a correct diagnosis. Various methods are available for evaluating the SP. They include orthopantomography (OPG) and computed tomography (CT). OPG visualises the jaw and surrounding structures in a two-dimensional view. It allows classification of elongated SP according to Lainglais's scale and the O'Carroll classification (More and Asrani, 2010). The inability to obtain three-dimensional imaging of the anatomical relationships significantly limits the diagnostic value of this examination. When clinicians suspect carotid artery syndrome (CES), they should extend the investigation to include CT angiography (CTA) performed in motion-free head positions (Nastro Siniscalchi et al., 2022). It is essential to visualise the relationships between the SP, the transverse process of C1, and the carotid vessels (Brassart et al., 2020). Such imaging enables clinicians to assess the degree of compression and potential narrowing or dissection of the carotid artery, which is critical for treatment planning (Nicholson and Nicholson, 2021). By performing radiological examinations in various dynamic positions, it is possible to capture the fundamental, position-dependent interactions between the styloid process and the surrounding neck structures. Such an approach is essential for correct diagnosis and reducing diagnostic errors. Digital subtraction angiography (DSA) provides additional information regarding arterial and venous patterns in cases of CES.

The heterogeneous clinical presentation of Eagle's syndrome (ES) makes both diagnosis and treatment particularly challenging. The nonspecific nature of ES symptoms, often mimicking neuralgia or temporomandibular joint dysfunction, leads to many years of delays and misdiagnoses. In light of new findings, it becomes essential to consider a broader neurological and vascular context of the condition. Some types of facial pain, incorrectly diagnosed as migraine, may in fact be the initial signs of classical or vascular forms of ES. These findings require neurologists and ENT specialists to adopt a broader perspective in the differential diagnosis of chronic headaches. Clinicians should consider Eagle's syndrome when they encounter spontaneous carotid artery dissection (CAD). Repeated micro-injuries of the vessel wall caused by the styloid process, especially during rotational movements of the head, may be the cause of this condition. The internal jugular vein compression syndrome (IJVCS) can produce symptoms very similar to idiopathic intracranial hypertension (IIH), such as chronic headache, tinnitus, and visual disturbances. This condition results from mechanical compression of the internal jugular vein (IJV) between the lateral mass of the C1 vertebra and the styloid process (SP). Studies indicate that both venous stenting procedures and styloidectomy are effective treatment options for venous stenosis. These findings also point out that ES is more than just a bone problem. It also involves compression of nerves and blood vessels (Zamboni et al., 2019).

Treatment strategies for Eagle syndrome differ between reports. Pharmacological therapy is described mainly as an initial option for pain control, although symptom persistence is common.

Surgical intervention is therefore discussed in most clinical series. Styloidectomy involves shortening or removal of the styloid process and may be performed using an intraoral or cervical route (Bargiel et al., 2023). Limited visualisation and the risk of soft tissue injury are mentioned in relation to intraoral procedures.

Postoperative complications are reported infrequently. Styloid process elongation has been described in patients with osteoporosis and atherosclerosis (Watanabe et al., 2010). These results indicate that styloid process elongation may be associated with systemic metabolic or vascular conditions rather than solely with local mechanical compression. The surgical techniques used to manage Eagle syndrome vary depending on anatomical conditions and symptom severity. A summary of the primary surgical methods, along with their advantages, limitations, and indications, is presented in Table 1.

Table 1. Surgical approaches used in the treatment of Eagle syndrome

Surgical approach	Access route	Main advantages	Main limitations	Typical indications
Intraoral styloidectomy	Oral cavity	No external scar; shorter operative time	Limited visibility; risk of injury to adjacent structures	Uncomplicated cases without vascular involvement
Cervical styloidectomy	External cervical incision	Good exposure; better anatomical control	External scar; longer operative time	Carotid artery involvement; advanced ossification; complex anatomy
Minimally invasive transcervical styloidectomy	Small cervical incision	Improved visualisation with reduced tissue trauma	Requires surgical experience	Vascular variants of Eagle syndrome
Robotic-assisted styloidectomy (TORS)	Transoral robotic access	High precision; enhanced visualisation	Limited availability; high cost	Selected cases in specialized centers

4. CONCLUSION

Eagle syndrome is often difficult to diagnose. Clinical examination and imaging are essential. Treatment options include conservative management and surgery. Improved recognition of the condition may benefit patient care.

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Authors' Contributions

Conceptualization: Natalia Kruszewska, Adrianna Kępa, Natalia Rosół, Michał Cholewiński
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Informed consent

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Ethical approval

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Data and materials availability
All data associated with this study will be available based on reasonable request to the corresponding author.

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