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Review

Management of stylohyoid syndrome: A systematic review following PRISMA guidelines

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ABSTRACT

Objectives: A systematic review of the literature on stylohyoid syndrome treatment was performed according to PRISMA guidelines.
Material and methods: Three hundred and forty-nine articles were retrieved in the PubMed and Cochrane databases using the search-terms "stylohyoid syndrome" and synonyms. Articles documenting treatment and outcome with more than 1 month's follow-up were selected. Treatment-related complications and rate of cure, defined as disappearance of symptoms and/or of revelatory complication, were analyzed. Overall analysis was performed for series and a mixed logistic regression model for case reports.
Results: Hundred and two articles (12 series, 90 case reports) were selected. The 12 series included 482 patients with pain syndrome managed by styloidectomy, with 84.2% and 73.7% cure rates for cervical and transoral approaches, respectively. There were no complications with the transoral approach, versus 1.2% transient facial paresis with the cervical approach. In the 90 case reports, 112 patients had pain syndrome (Group I) and 16 neurological deficit (Group II). Cure rate in Group I varied significantly ($P=0.005$; OR 8.33, 95% CI [2.12–32.81]) from 64.3% following medical treatment (antiepileptics, muscle relaxants, analgesics, per os and/or locally injected anti-inflammatory drugs) to 91.8% following styloidectomy, without any significant impact of surgical approach ($P=0.1$; OR 0.17, 95% CI [0.02–1.60]). In Group I, no complications occurred after medical treatment, versus 4.3% and 16.3% after transoral and cervical styloidectomy, respectively. In Group II, cure and complication rates were 87.5% and 6.2%, respectively. Due to the small sample size and heterogeneity of Group II, no statistical assessment of the contribution of styloidectomy to medical treatment (antiplatelet drugs, with or without stenting) was performed.
Conclusion: Styloidectomy appears to be the treatment of choice for stylohyoid syndrome. The surgical approach does not significantly influence the cure or complications rate.

1. Introduction

In 1937, the American ENT specialist Watt Eagle of Duke University, North Carolina, published the first series of pain syndrome induced by elongation and ossification of the stylohyoid process [1–5]. However, it was Marchetti [6] in 1652, Lucke [7] in 1870 and Kulvin [8] in 1930, who first, respectively, described the styloid process, implicated ossification in the pain syndrome, and introduced the term "elongated styloid process" to explain its onset (Fig. 1).

There have since been very many reports dealing with this pathology. In 2012, Morrison et al. [9] found more than 9000 articles on stylohyoid syndrome in PubMed, although they did not explain how they arrived at this figure. To our knowledge, however, there have been no studies of treatment based on systematic review using the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) criteria [10]. We therefore sought to assess cure and complications rates for the various treatments advocated, and the presenting symptoms and pathophysiology of the syndrome, which, in Finland, was reported to have an incidence of 1/250 consultations for cervicopharyngeal pain [11].

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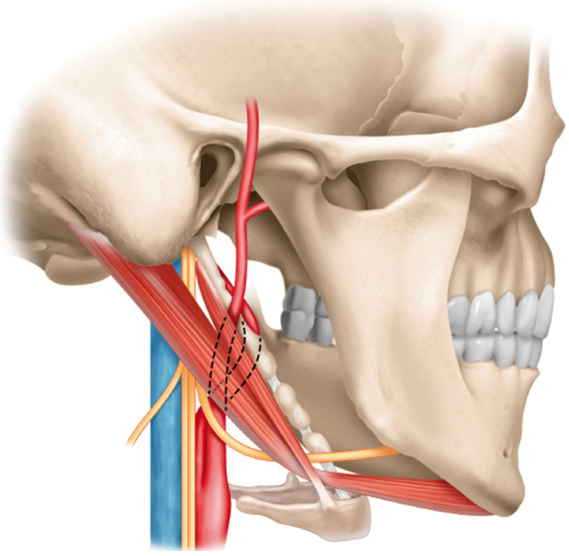

Fig. 1. Illustration of calcification and elongation of styloid process and stylohyoid ligament and potential relations with neurovascular structures.

2. Methodology

2.1. Search strategy

The keywords "syndrome stylohyoïdien", "syndrome styloïdien", "syndrome stylo-carotidien", "syndrome de la longue apophyse styloïde", "syndrome de l'apophyse styloïde calcifiée", "syndrome de l'os hyoïde, stylalgies, carotidynies", "syndrome d'Eagle" and their English translations (stylohyoid syndrome, styloid syndrome, stylocarotid syndrome, long styloid process syndrome, calcified styloid process syndrome, hyoid bone syndrome, carotidynia, Eagle syndrome) were used as search-terms in the Medline (PubMed) and Cochrane data-bases up to the date April 1, 2018.

2.2. Data selection and extraction

Three hundred and forty-nine articles were retrieved and analyzed on the PRISMA criteria [10]. Those not reporting series and/or case reports, not reporting the type and/or results of treatment and/or with follow-up not specified or less than 1 month were excluded (Fig. 2). Data extracted from the selected articles comprised: gender, age, type of treatment, success (resolution of symptomatology and/or of revelatory complication), follow-up duration (months), and onset and type of treatment-related complications.

2.3. Statistical analysis

In series reports (with more than 6 patients), cure rates were analyzed globally. In case reports providing individual data, mixed logistic regression models were used to estimate adjusted odds ratios (OR) with 95% confidence intervals (95%CI); adjustment was on age and gender (fixed effects), with additional adjustment for publication to take account of non-independence of data from the

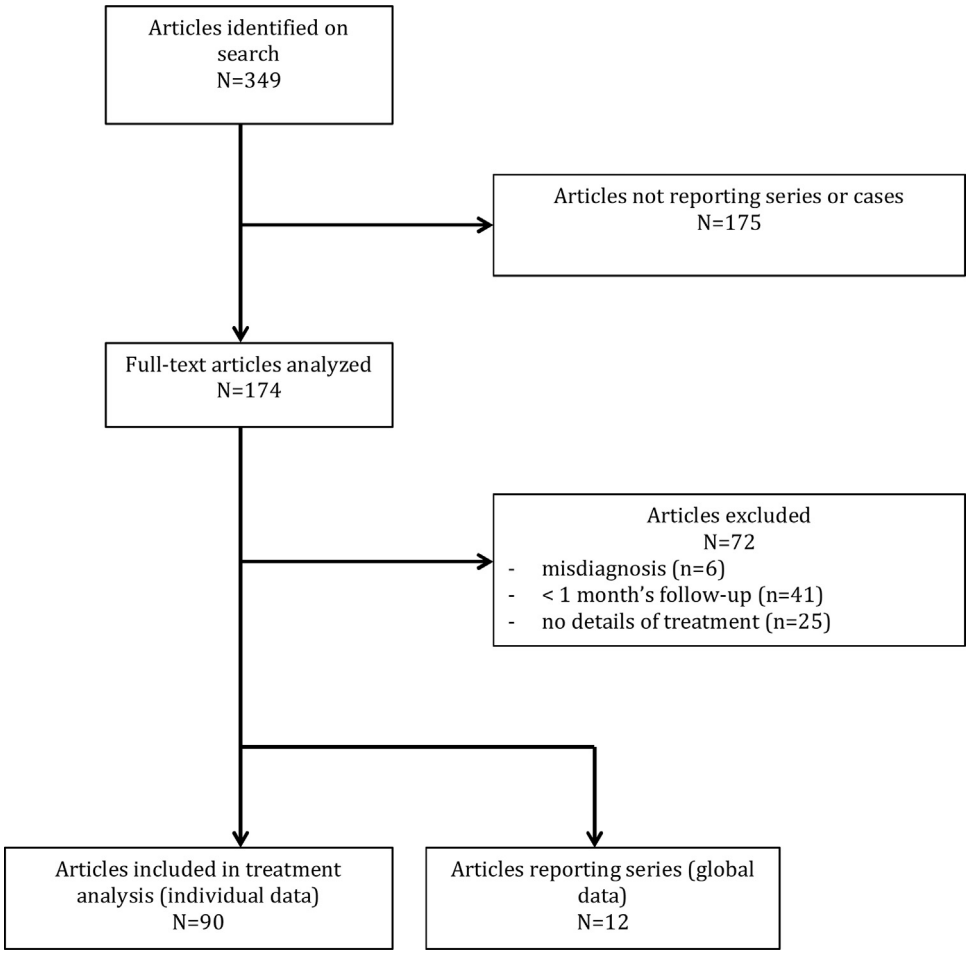

Fig. 2. Flowchart (PRISMA methodology [10]).

Table 1
Treatment and cure and complications rates in the 12 series.

Authors	Treatment	Cure rate, *n* (%)	Follow-up (months)	Complications
Murthy et al. [14]	OS	20/20 (100)	3–60	None
Fini et al. [15]	OS[c]	5/11 (45.4)	5–48	None
Yadav et al. [16]	OS[c]	31/40 (77.5)	6–24	None
Beder et al. [17]	OS	11/19 (57.8)	3–12	None
Ceylan et al. [18]	CS	57/61 (93.4)	12–60	2 facial pareses
Mohanty et al. [19]	OS[c]	27/28 (96.4)	6	None
Peng et al. [20]	CS[d]	18/22 (81.8)	7–26	None
Yavuz et al. [21]	OS[c]	22/27 (81.4)	3–63	None
Singhania et al. [22]	OS	18/26 (69.2)	3	ND
Torres et al. [23]	OS	10/11 (90.9)	9–84	None
Chen et al. [24]	CS[a]	107/133 (80.5)	12–50	1 facial paresis
Cheng et al. [25]	OS[b]	36/62 (58.1)	3–60	None

CS: cervical styloidectomy; OS: oral styloidectomy.
[a] Video-assisted.
[b] With coblation.
[c] With tonsillectomy.
[d] With oral fluoxetine.

Table 2
Associations between treatments and success in the group of 112 patients with pain syndrome without neurologic deficit (Group I).

Treatment	Success, % (*n*)	Raw odds ratio	Adjusted odds ratio[a]
Type of treatment			
Medical	64.3 (9/14)	1 (ref)	1 (ref)
Surgical	91.8 (90/98)	8.33 (2.12–32.81)	8.90 (2.18–36.5)
Surgical approach			
Cervical	95.8 (48/49)	1 (ref)	1 (ref)
Transoral	89.1 (41/46)	0.17 (0.02–1.52)	0.17 (0.02–1.60)

n: number; ref: reference category.
[a] Odds ratio adjusted on age and gender.

same publication (random effect). Analyses used R software, version 3.3.3 (http://www.r-project.org). The significance threshold was set at $P < 0.005$ [12,13].

3. Results

After applying the exclusion criteria (Fig. 2), 102 articles were analyzed: 12 series [14–24] and 90 case reports (Appendix 1).

3.1. Global data analysis (series)

The 12 series [14–25] included 460 patients, aged 20 to 79 years. All had pain syndrome without neurologic deficit, and were treated by styloidectomy (Table 1). Cure rates ranged from 45.4% to 100%, for a mean 78.7% (362/460) overall: 73.7% (180/244) for the transoral approach and 84.2% (182/216) for the cervical approach. There were no complications with the transoral approach, but a 1.2% rate (3/244) of ipsilateral inferior cervicofacial paresis with the cervical approach.

3.2. Individual data analysis (case reports)

The 91 case reports included 128 patients: 79 female, 49 male, aged 32 to 58 years (mean, 45 years). Two populations were distinguished, according to symptomatology: 112 patients with pain syndrome (Group I) and 16 with neurologic deficit (8 cases of ischemic stroke and 8 of transient ischemic attack), associated with pain syndrome in 5 cases (Group II). In Group II, CT found 7 cases of carotid dissection and 9 of carotid compression.

In Group I, treatment was medical (non-steroidal anti-inflammatory drugs, analgesics, muscle relaxants, anesthetic and/or anti-inflammatory injection to the styloid process or tonsils) in 14 cases, and surgical (styloidectomy: 48 by transoral and 50 by cervical approach) in 98, following failure of medical treatment in 23.5% of cases (23/98). In Group II, medical treatment (antiplatelets, with or without stenting) was systematic, with associated styloidectomy in 9 cases.

Cure rate in Group I, at a mean 15 months' follow-up (range, 1 month to 13 years), was 91.8% (90/98) after styloidectomy and 64.3% (9/14) after medical treatment ($P = 0.005$), whether without adjustment (OR 8.33, 95%CI [2.12–32.81]; Table 2) or after adjustment on age and gender (OR 8.90, 95%CI [2.18–36.5]; Table 2). In the styloidectomy subgroup, cure rate was 89.1% (41/46) with the transoral approach and 95.8% (48/49) with the cervical approach (non-significant: $P = 0.1$; adjusted OR, 0.17, 95%CI [0.02–1.60]; Table 2). The complications rate was 4.3% with the transoral approach (1 brachiocephalic pain syndrome, 1 transient trismus), and 16.3% (8/49) with the cervical approach (2 cervical hematomas, 1 transient deficit in the marginal branch of the ipsilateral facial nerve, 1 transient cranial nerve (CN) XII deficit, 1 combined IX-X-XI-XI deficit of non-specified duration, 1 subcutaneous emphysema, 1 first-bite syndrome, and 1 depressive syndrome).

In Group II, at a mean 8 months' follow-up (range, 1–32 months), the cure rate was 87.5% (14/16) and the complications rate 6.2% (1/16). One patient with carotid compression, non-operable due to fragile general health status, received oral anti-inflammatory drugs but was lost to follow-up at 32 months. One patient with carotid dissection treated medically suffered recurrence of ischemic stroke with stent fracture, successfully managed by styloidectomy. The small size and clinical heterogeneity of Group II, with transient ischemic attack and ischemic stroke and internal carotid wall lesions, prevented analysis of the impact of styloidectomy, approach or indication (primary or secondary) on cure rate.

4. Discussion

The styloid process is attached to the temporal bone and runs through two angles, downward then medially toward the pharynx.

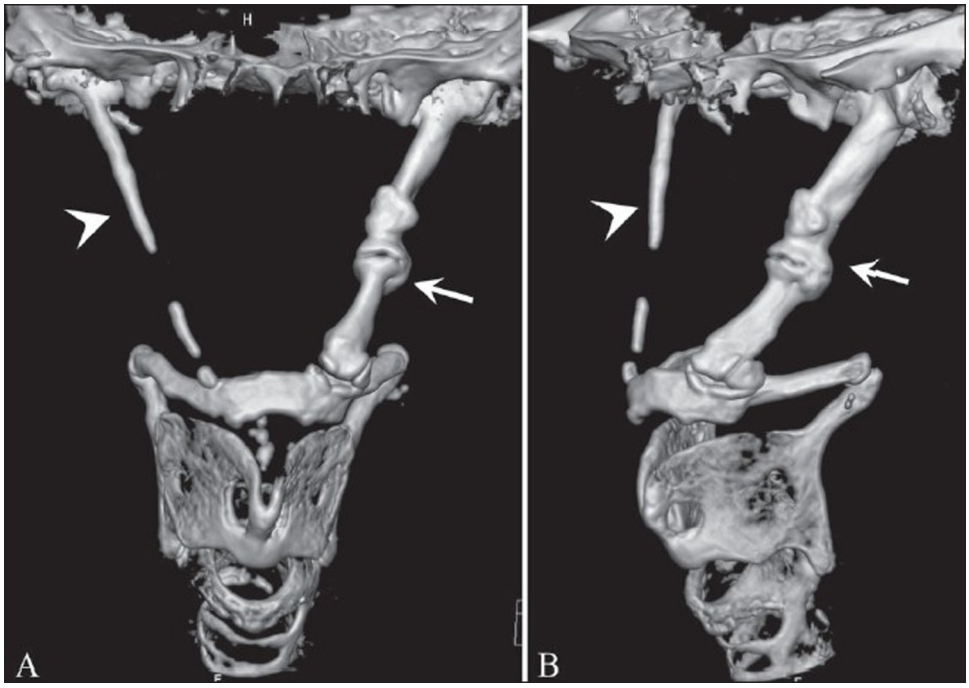

Fig. 3. Stylohyoid syndrome: 3D CT reconstruction (from Raina D, Gothi R, Rajan S. Eagle syndrome. Ind J Radiol Imaging 2009;19:107–108).

The cartilage extremity is prolonged by a fibrous band, the stylohyoid ligament, inserting on the lesser horn of the hyoid bone. Stylohyoid syndrome implicates trauma (contact sports, road accidents, etc.) or ossification in adulthood of the styloid process and stylohyoid ligament (Fig. 3) or styloglossus muscle, for which various etiopathogenic factors have been identified: tonsillectomy, adult activation of ossification centers within embryonic residues stimulated by factors such as carrying heavy loads on the head, styloid process tension inducing bone hyperplasia and/or metaplasia, osteoporosis or menopause, or osteoarthritis and genetic predisposition [14–27].

Diagnosis is often not quickly established. In 1948, Eagle [2] reported that he had been monitoring his first case for 5 years before reaching diagnosis, and that symptoms resolved on transoral resection of the styloid process (styloidectomy). The infrequency of the syndrome [11] and wide variation in symptoms, and especially in pain location [14–27], account for the frequent delay in diagnosis.

The associated pain is very intense, sharp or shooting, localized mainly in the pharynx and/or neck, or sometimes ear, temporomandibular joint, face, eye, oral floor, mandible and/or skull. It is often triggered by swallowing, turning the neck or yawning [14–26]. These variations in pain location depend on the contacts made by the calcified and prolonged stylohyoid complex (Fig. 1): sensory branches of CN V, VII, IX and/or X, or sympathetic plexi of the parietal adventitia of the external (facial or peri- and retro-orbital pain) or internal carotid artery (cranial pain in the form of parietal headache at the vertex or frontal supraorbital headache) [2,3,14–26]. Pain is often accompanied by a sensation of pharyngeal foreign body, globus, dysphagia or sometimes tinnitus and balance disorder. Various authors have also reported palsy of CN X and XII or of the lingual or cervical sympathetic nerve, trismus, taste and speech disorder and dysphonia [14–26]. A more infrequent presentation, found in 16 out of the 128 patients (12.5%) in our review of 90 case reports, follows direct trauma (compression, pseudoaneurysm) caused by the calcified and elongated stylohyoid complex (Figs. 1 and 4) in the wall of the ipsilateral internal carotid artery [26–29]; presenting symptomatology is then dominated by vertigo, dizziness, drop attacks, epileptic attacks or stroke

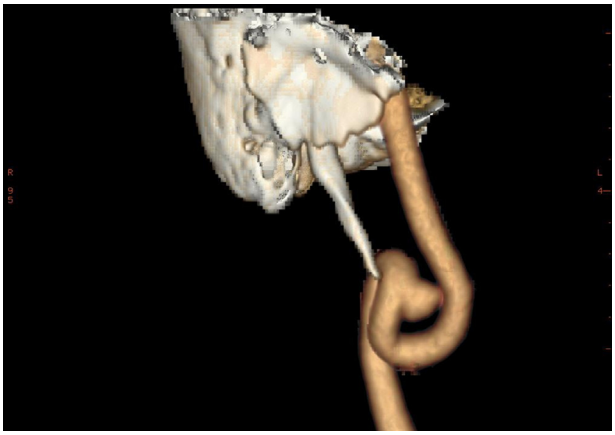

Fig. 4. CT-angiography with 3D reconstruction showing impingement between styloid process and internal carotid artery (carotid dissection) in stylohyoid syndrome (from Karam C, Koussa S. Eagle syndrome: the role of CT scan with 3D reconstructions. J Neuroradiol 2007;34:344–345).

with motor deficit, language disorder and/or visual disorder, due to the anatomic effects of contact (stenosis, thrombosis and/or dissection) or to compression by the stylopharyngeus muscle triggering symptoms on ipsilateral neck rotation [30].

In the literature, it is often claimed that a styloid process longer than 3 cm increases the incidence of stylohyoid syndrome, due to increased displacement of the tip with increasing length (all the more in case of stylohyoid ligament calcification), leading to contact with neighboring neurovascular structures [26]. However, many studies based on anatomic dissection or radiologic analysis failed to confirm any such 3 cm threshold: in 2017, analysis of CT data for 2000 styloid processes in adults free of stylohyoid syndrome found styloid processes exceeding 3.5 cm in length in 34.2% of cases [31]; conversely, in CT assessment of 133 stylohyoid syndromes, Chen et al. [22] found lengths of less than 3 cm in 15.4% of cases.

According to Eagle [2], the styloid process is pathological if palpable and painful in the ipsilateral tonsil. Various authors

[18,24,26,32–36] highlight the diagnostic contribution of pain resolution on tonsillar injection of anesthetic and/or steroidal anti-inflammatory drugs: otherwise, stylohyoid syndrome, along with other pathologies with similar pain symptomatology, should be considered. Clinical examination should rule out dental problems, such as wisdom tooth, tumor or infection, and screen for signs of various differential pathologies. Pain on cervical spine palpation suggests occipital neuralgia (e.g., Arnold's neuralgia); pain on glossotonsillar sulcus palpation suggests glossopharyngeal neuralgia; pain on thyrohyoid membrane palpation suggests superior laryngeal neuralgia; and tears with facial erythema and ocular signs suggest trigeminal neuralgia (e.g., Sluder syndrome) or nasal neuralgia (e.g., Charlin syndrome). Pain on palpation of the carotid bulb suggests carotidynia; pain on palpation of the temporomandibular joint or temporal muscle tendon suggests joint dysfunction; pain on percussion of the mastoid suggests mastoiditis; pain on palpation behind the horizontal branch of the mandible or of the extremity of greater horn of the hyoid bone respectively suggest stylomandibular ligament insertion tendinitis (e.g., Albert syndrome) or hyoid bone syndrome (bursitis); pain on palpation of the thyroid or cricoid cartilage plate suggests corresponding tendinitis. When clinical data are atypic and/or diagnosis is uncertain, several authors [6,37–39] stress the contribution of a psychiatric opinion.

While clinical examination is important in guiding diagnosis toward stylohyoid syndrome, definitive diagnosis relies on CT, which has replaced plain X-ray in this role. Modern imaging (3D CT reconstruction with contrast enhancement and dynamic views in rotation) provides optimal visualization of the morphology and angulation of the elongated calcified styloid process (Figs. 3 and 4), and relations to or involvement of the carotid artery (Fig. 4). CT also simultaneously analyzes deep spaces, to rule out infection (mastoiditis, osteitis), tumor (skull base, deep parotid lobe, parapharyngeal space, pharynx) or malformation (ponticulus posticus), which presents very similar pain symptoms [14–26]. CT may be supplemented by MRI, determining the etiology of glossopharyngeal or geniculate ganglion neuralgia, and visualizing inflammatory thickening of the carotid bulb wall typical of carotidynia, or calcification in retropharyngeal tendinitis. Normal findings serve to reorient diagnosis toward more "general" conditions, such as temporal arteritis, migraine, tension neuralgia, angina pectoris or psychosomatic disorder [14–26]. It is also the key to diagnosis when stylohyoid syndrome presents as a syndrome of transient or lasting neurologic deficit [14–26].

Several articles suggest that stylohyoid syndrome can be successfully treated non-operatively [35–50]. This option was taken in 12.5% (14/112) of clinical cases without neurologic deficit in our literature review, and is based on various oral treatments (non-steroidal anti-inflammatory drugs, analgesics, antiepileptics or muscle relaxants) and/or injection of anesthetics or steroidal anti-inflammatory drugs to the styloid process or tonsil. The advocates of this option point out its safety and efficacy, especially when pain is not intense or surgery is contraindicated [35–50]. In our review of case reports, however, the cure rate was only 64.3%, significantly ($P = 0.005$) lower than the 91.8% found with styloidectomy, with or without adjustment on age and gender (Table 2). Gervickas et al. [48], in the largest series of medical treatment for stylohyoid syndrome, reported that in most cases pain was not relieved or else recurred within 6–12 months. Moreover, safety is debatable: as well as side effects of the various drug classes, injection to the styloid process incurs a risk of facial palsy [36]. Medical treatment also does not act upon the causal process, leaving open a risk of neurologic deficit caused by internal carotid artery impingement [29,50] or even of death from asphyxia or cardiovascular arrest [49–54].

The alternative to medical treatment is styloidectomy. In his princeps article, Eagle [1] mentioned that a European physician, Weinlecher, first reported its efficacy in the late 19th century [1].

Initial reports were of transoral surgery [1], usually under general or sometimes local anesthesia, with 6 classical stages: transoral exposure and palpation of the styloid process, tonsillectomy, incision of the pharyngeal constrictors against the styloid process, sectioning against the styloid process of the inserted ligaments and muscles, fragmentation of the styloid process, which is resected, and closure in several planes [1–5,14–17,19,21–23]. In the decade following 2000, systematic primary tonsillectomy was abandoned [23,55], endoscopes were introduced and a piezoelectric technique was used to fracture the styloid process, with coblation for hemostasis, and use of robotic surgery [25,27,55–60], although there was no published evidence of benefit. However, resolution of pain on lidocaine injection in the tonsil demonstrated strong predictive value for the efficacy of styloidectomy [22]. Postoperative antibiotic therapy was also replaced by intraoperative antibiotic prophylaxis [61]. A very large number of authors reported risk of infection and of neurovascular lesions with a transoral approach for styloidectomy; Mohanty et al. [19], in a cohort of transoral styloidectomies, reported difficulty in controlling intraoperative tonsillar bleeding and in dissecting the styloid process, especially when the medial angle was absent. In contrast, however, the present review of case reports and series (Table 1) found no cases of infection, hemorrhage, neurovascular complications or postoperative death in published reports of transoral styloidectomy.

In 1948, Eagle [4] noted that Loeser and Caldwell [62] were the first to report styloidectomy via a transcutaneous cervical approach. It offers an alternative to the transoral approach and its reputed risks, and can deal with the possible absence of a medial angle in the elongated and calcified stylohyoid complex, sometimes revealed by painful cervical swelling at the junction with the lesser horn of the hyoid bone. The procedure consists in 4 successive stages: cervicotomy in the superior cervical fold, location of the anterior edge of the sternocleidomastoid muscle and posterior belly of the digastric muscle, palpation of the calcified styloid process, sectioning the styloid curtain muscles and ligaments strictly in contact with the styloid process, then fracturing and resecting the styloid process [18,20,24,54,62–64]. In the decade following 2000, it was sought to optimize cervical incision esthetics [64], reducing its length by use of endoscopy [24]; cervical approaches were used in case of recurrent or persistent pain after transoral styloidectomy [65]; and short-course fluoxetine (an antidepressant) was introduced postoperatively [20].

Whatever the means of assessment, whether global rates for series or regression models for case reports, cure rates were higher on a cervical than a transoral approach: respectively, 84.2% vs. 73.7% for series and 95.8% vs. 89.1% for case reports in our review of the literature. The fact that the mean global cure rate of 73.7% in the 12 published series (Table 2) was lower than the 91.8% rate for case reports without neurologic deficit in our opinion highlights the problem of case reports, which rarely focus on complications or failure and tend to overstate real efficacy. Statistically, the difference between the two approaches in case reports was not significant, and one approach cannot be said to be superior to the other. On the other hand, the cervical approach was associated with a higher rate of complications (16.3% vs. 4.3%), notably involving CN VII, IX, X, XI and/or XII, but again without significant difference.

Complete resolution of pain showed no association with styloid process length, morphology, angulation or degree of resection; if, however, resolution is incomplete, it should be checked whether resection was sufficient [18], given that Steinmann [66] demonstrated that the styloid process may regrow years after styloidectomy, which is attributed to embryonic cartilage residue. In such cases, another etiology, such as first-bite syndrome [67],

should also be sought for the pain, and various causes of subjective impact, such as stress, anxiety or psychiatric disorder, should be assessed [37–39].

Treatment of stylohyoid syndrome revealed by transient or lasting neurologic deficit is a special case. It constitutes a neurovascular emergency, involving internal carotid compression, dissection or aneurysm detected on CT (Fig. 4) [29]. In the 16 case reports in our review, antiplatelet treatment was systematic, sometimes associated to stenting (in case of dissection or aneurysm) and, in 9 cases, to styloidectomy; the cure rate was 87.5% and the complications rate 6.2%. The small sample size and heterogeneity of clinical presentation, between transient ischemic attacks and stroke, of the internal carotid wall lesions and of follow-up precluded analysis of the impact of styloidectomy or approach on cure rate, or of indications for styloidectomy: primary, or secondary following recurrence of neurologic deficit or onset of complications such as stent fracture.

5. Conclusion

Several points emerged from the present systematic review of the literature on treatment of stylohyoid syndrome following the PRISMA methodology [10]. Pain triggered by cervical rotation and intraoral palpation of the tonsils is highly indicative, but CT is essential for definitive diagnosis. Medical treatment is reserved to formal contraindications to or refusal of surgery, and the patient should be informed of the neurological risk incurred. Surgery is recommended, due to its high success rate, and low rate of non-hemorrhagic and non-infectious postoperative complications, and to avoid neurologic complications. Any associated neurologic deficit should be treated as a neurovascular emergency, in which primary or secondary styloidectomy again shows real efficacy.

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Disclosure of interest

The authors declare that they have no competing interest.

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Appendix A. Appendix 1 List of 90 case reports.

First author	Journal	Date
Cordier	Presse Med	1967
Steinmann	Arch Otolaryngol	1970
Shenoi	J Laryngol Otol	1972
Messer	J Oral Surg	1975
Moffat	J Laryngol Otol	1977
Karlan	Otolaryng Head Neck Surg	1979
Sykes	J Dist Columbia Dent Soc	1980
Glogoff	J Oral Surg	1981
Dolan	Surg Neurol	1984
D'Erceville	Rev Stomatol Chir Maxillofac	1985
Strauss	Laryngoscope	1985
Zohar	J Maxillofac Surg	1986
Yoshimura	J Craniomandibular Pract	1989
Forman	J Am Dent Assoc	1990
Chouvel	Acta Otolaryng	1996
Bafaqeeh	J Otolaryngol	2000
Murtagh	AJNR	2001
Slavin	J Neurosurg	2002
Mortellaro	J Craniofac Surg	2002
Cernea	Laryngoscope	2007
Pereira	J Oral Maxillofac Surg	2007
Martin	ENT	2008
Carvalho	Brit J Oral Maxillofac Surg	2008
Politi	Int J Dent	2008
Shin	J Neurosurg	2009
Hossein	J Craniofac Surg	2010
Khandelwal	Saudi Dent J	2010
Tekaya	Tunisie Medicale	2011
Dao	Emerg Radiol	2011
Jain	J Orofacial Pain	2011
Thotappa	Ind J Dent Res	2011
Ohara	J Stroke Cerebrovasc Dis	2012
Koivumaki	Int J Maxillofac Surg	2012
Blackett	J Med Case Rep	2012
Langstaff	BMJ Case Rep	2012
Mayrink	Oral Maxillofac Surg	2012
Nagato	Arthritis & Rheumatology	2012
Kawasaki	J Anesth	2012
Todo	Ann Vasc Surg	2012
Santini	Rev Laryngol Otol Rhinol	2012
Baig	J Coll Phys Surg Pakistan	2012
Hassan	Ind J Dent Res	2012
Sveinsson	BMJ Case Rep	2013
Hoffmann	J Craniomaxillofac Surg	2013
Yamamoto	Intern Med	2013
Soldati	Arq Neuropsiquiatr	2013
Park	J Laparoendos Adv Surg Tech	2013
Mollinedo	Pain Practice	2013
Martins	Cranio	2013
Han	Korean J Pain	2013
Werhun	ENT	2014
Scheller	Med Oral Pathol Oral Chir Bucal	2014
Ferreira	J Craniofac Surg	2014
Bensoussan	Head Neck	2014
Ohe	J Korean Assoc Oral Maxillofac Surg	2014
David	J Vasc Surg	2014
Guimaraes	J Contemporary Dent Pract	2014
Kamal	J Pak Med Assoc	2014
Moon	J Korean Assoc Oral Maxillofac Surg	2014
Taheri	J Korean Assoc Oral Maxillofac Surg	2014
Naito	J Anesth	2014
Muderris	Eur Arch Otorhinolaryngol	2014
Bertossi	J Craniofac Surg	2014
Costa Ferreira	J Craniofac Surg	2014
Kim	Austral Fam Phys	2014
Thoenissen	Int J Surg Case Rep	2015
Kamil	Ann ORL	2015
Ho	Head Neck	2015
Ogura	NMC Case Rep J	2015
Malik	BMJ Case Rep	2015
Weteid	Int J Oral Maxillofac Surg	2015
Bakshi	Am J Med	2016
Altun	J Anesthesiol	2016
Kermani	Trauma Mon	2016
Aldelaimi	J Craniofac Surg	2016
Costantinides	Gerodontology	2016
Spalthoff	Int J Oral Maxillofac Surg	2016
Bizet	Med Buc Chir Buc	2016
Aldakkan	J Radiol	2017
Papadiochos	J Stomatol Oral Maxillofac Surg	2017
Jelodar	J Stroke Cerebrovasc Dis	2017
Gallaways	J Surg Case Rep	2017
Gárriz-Luis	Neuroped	2017
Heim	J Craniofac Surg	2017
Smoot	Interventional Neuroradiol	2017
Sharma	Ann Maxillofac Surg	2017
Aydin	Turk Neurosurg	2018
Maki	Case Rep Otolaryngol	2018
Bal	J Craniofac Surg	2018

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