Original Article

Anterior cervical osteophytes causing dysphagia: Choice of the approach and surgical problems

ABSTRACT

Background: Anterior cervical osteophytes (ACOs) may rarely cause dysphagia, dysphonia, and dyspnea. Symptomatic ACOs are most commonly located between C3 and C7, whereas those at higher cervical (C1–C2) levels are rarer. We report a case series of 4 patients and discuss the best surgical approach according to the ostheophyte location and size, mainly for those located at C1–C2, and the related surgical problems.

Materials and Methods: Four patients (two males and two females) aged from 57 to 72 years were operated on for ACOs, causing variable dysphagia (and dyspnea with respiratory arrest in one). Three patients with osteophytes between C3 and C5 were approached through antero-lateral cervical approach, and one with a large osteophyte between C1 and C3–C4 level underwent a two-stage transcervical and transoral approach. All had significant postoperative improvement of dysphagia.

Results: The patient operated on though the transoral approach experienced postoperative flogosis of the prevertebral tissues and occipital muscles and thrombosis of the right jugular vein and transverse-sigmoid sinuses (Lemierre syndrome).

Conclusion: The transoral approach is the best surgical route to resect C1 and C2 ACOs, whereas the endoscopic endonasal approach is not indicated. The anterior transcervical approach is easier to resect osteophytes at C3, as well as those located below C3. A combined transoral and anterior cervical approach may be necessary for multilevel osteophytes.

Keywords: Anterior cervical osteophytes, cranio-vertebral junction, dysphagia, transcervical approach, transoral approach

INTRODUCTION

Anterior cervical osteophytes (ACOs) are common radiological findings of the elderly, with an incidence of 20%–30% in over 60 years old patients.[1] They are usually small and asymptomatic or associated with a specific neck pain. However, when they reach a large size, they may cause dysphagia, globus sensation, and more rarely dysphonia and dyspnea.[2-4] The incidence of dysphagia in patients with ACOs is variable according to the patient's age (1% at all ages[5] and 10.6% of patients 60 years old or older observed for dysphagia evaluation[4]).

Symptomatic ACOs causing dysphagia are more commonly found at the C4–C7 levels and rarely at higher cervical levels[3,6] (with only 7 out of 68 patients showing the involvement of C1 in a case series[6]).

Access this article online	
Website: www.jcvjs.com	Quick Response Code
DOI: 10.4103/jcvjs.JCVJS_147_20	

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Submitted: 15-Sep-20 **Accepted:** 15-Oct-20
Published: 26-Nov-20

How to cite this article: Maiuri F, Cavallo LM, Corvino S, Teodonno G, Mariniello G. Anterior cervical osteophytes causing dysphagia: Choice of the approach and surgical problems. J Craniovert Jun Spine 2020;11:300-9.

The surgical approach and resection of symptomatic ACOs mainly depend on their location in height and size.

This study reports four surgical cases of ACOs, causing dysphagia and discusses the surgical problems and the best approach according to the osteophyte location.

MATERIALS AND METHODS

Four patients who complained of dysphagia due to ACOs, operated on in our neurosurgical unit, were reviewed retrospectively. None of them had a history of trauma, neurological and rheumatologic diseases, previous surgery, or infection.

All four patients were studied by computerized tomography (CT) of the cervical spine and barium swallow study and three also by the magnetic resonance of the cervical spine [Figures 1-3]. In all four cases, these studies excluded other causes of dysphagia.

The case records, diagnostic studies, surgical descriptions, and postoperative clinical and radiological data were analyzed. The dysphagia was graded according to the "Functional Outcome Swallowing Scale" (FOSS) described by Salassa[7] [Table 1]. The analyzed factors were patient age and sex, grade of dysphagia, presence of other related symptoms, location and size of the osteophyte, surgical approach and resection, complications, and clinical outcome.

In all patients, the conservative treatment, including swallowing therapy, anti-inflammatory, myorelaxing, and antireflux treatment were administered for 3 months before the surgical operation, with no clinical improvement.

The follow-up ranges from 3 months to 6 years.

RESULTS

The data of the four patients are summarized in Table 2. The patients were 2 men and 2 women, with age ranging from 57 to 72 years (average 65 years). All four patients complained of dysphagia for solid and two also for liquid foods, with FOSS grade ranging from 2 to 4; all also had unspecific cervical pain, variable reduction of the neck movements, pharyngeal irritation, and sensation of foreign body in the throat. One patient (case 4) also had weight loss and slight occasional dyspnea. Finally, one patient complained of significant dyspnea and experienced respiratory arrest requiring an urgent tracheostomy.

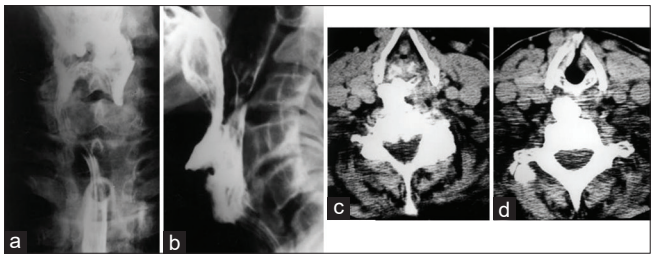

Figure 1: Case 1: (a and b) Barium swallow study in anteroposterior (a) and lateral (b) views: Interruption of the column of contrast at the level of the osteophyte. (c and d) CT scan, axial section at C4 (c) and C5 (d): Large anterior osteophyte

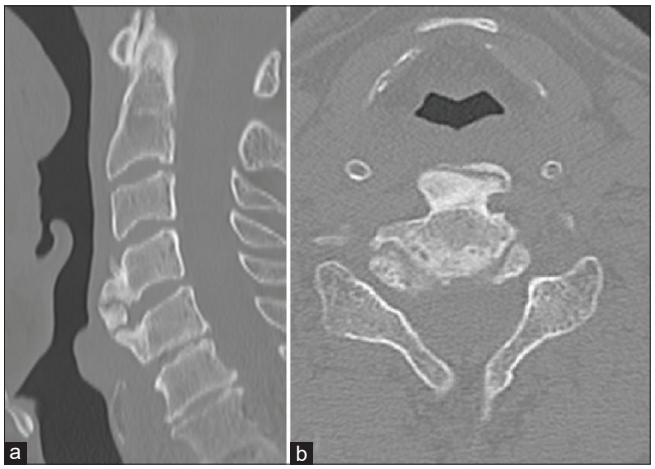

Figure 2: Case 2: CT scan in sagittal (a) and axial (b) views: Anterior cervical osteophyte at C4–C5 level

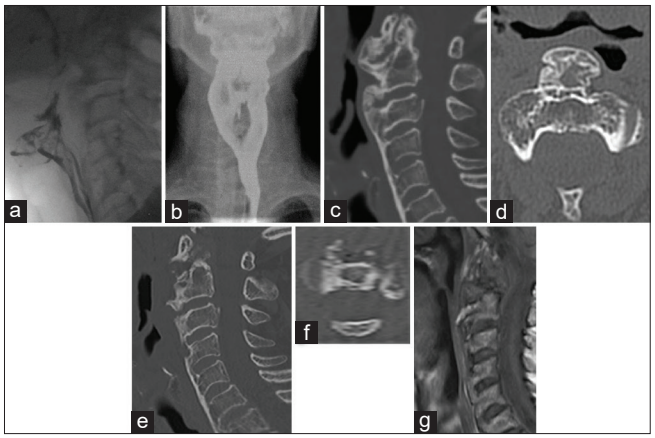

Figure 3: Diagnostic studies of case 4. (a and b) Barium swallow study in lateral (a) and antero-posterior (b) views: Defect of the esophageal opacization at level of the osteophyte. (c and d) Preoperative cervical CT scan, sagittal (c) and axial C1–C2 (d) views: Anterior osteophyte extending from C1 to C3-C4 level; the calcified anterior longitudinal ligament is visible. (e-g) Postoperative studies: Cervical CT scan, sagittal (e) and axial C1–C2 (f) sections; magnetic resonance, sagittal T1-W sequence (g): Good resection of the osteophyte and normal esophageal lumen

The osteophyte was located between C3 and C5 in three patients, whereas another had a large osteophyte extending between C1 and C3–C4 discal space.

The surgical approach was transcervical antero-lateral in three cases with osteophyte located between C3 and C5 (from the right side in two cases and from the left side in one, according to the greater extension of the osteophyte). An horizontal skin incision allowed to obtain sufficient longitudinal muscle opening to well expose the upper and lower margin of the osteophyte. The microsurgical resection was made by a high-speed drill up to the base of the osteophyte.

In a patient with an osteophyte extending between C1 and C3–C4 level, a combined two-stage right transcervical and transoral approach was necessary; in fact, because of the narrow mouth opening and the hypertrophic tongue, the only transoral approach was considered insufficient.

The transoral approach was made with the patient in the supine position with intubation through a prophylactic tracheostomy and with the head secured in a Mayfield fixation. A dedicated transoral system was used for the approach. The osteophyte was found to occupy the mouth cavity [Figure 4a]. A longitudinal midline incision of the posterior pharyngeal wall allowed to expose the osteophyte which was resected by drilling [Figure 4b] up to visualize the partially preserved anterior longitudinal ligament [Figure 4c].

In all four patients, the osteophyte was largely excised up to obtain a smooth spinal curve. Intraoperative X-ray studies were performed in all cases to confirm the resection. No spinal fusion was made.

No major immediate postoperative complications, such as laryngeal damage, esophageal perforation or major vascular injury, occurred. However, patient 4 operated on by combined transcervical and transoral approach experienced, 1 month after the transoral surgery, severe neck pain, and fever.

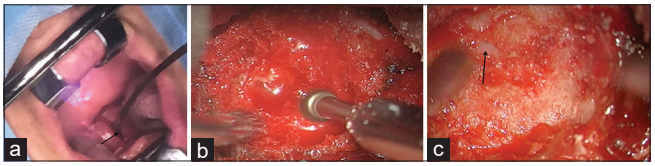

Figure 4: Intraoperative images of the transoral approach to C1–C2 anterior osteophyte (case 4). (a) The osteophyte is visible in the mouth cavity; the posterior pharyngeal wall is cut on the midline (↑). (b) The osteophyte is exposed. (c) The osteophyte is almost wholly resected; the partially preserved anterior longitudinal ligament is visible (↑)

Table 1: Functional outcome swallowing scale

Stage	Symptoms
0	Normal physiologic function without symptom
1	Normal function with daily or episodic symptoms of dysphagia
2	Compensated abnormal function manifested by significant dietarymodifications or prolonged meal time (without weight loss or aspiration)
3	Decompensated abnormal function with weight loss of 10% or less of bodyweight over 6 months due to dysphagia; or daily cough, gagging, oraspiration during meals
4	Severely decompensated abnormal function with weight loss of more than10% of body weight over 6 months due to dysphagia; or severe aspirationwith bronchopulmonary complications, nonoral feeding for most ofnutrition
5	Nonoral feeding for all nutrition

Table 2: Summary of clinical and surgical data of 4 patients with anterior cervical osteophytes causing dysphagia

Patients age/ sex	Level	Diagnostic studies	Surgical approach	Fusion	Complications	FOSS			Respiratory symptoms	
						Preoperative	Postoperative	Difference	Preoperative	Postoperative
1 57 male	C5	CT scan BSS	Right transcervical antero-lateral	No	None	3	0	−3	Dyspnea, respiratory arrest, tracheostomy	Remission
2 62 female	C4-C5	MRI CT scan BSS	Right transcervical antero-lateral	No	None	2	0	−2	None	-
3 68 male	C3	MRI CT scan BSS	Left transcervical antero-lateral	No	None	3	1	−2	None	-
4 72 female	C1-C3	MRI CT scan BSS	Right transcervical antero-lateral + transoral (two stage)	No	Prevertebral tissue inflammation right jugular vein thrombosis	4	1	−3	Slight occasional dyspnea	Remission

BSS - Barium swallow study, CT - Computed tomography, MRI - Magnetic resonance imaging, FOSS - Functional outcome swallowing scale

Table 3: Data of 198 reviewed patients with anterior cervical osteophytes treated by anterolateral transcervical approach (1995- 2020)

Covariates	Number of cases (%)
Patient sex	
Male	180 (91)
Female	18 (9)
Age (years)	
<50	11 (6)
51- 60	28 (14)
61- 70	82 (41)
71- 80	63 (32)
>80	14 (7)
Number of involved levels for each patients	
1	72 (37)
2	40 (20)
3	40 (20)
4	26 (13)
5- 6	20 (10)
Involved spine level (in 174 pts)	
C2- C3	32 (7)
C3- C4	99 (22)
C4- C5	124 (28)
C5- C6	105 (24)
C6- C7	60 (14)
C7- T1	16 (4)
T1- T2	4 (1)
Symptoms	
Dysphagia	183 (92)
Dyspnea	39 (20)
Neck pain	24 (12)
Dysphonia	17 (9)
Hoarsmess	7 (3.5)
Myelopathy	6 (3)
Diagnostic studies	
Barium swallowing study	90 (45)
X-ray of the cervical spine	142 (71.5)
Cervical computerized tomography	138 (69.5)
Cervical magnetic resonance	83 (44)
Spinal fusion	35 (17.5)
Tracheostomy	17 (8)
Postoperative complications	
Hematoma of the surgical field	6 (3)
Laryngeal nerve palsy	2 (1)
Epidural abscess	1 (0.5)
Wound infection	1 (0.5)
Complete aphagia	1 (0.5)
Stroke	1 (0.5)
Outcome	
Remission or variable improvement	190 (96)
Unchanged or worsening	8 (4)

Radiological studies evidenced flogosis of the paravertebral tissues and occipital muscles and thrombosis of the right jugular vein and transverse-sigmoid sinuses. This condition was diagnosed with Lemierre syndrome,[8,9] due to infection from *Streptococcus constellatus*. Complete clinical remission of the infectious complication was obtained by antibiotic and anticoagulant therapy.

The clinical outcome was as follows. Dysphagia disappeared or significantly improved from 2 to 3 grades of the FOSS scale [Table 2]. In one patient, who experienced respiratory arrest, the tracheostomy was removed 2 months after the surgery and the respiratory function returned to be normal.

DISCUSSION

ACOs may sometimes become symptomatic with different mechanisms, including mechanical compression of the pharynx and esophagus, periosteophyte and pharyngo-esophageal inflammation, fibrosis, displacement of the laryngeal structures, and pharyngeal spasm.[10-13] Dysphagia is the main and more frequent complaint; dyspnea, dysphonia, and hoarseness are rarer.

Patients with ACOs and dysphagia should be first treated conservatively with swallowing therapy, anti-inflammatory and myorelaxing drugs. These therapies result in long-term clinical improvement or remission in many cases.

The surgical treatment of ACOs with the aim to resolve the dysphagia was suggested for about 60 years, as confirmed by some literature reviews.[14-16] More frequent mid- or low cervical osteophytes were treated by standard anterolateral cervical approach; those located in the high cervical region, significantly less frequent, were approached through the transoral route. Besides, other endoscopic approaches, such as endonasal and cervical, should be evaluated.

Anterolateral cervical approach

The standard anterolateral cervical approach is used in most patients. We have reviewed 67 studies reported in the literature of the past 25 years, which include patients with symptomatic ACOs treated by this approach.[11-13,17-80] Nineteen studies[29,30,34,38,39,49-51,54,56,62,63,67,69,73,76-78,80] report series of 4 or more patients while the others are reports of one to three patients. An overall number of 198 patients have been collected.

The data of the 198 reviewed cases are summarized in Table 3. These show a significant prevalence of men (91% vs. 9%), mainly aged between 60 and 80 years. Most patients had involvement of one to 3 levels, mainly from C3 to C6. High C2–C3 (7%) and low C7–T2 (5%) osteophytes were rare; besides, there were no lesions extending to C1.

Dysphagia was the main complaint (92%); 39 patients (20%) presented variable dyspnea requiring perioperative tracheostomy in 17. Chronic neck pain (12%) and dysphonia (9%) were less frequent.

Preoperative diagnostic studies included barium swallowing study (45%), cervical spine X-ray (71.5%), CT (69.5%), and magnetic resonance (44%) of the cervical spine. An anterior spinal fusion was associated after the osteophyte resection in 35 patients (17%).

Postoperative complications included hematoma of the surgical field in 6 cases (3%) (requiring reoperation in 4), laryngeal nerve palsy in 2 (1%), complete aphagia in one, wound infection, epidural abscess, and stroke in one, respectively. No other major complications (esophageal perforation or major vessel injury) are reported.

Remission or variable improvement of dysphagia and other symptoms are reported in 96% of the patients, whereas 4% were unchanged or worsened.

Data on regrowth and recurrence are missed in most studies because of the short follow-up. Some studies report no regrowth after a median follow-up of about 2 years[62,73] and initial regrowth at median follow-up of 53 months;[51] on the other hand, in their series of 7 cases with follow-up from 6 to 13 years Miyamoto *et al*.[49] report radiological recurrence in all cases with related symptoms in two. Thus, it seems that the osteophyte recurrence is not a negligible problem in the long-term follow-up, mainly in younger patients. Suggested prophylactic measures include therapy with indomethacin, additional anterior stabilization, and radiotherapy.[49,67,77] However, there are no precise guidelines.

We agree that all patients should be explored preoperatively by barium swallow study with the aim to confirm that the dysphagia is mechanical due to osteophytic compression. The diagnostic protocol should also include CT and magnetic resonance, to better define the osteophyte and exclude its extension into the spinal canal. On the other hand, the X-ray of the cervical spine, used as a unique diagnostic study in several reviewed otolaryngological series, is not sufficient.

The anterolateral cervical approach requires a greater longitudinal opening of the muscle planes to expose the frequent multilevel osteophytes. For strictly median osteophytes, the side of the approach may be decided according to the surgeon preference. Osteophytes with significantly asymmetric growth should be approached by the side of the greater growth to reduce the risk of damaging the esophagus displaced contralaterally. The dissection must be careful because of the adhesions of the osteophyte with the surrounding tissues and esophagus due to the lack of normal anterior longitudinal ligament. Intraoperative X-ray controls (or CT if available) are necessary to define the entity of the bone resection.

The need for fusion, performed in 35 (17.5%) of the reviewed cases, is controversial. Anterior fusion with interbody cage and/or anterior cervical plate is suggested to prevent instability and osteophyte regrowth.[49,62] However, it requires the discectomy, the most extensive dissection of the prevertebral tissues, and longer surgical time. Thus, in agreement with most reviewed studies, we did not perform fusion in our patients.

Transoral approach

Anterior osteophytes located at C1 and C2 are better approached by the transoral route.[69,81] This approach through the incision of the posterior pharyngeal wall in the midline, allows direct exposure to the osteophyte protruding in the mouth cavity. This is associated with low risk of damaging the main vascular structures, the vagus, and laryngeal nerves.[82]

The transoral approach to the high cervical osteophytes is reported only in five studies.[20,24,69,81,83] On the other hand, even a large series of patients treated by transoral approach to the cervical spine for different pathologies do not include cases of osteophytes or diffuse skeletal hyperostosis.[84,85] The large study of 533 transoral operations by Choi and Crockard[86] does not focus on anterior osteophytes. Besides, in the literature review by Verlaan *et al*.[16] including 134 surgical cases of cervical osteophytes reported between 1980 and 2010, only one study includes a patient treated by transoral approach.[19]

The data of the 12 reviewed patients with anterior osteophytes of the high cervical region treated by transoral approach are summarized in Table 4.[20,24,69,81,83] Differently from those located below C3, a female prevalence (8 among 12 cases) is evidenced. Dysphagia was referred to in 9 cases, odynophagia in 3, and dysphonia in 3. The transoral technique was microsurgical in 5 cases and endoscopic in 7. The postoperative complications include cervical instability in one case ad infection in another. Clinical improvement or remission occurred in all cases.

The intraoperative surgical problems related to the osteophyte resection by the transoral approach deserve to be discussed [Table 5].

Table 4: Data of 12 reported cases of anterior cervical osteophytes treated by transoral approach

Authors/year	Age/sex	Symptoms	Level	Diagnostic studies	Surgical technique	Complications	Outcome
Ramadass *et al*., 1997[20]	31 Male	Dysphagia, dyspnea	C1- C2	X-ray , laryngoscopy	Microsurgical	_	Improved
Motsch *et al*., 1999[24]	54 Male	Dysphagia	C2	X-ray, CT	Microsurgical	_	Improved
Erdur *et al*., 2017[69]	56 Male	Dysphagia	C2- C3	BSS	Microsurgical	_	Improved
	58 Female	Dysphagia	C2- C3	BSS	Microsurgical	cervical instability	Improved
	56 Female	Dysphagia	C2- C3	BSS	Microsurgical	infection	Improved
Jabarkheel *et al*., 2018[81]	57 Female	Dysphagia, dysphonia	C1- C2	CT, transoral endoscopy	Endoscopic	_	Remission
	n.a Female	Dysphagia	High cervical		Endoscopic	_	Remission
	n.a Male	Odynophagia	High cervical		Endoscopic	_	Remission
	n.a Female	Odynophagia	High cervical		Endoscopic	_	Remission
	n.a Female	Odynophagia	High cervical		Endoscopic	_	Remission
	n.a Female	Dysphagia	High cervical		Endoscopic	_	Remission
Sanroman-Alvarez *et al*., 2020[83]	53 Female	Dysphagia, dysphonia, dyspnea	C1- C2	X-ray, CT	Endoscopic	_	Remission

BSS - Barium Swallow Study, CT - Computed tomography, n.a. - Not available

Table 5: Surgical approaches to C1-C2 anterior cervical osteophytes

Surgical approach	Advantages	Disadvantages	Indication
Extended endoscopic endonasal	Wide working area Good exposure of C1 and odontoid process Top-down drilling of the osteophyte Less retraction	Contamined surgical field Too downward oblique trajectory Difficult C2 exposure (or below)	Osteophytes limited to C1 (exceptional)
Transoral	Direct approach to the osteophyte Good cranial and caudal exposure Top-down drilling	Contamined surgical field Not possible for mouth opening <3 cm Tongue retraction and palate splitting More difficult if the osteophyte extends to C3	C1-C2 osteophytes with no or limited C3 extension
Endoscopic transcervical	Sterile surgical field No pharyngeal opening Less retraction Good exposure up to C2	Narrow working angle Difficult approach to large osteophytes Long working distance Pharyngeal retraction Caudal to cranial resection alone No control of the superior osteophyte angle	C2 osteophytes with downward extension

The transoral approach is commonly used for different pathologies, including rheumatoid arthritis, impressio basilaris, developmental anomalies C0–C2, fractures C1–C2, chordomas, and other tumors. Almost all these lesions, except for several tumors, are located within the vertebral bodies, posterior to the anterior longitudinal ligament, and do not protrude in the mouth cavity and pharynx. Thus, a rather wide working area is available. On the other hand, symptomatic ACOs are often large; they variably protrude in the mouth cavity and then occupy most of the surgical field. In this way, the working area is more limited. Although the drilling may be realized in a cranial to caudal direction, it may be difficult to control the inferior margins of the osteophyte, mainly when it extends to C3 and when the mouth opening is narrow. The tongue retraction and the palate splitting are disadvantages of this technique;[82,87] besides, the transoral approach cannot be used in patients with mouth opening of <3 cm. The lateral exposure of the transoral approach is 15–20 mm bilaterally;[82] thus, if the osteophyte extends in the paramedian region, further lateral exposure may involve the risk of damaging the hypoglossal nerve and the vertebral artery. The intraoperative X-ray control is particularly important during the transoral approach because of the difficulty to define the depth of the resection and the lack of the surgical landmark of the anterior vertebral surface, as for the anterolateral approach.

If the bone resection is limited to the osteophyte, by sparing the anterior longitudinal ligament (if still present), the vertebral bodies and the C2–C3 disc, the posterior fusion, often advised for transoral approaches for other pathologies, is not necessary.

Although the video-assisted endoscopy may be useful to better visualize the blind angles around the osteophyte,[81,83]

we think that the microsurgical technique allows a good view in almost all cases.[88]

The C3 vertebral osteophytes may be approached by both antero-lateral transcervical and transoral routes. In our experience, the antero-lateral cervical approach allows to well expose and resect the osteophyte, thus avoiding the transoral approach. Multilevel osteophytes extending above and below C3 may be approached by a combined transoral and antero-lateral approach in one-stage or two-stage operation, as in the case of our series.

Endoscopic transcervical approach

The endoscopic transcervical approach to the craniovertebral junction, proposed by Wolinsky *et al*.,[89] is realized through minimally invasive tubular retractors with endoscopically controlled dissection. The advantages of this technique include the sterile surgical field, the lesser retraction with lower related complications [Table 5]. However, the working angle is narrow and the working distance is long [Figure 5]. Besides, this approach allows bone resection only in caudal to cranial direction, differently from the transoral approach, which also permits a superior to the inferior trajectory.

The transcervical endoscopic approach was first described for odontoid resection. On the other hand, we did not find reported cases of anterior osteophytes treated by this technique.

Although this approach may be useful for pathologies located from C4 to the inferior clivus, its optimal surgical trajectory is for lesions at or below C2; on the other hand, this approach is not recommended for access to the inferior clivus and C1. Because the transcervical approach is performed through dissection between the spine and the pharyngeal-esophagus complex, the large anterior osteophytes hinder this dissection. Although the osteophyte may be resected by drilling in a caudal to cranial dissection, its dome and superior angle are not controlled [Table 5].

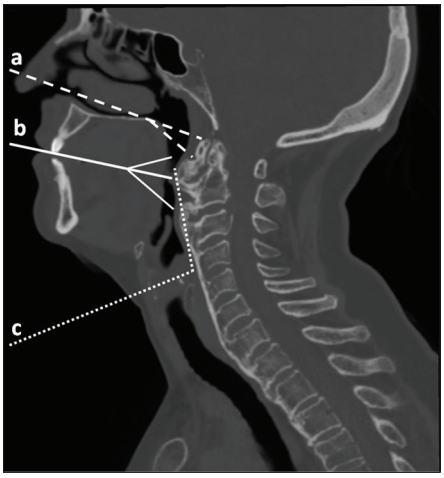

Figure 5: Schematic approaches to the high cervical (C1–C2) osteophytes. (a) Endoscopic endonasal approach allowing exposure to C1 and odontoid process. (b) Transoral approach allowing good exposure to C1–C2 and high half of C3. (c) Endoscopic transcervical approach from C4 to C2

Endoscopic endonasal approach

The endoscopic endonasal approach allows to well expose the craniovertebral junction, C1 and odontoid process[90,91] [Figure 5], as shown by several anatomic studies from our neurosurgical group.[92,93] Some conventional radiological lines, such as the nasopalatine[94] and nasoaxial[95] lines, have defined the inferior limit of the approach at the dens or at the upper half of the C2 body. Because of its limited downward extension and the oblique surgical view, the endoscopic endonasal approach is limited to C1, whereas the exposure of C2 is rather difficult. Besides, in the presence of an anterior osteophyte, the approach requires a more downward oblique trajectory to expose the dome of the osteophyte [Table 5]. For these reasons, we did not find cases of high cervical anterior osteophyte treated by this approach. We agree that the transoral approach provides a more direct surgical view to C1-C2 anterior osteophytes than the endoscopic endonasal approach.[85,88,96,97]

Although the transoral approach carries the risk of infection from the oral flora, the rate of infection of transoral surgery is low with prophylactic antibiotics, ranging from 0.6% to 4%.[86,98,99] A patient of our series presented pharyngeal flogosis extended to the prevertebral tissues and thrombosis of the right jugular vein and sigmoid-transverse sinuses. The inflammatory process, defined as "Lemierre's syndrome," is observed mainly as consequence of otolaryngological and pharyngeal infections,[8,9,100] but it has not previously reported as a complication of transoral surgery.

CONCLUSION

The transoral approach is the best surgical route to resect C1 and C2 ACOs; on the other hand, the endoscopic endonasal approach is not indicated. Although osteophytes located at the C3 vertebral body may also be approached by the transoral route, the anterior transcervical approach is easier, as for those located from C3 to C7. A combined transoral and anterior transcervical approach may be necessary for multilevel osteophytes.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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