

## CASE REPORT

# Having a carotid in the throat: A rare case of internal carotid medialization-induced dysphonia

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**Key Clinical Message**

Positional anomalies of the internal carotid artery are common. Often asymptomatic, they can cause dysphagia or dysphonia and can represent an important surgical risk. Knowing their existence is, therefore, essential for the ENT specialist.

**Abstract**

Aberrant positions of the extracranial internal carotid artery (eICA) affect between 10 and 40% of the population and can present several forms that can bring them close to the pharyngeal walls. Although usually asymptomatic, some aberrant positions of eICA may cause symptoms such as cough or dysphagia but rarely dysphonia. Depending on their location, they can also represent a great risk during oro/hypopharyngeal interventions or intubations. We report here the case of a 72-year-old patient who presented for a first consultation with a little progressive chronic dysphonia without associated dysphagia or cough. The nasofibroscopy revealed a pulsatile retrocricoid mass pushing the right arytenoid forward. Otherwise, the clinical examination of the ENT sphere was normal. A cervicofacial CT scan revealed a major medialization of the right carotid bifurcation and the eICA located within the retropharyngeal fatty space and causing a mass effect pushing forward and downward the right arytenoid and the piriform sinus, resulting in a loss of horizontality of the glottic plane. Given the absence of life-threatening complications and the associated risk of surgery, no treatment was proposed. A follow-up was established after discussion with the patient. The aim of this study was to describe a rare case of isolated dysphonia caused by right internal carotid medialization with mass effect on the arytenoid cartilage. It seems important for ENT to know these rare causes of dysphonia and/or dysphagia due to anatomical variations of eICA in order to avoid the operative risks associated with possible future therapeutic procedures in these patients.

**KEYWORDS**

anatomy, dysphonia, Head and Neck Surgery, otolaryngology

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## 1 | INTRODUCTION

Aberrant positions of the extracranial internal carotid artery (eICA) are common, with several articles reporting an incidence of between 10% and 40% of the population with up to 6% of severe cases.<sup>1</sup> Usual anatomy describes the path of the eICA as a straight line from the carotid bifurcation to the temporal bone.<sup>2,3</sup> In case of anomaly of this path, the artery may present loops, twists, or even marked medializations that may represent an unsuspected danger during surgical procedures or intubation due to its proximity to the lateral pharyngeal wall.<sup>1,4</sup> These anomalies are usually diagnosed either by direct vision of a pulsatile mass of the oro or hypopharynx or incidentally during cervicofacial imaging. Although asymptomatic in the vast majority of cases,<sup>3</sup> some of them may cause complaints such as a sensation of a foreign body in the throat, dysphagia, or dysphonia<sup>5</sup> as reported in the literature.<sup>1</sup> We present here a rare case of a patient presenting an isolated dysphonia caused by an abnormal medialization of the carotid bifurcation and the right eICA pushing forward and downward the right arytenoid and causing a disruption of the horizontal plane of the glottis.

## 2 | CASE REPORT

A 72-year-old patient presented at the Voice Clinic for a little chronic progressive dysphonia described as a fluctuation of his vocal tone disrupting his activity as a singer at the church. The patient was a non-smoker and had no other associated symptoms such as dysphagia or cough.

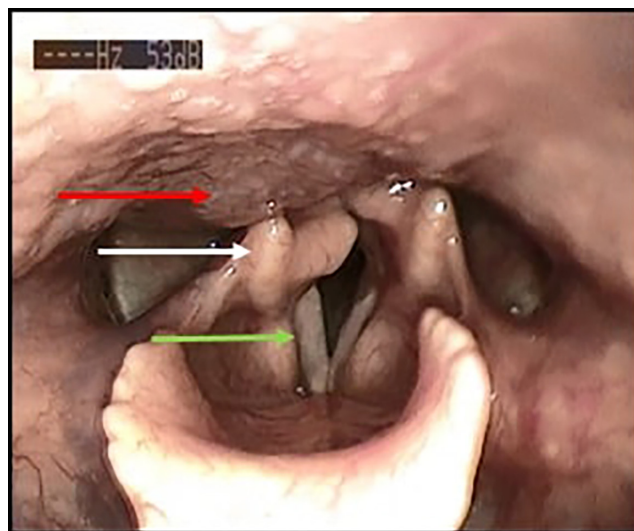
The nasofibroscopic examination performed at the first consultation revealed a pulsatile retrocricoid mass pushing the right arytenoid forward (Figure 1). Given the pulsatile appearance of this mass, an anatomic variant of the internal carotid artery was quickly suspected. The rest of the clinical examination of the ENT sphere was normal.

A cervicofacial CT scan confirmed a medialization of the right carotid bifurcation with an aberrant position of the internal branch (Figure 2) located within the retropharyngeal fatty space and causing a mass effect pushing forward and downward the right arytenoid and the piriform sinus, resulting in a loss of horizontality of the glottic plane (Figures 3 and 4). The hypothesis of an aneurysm was excluded on the basis of a previous CT performed 5 years ago as part of a workup for cervicobrachialgia and incompletely protocolized, showing an identical and non-evolving image. Surgeons were consulted to learn about therapeutic possibilities. Considering the unworrisome symptomatology and the major risk of complication in case of surgery, they proposed a simple follow-up.

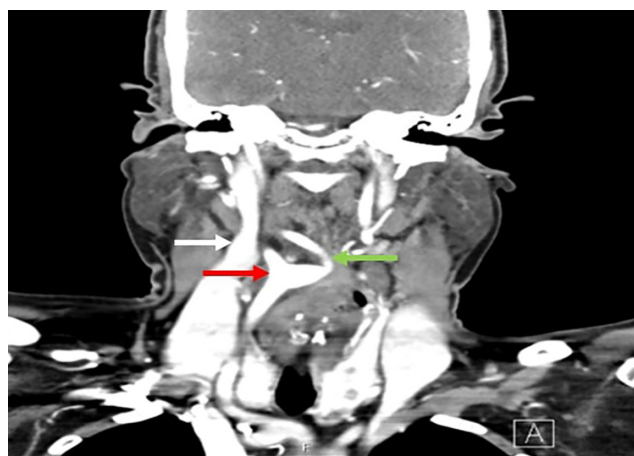
Full information was provided to the patient on the nature of his pathology, including the lack of indication for surgical management and the risk of bleeding during technical or surgical procedures at the hypopharyngeal level as well as during intubations. A follow-up was, therefore, proposed.

## 3 | DISCUSSION

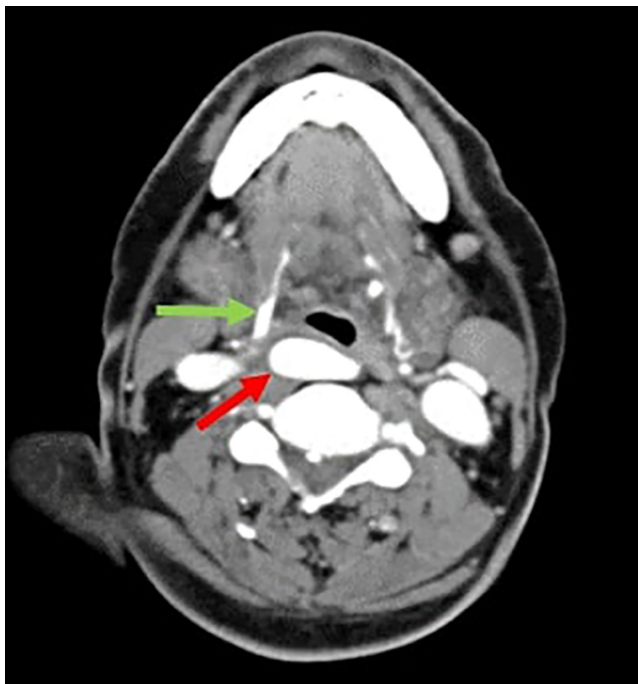
Although less studied than the variations of its intracranial segment, aberrant tracts of the cervical portion of the internal carotid artery and their clinical aspects have been described by several teams in the literature.<sup>1,2</sup>



**FIGURE 1** Fibrosopic view of the larynx. Bulging of the posterior pharyngeal (red arrow) wall pushing the right arytenoid (white arrow). The right vocal cord (green arrow) is not damaged.



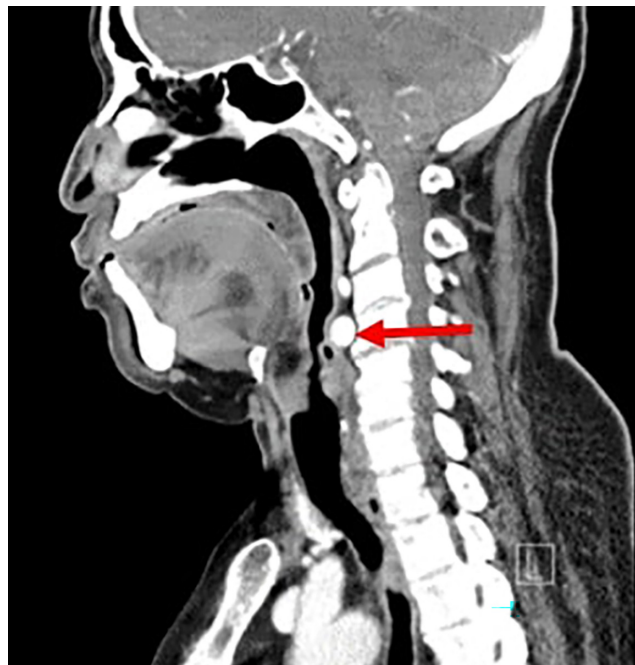
**FIGURE 2** Cervicofacial CT scan, coronal view: Medialization of the carotid bifurcation (red arrow) and mediocervical course of the right internal carotid artery (green arrow). The right internal jugular vein is indicated by the white arrow.



**FIGURE 3** Cervicofacial CT scan, axial view; Retropharyngeal position of the right internal carotid artery (red arrow) with mass effect on the posterior pharyngeal wall. The hyoid bone is indicated by the green arrow.

The majority of the described cases were asymptomatic and diagnosed incidentally on the basis of imaging. The particularity of our case is due to the symptomatology, with dysphonia as the only complaint associated with a pulsatile bulge of the posterior pharyngeal wall visible at nasofibroscopy causing a mass effect on the right arytenoid moving the structure down and forward. The majority of the previous case reports described in retrospective studies report mainly complaints of dysphagia, cough or foreign body sensation.<sup>5</sup> In the literature, only one case of a 42-year-old female patient is described with a complaint of dysphonia with dysphagia and cough caused by medialization of her internal carotid artery similar to our patient but without significant displacement of the arytenoid cartilage.<sup>1</sup>

The internal carotid artery derives embryologically from the artery of the third branchial arch and emerges from the cranial part of the dorsal aorta.<sup>6</sup> During the 5th week of development, a loop is formed at the junction of the two vessels and then becomes straight following the descent of the heart and large vessels into the mediastinum around the 8th week.<sup>5,6</sup> This sequence results in a carotid artery with two anchor points, the first at the bifurcation and the second at its entry into the skull in the petrous portion of the temporal bone.<sup>2</sup> The carotid artery then divides to ensure the vascularization of most of the cerebral hemispheres, the orbital cavities, and the



**FIGURE 4** Cervicofacial CT scan, sagittal view; Bulging of the posterior pharyngeal wall caused by the internal carotid artery (red arrow).

frontonasal region.<sup>6</sup> Between these two points, the vessel is free of attachment and normally presents a linear course without branching passing posterolaterally to the pharyngeal wall.<sup>2</sup> The distance between them evolves with age, going from about 1.4 cm in the one-year-old child to about 2.5 cm in the adult.<sup>7</sup>

However, there are developmental abnormalities that can lead to the formation of loops or kinkings, the most frequently observed being an anteromedial curvature in the tonsillar fossa.<sup>7,8</sup> Much rarer cases of agenesis, hypoplasia or aplasia are also described.<sup>6</sup>

These aberrant tracts have been known at least since the 18th century.<sup>1</sup> In 1965, Weibel and Fields proposed a classification system to study the role of carotid anomalies in cerebrovascular insufficiency.<sup>7,8</sup> They distinguished three types of pathways based on deviations from the vertical plane: tortuosities, kinking, and coiling.<sup>7,8</sup> The main limitation of this classification was the absence of the notion of distance from the pharyngeal wall, which is of primary clinical and surgical importance.<sup>7,8</sup> Therefore, Pfeiffer and Ridder proposed an adaptation of this classification in 2008 by adding data such as the minimum distance from the pharyngeal wall, the location of the anomaly, and the resulting risk of injury to the ICA (Table 1).<sup>7,8</sup>

This classification thus facilitates the evaluation of the severity of the injury and the risk associated in case of cervical surgery. Based on this classification, our patient should be staged grade III given its hypopharyngeal location with a minimum distance of 1.9 mm from the

TABLE 1 Proposal for a Clinical Classification System of Parapharyngeal ICA Aberrations. Aft Pfeiffer J. and Ridder G., 2008.<sup>7</sup>

Aberrant ICA	Risk potential for ICA injury	Location	Minimum distance to pharyngeal wall
Grade I	Low	Nasopharynx Oropharynx	10 mm or more
Grade II	Moderate	Hypopharynx Nasopharynx Oropharynx	5 mm or more Between 5 and 10 mm
Grade III	High	Nasopharynx Oropharynx Hypopharynx	Between 2 and 5 mm Contact to pharyngeal wall (2 mm or less)
Grade IV	Very high	Nasopharynx Oropharynx	Contact to pharyngeal wall (2 mm or less)

Abbreviation: ICA, internal carotid artery.

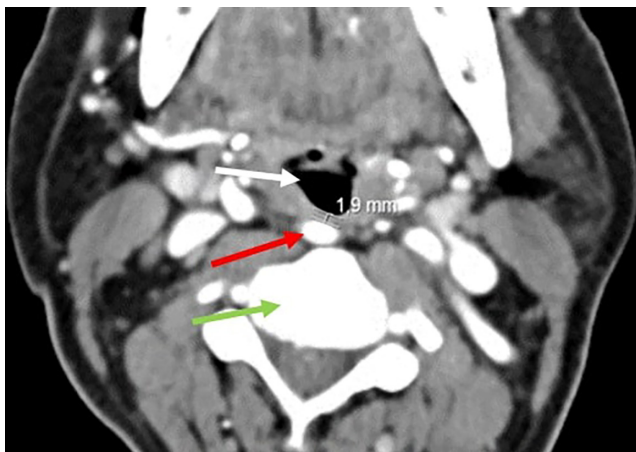


FIGURE 5 Cervicofacial CT scan, horizontal view; Minimum distance of 1.9 mm between the internal carotid artery (red arrow) and the posterior pharyngeal wall at the C3 vertebral level (green arrow). The hypopharyngeal space (white arrow) is compressed on the right by the carotid bulge.

posterior pharyngeal wall (Figure 5). Our patient has a high risk of injury in case of a local procedure.

The exact origin of these aberrant tracts is not completely known but two hypotheses are advanced. The genetic origin is supported by the fact that certain syndromes such as velocardiofacial syndrome are associated with an increased prevalence of carotid abnormalities.<sup>1</sup> This theory is supported by the existence of rare cases of bilateral involvement. However, several authors also suggest an involvement due to age<sup>1,3</sup> and different retrospective studies have identified an increased frequency of moderate ICA pathway abnormalities in elderly patients, which would be secondary to loss of vessel wall elasticity, atherosclerosis, arterial hypertension, etc.<sup>3</sup> This hypothesis is supported by the work of Lukins, Pilati and Escott who studied the variability of the carotid trajectory over time and thus demonstrated

in 6% of their patients a dynamic phenomenon resulting in a displacement of the artery from a retro to a lateropharyngeal position and vice versa.<sup>3</sup> The prevalence found in the literature varies according to the articles between 10% and 40% with severe forms reaching 6% of cases.<sup>1</sup> Arslan et al. reported that the majority of cases are unilateral, most often on the right side,<sup>2</sup> and mainly affecting women (61.1%).<sup>2,5</sup> However, the exact evaluation is probably underestimated because the majority of affected patients are asymptomatic, more than 80% according to Van Abel and colleagues.<sup>1</sup> In another study evaluating 231 patients, the reported percentage reached 92%.<sup>8</sup> In fact, most diagnoses are made incidentally during radiological examinations.<sup>1</sup> Less frequently, a pulsatile retropharyngeal mass is found during a nasofibroscope examination or during intubation before surgery.<sup>1</sup> In the same study, only 6 out of the evaluable 231 patients had a visible mass.<sup>8</sup> Symptomatic patients most often presented with sleep disturbances, foreign body sensation in the throat or dysphagia.<sup>8</sup> Dysphonia appears to be a less common symptom.

In case of suspicion and to make a radiological diagnosis, CT scan and MRI are the techniques of choice compared to the angioCT because they are less invasive and provide essential information about the topography of the vessel and the distance to the pharyngeal wall.<sup>5,6,9</sup> Moreover, Doppler echography can complete the investigation by providing functional information.<sup>6</sup>

Findings in the literature concluded that there are few possibilities of curative treatment, particularly for patients with nonlife-threatening symptoms.<sup>1,5,10</sup> In these patients, a close follow-up is generally proposed to ensure the absence of pejorative evolution.<sup>10</sup> Moreover, lifestyle and dietary measures are sometimes proposed such as adaptation of the diet (soft diet, avoidance of risky foods such as fish bones and chicken bones, etc.). In rare cases of cerebrovascular insufficiency, several teams have attempted a surgical



approach to prevent artery thrombosis and stroke.<sup>1</sup> Patients are also strongly encouraged to inform other practitioners of their anatomical particularity.<sup>1</sup> Although often asymptomatic, knowledge of these aberrant pathways is obviously paramount for many clinicians because they put the patient at great risk during surgical maneuvers or intubation. As such, several cases of vascular lesions during routine adenotonsillectomies have been described.<sup>1,6</sup>

## 4 | CONCLUSION

According to our knowledge, we report here the first case of isolated dysphonia caused by right internal carotid medialization with mass effect on the arytenoid cartilage. It seems important for ENT specialists to know these rare causes of dysphonia and/or dysphagia due to anatomical variations of eICA in order to avoid the operative risks associated with possible future therapeutic procedures in these patients. General practitioners should also be made aware of the existence of this differential diagnosis so that they can carry out the relevant additional tests or rapidly refer patients to the relevant specialists.

### AUTHOR CONTRIBUTIONS

**Antoine De Stercke:** Conceptualization; writing – original draft; writing – review and editing. **Didier Dequanter:** Writing – review and editing. **Alexandra Rodriguez:** Conceptualization; supervision; validation; writing – review and editing.

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### CONFLICT OF INTEREST STATEMENT

None of the authors reported any conflict of interest.

### DATA AVAILABILITY STATEMENT

Data sharing not applicable to this article as no datasets were generated or analysed during the current study.

### CONSENT

Written informed consent was obtained from the patient to publish this report in accordance with the journal's patient consent policy.

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