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## Case Report

# Wandering carotid arteries: Reciprocating change between normal and retropharyngeal positions on serial CT studies

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## ABSTRACT

Positional change in the retropharyngeal carotid artery, a rare phenomenon over time, is even rarer in previous reports, and it is important to be aware of this before any neck surgical procedure. A woman in her 50s underwent an anterior maxillectomy for upper gingival cancer, without neck dissection. The patient had medical histories of diabetes mellitus and liver dysfunction, with unremarkable family histories. Serial neck contrast-enhanced computed tomography for detecting locoregional recurrence had been performed as a follow-up during 4 years. A radiological course of moving carotid arteries in serial computed tomography studies showed reciprocating positional changes (wandering) between normal and retropharyngeal regions. There was no locoregional recurrence of the gingival cancer. This is the first case to describe a so-rare presentation of wandering carotid arteries. It is important for clinicians to be aware of a wandering carotid artery to avoid potentially fatal complications.

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## Introduction

Variations in the anatomic position including that of the retropharyngeal carotid artery (RCA) are relatively rare [1,2]. These anatomic variations can cause fatal complications during biopsy or surgery in the head and neck region including the pharynx.

A few cases have been reported that describe positional changes in the carotid artery from the lateral region to the retropharyngeal space (RPS) or vice versa [1,3]. However, none has described arteries to move back to its original position. This is the first case to describe a so-rare presentation that bilateral carotid arteries show positional changes from the normal position to the RPS and a reposition to the normal position over time.

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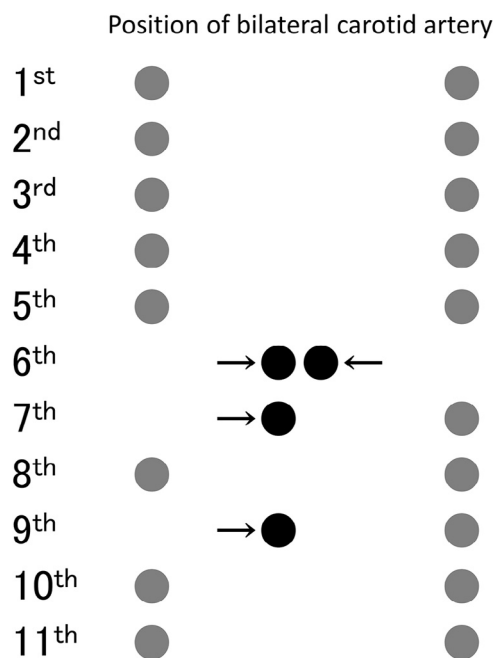
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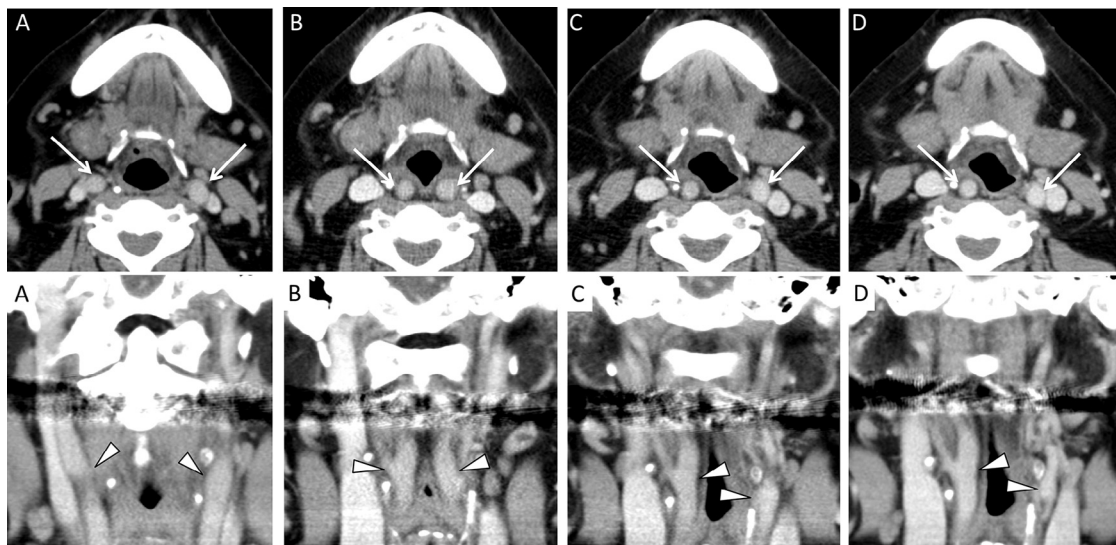
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## Case report

A woman in her 50s underwent an anterior maxillectomy for upper gingival cancer (squamous cell carcinoma) classified as T4aN0M0, without neck dissection. There was no radiation therapy or chemotherapy. The patient had medical histories of diabetes mellitus and liver dysfunction, and presented with a normal blood pressure. The patient had a postmenopausal status and had unremarkable family histories. A regular neck contrast-enhanced computed tomography (CECT) was scheduled as a follow-up. During 4 years of follow-up, 11 serial CECTs with 2- to 4-month intervals were performed in total. None of the follow-up CECTs showed any signs of recurrence. However, the series of CECTs showed changes in the position of the bilateral carotid arteries. All CECT studies were performed with the same head position. The chronological transition of both carotid arteries' positions is simplified in Figure 1. Both carotid arteries had persistently stayed in a normal position until the fifth CECT for 1 year (Fig. 2A). On the sixth CECT (performed 3 months after the fifth CT), medialization of both carotid arteries-RCA was demonstrated (Fig. 2B). The seventh CECT (performed 5 months after the sixth CT) revealed a reposition of only the left carotid artery (Fig. 2C), with the right carotid artery remaining medialized. The eighth CECT (performed 6 months after the seventh CT) showed a normal anatomic position of both carotid arteries. On the ninth CECT (performed 4 months after the eighth CT), a medialization of only the right carotid



**Fig. 1** – Schematic drawing of the position of both carotid arteries in each computed tomography of the series showing the reciprocating positional changes between the normal and the retropharyngeal regions.



**Fig. 2** – (A) Fifth axial and coronal CECTs demonstrated the normal position of both carotid arteries (arrows and arrowheads). (B) The sixth axial and coronal CECTs demonstrated a medialization of both carotid arteries (arrows and arrowheads). (C) The seventh axial and coronal CECTs revealed a medialization of only the right carotid artery, and the normal position (reposition) of the left carotid artery (arrows and arrowheads) was confirmed. (D) The ninth axial and coronal CECTs revealed a medialization of only the right carotid artery, and the normal position (reposition) of the left carotid artery (arrows and arrowheads) was confirmed. (A) The fifth coronal CECT demonstrated a normal position of both carotid arteries (arrows). (B) The sixth CECT demonstrated a medialization of both carotid arteries (arrows). (C, D) The seventh and ninth CECTs revealed a medialization of only the right carotid artery, and a normal position (reposition) of the left carotid artery (arrows) was confirmed. CECT, contrast-enhanced computed tomography.

artery-RCA reappeared (Fig. 2D). Since the tenth investigation, subsequent CECT studies continued to show a normal position of the bilateral carotid arteries for 4 months. Overall, the radiological course of moving the carotid arteries in serial CT studies had shown reciprocating positional changes (wandering) between the normal and the retropharyngeal regions (Fig. 2). During the follow-up period, while the arteries were presumably moving back and forth, the patient remained asymptomatic. There had been no definite findings of a local failure or a neck relapse of upper gingival cancer over this time period.

## Discussion

RCA has been described as an anatomic variant in as early as 1925 [4]. This anatomic abnormality is seen as a medialization of the unilateral or the bilateral carotid artery to RPS. This variant is clinically significant as it has a potential for surgical complications, such as fatal hemorrhage, especially as a result of surgeries such as tonsillectomy, adenoidectomy, peritonsillar abscess drainage, transoral tumor resection, and tracheal intubation [5,6]. This variant may also lead to a faulty anesthetic injection to the carotid artery when blocking the glossopharyngeal nerve transorally [6]. The presence of RCA can also be the cause of obstructive sleep apnea [6]. These events can be explained by the anatomic characteristics that RPS locates immediately posterior to the mucosa of the pharynx. In 1 study, the incidence of RCA has been reported to be 15.5% in cancer patients [1]. Four out of 63 patients (6.3%) had been confirmed to have a unidirectional change in the carotid arteries from the RPS to the lateral or vice versa [1]. Including the 4 patients mentioned earlier, a total of 5 patients have been reported to have positional changes in the carotid artery from the lateral to the RPS or vice versa [1,3]. However, to our knowledge, this is the first report in which serial CT studies revealed a reciprocating positional change (wandering) in both carotid arteries.

A definite etiology of this phenomenon remains unknown. An increased grade of atherosclerosis and aging have been reported with increased incidence of positional change in the carotid artery in general [7,8], and there is also a study which shows that evidence of atherosclerosis and of being female is a risk factor for tortuous carotid arteries [8]. However, the severity of atherosclerosis is not correlated with the degree of the malposition of the carotid arteries [1]. In our case, the patient had been diagnosed with diabetes mellitus 20 years previously, with an HbA1c of 9.6% at the time of surgery. Although the atherosclerosis of this patient was not particularly evaluated, having a poorly controlled diabetes for many years could have easily led to vascular atherosclerosis, creating an environment for moving arteries. The neoplasms can contribute to the vascular elasticity via matrix metalloproteins [9], and the patient's history of upper gingival cancer (squamous cell carcinoma) could have complemented the tortuosity of the carotid arteries. We could not conclude the arteries to be tortuous, as they moved to change their shapes, sometimes being straight and at other times being tortuous, in our serial CECT studies. The patient was not hypertensive, and there is no

statistically significant relationship between hypertension and the frequency of RCA [1]. Another component to consider is local anatomic characteristics of carotid artery. The carotid sheath, which is a fascia enclosing the carotid artery and the internal jugular veins, is complete and firm in its caudal portion. However, the suprahyoid portion of the carotid sheath may be incomplete or defective, either because there is no true fascial sheath or because the sheath is incomplete [10]. This loose fascia may possibly allow vascular structure mobility. The possibility of a relationship between the pharyngeal wall diameter and the position of the hyoid bone with respiratory motion has been discussed, including changes in the internal carotid artery, but the physiology remains uncertain [3]. The anterior and the medial shifts of the internal and external carotid arteries during a pharyngeal contraction have been reported in a study of motion of parapharyngeal and retropharyngeal structures by Paulsen et al. [11]. The positional change in the carotid artery was detected at a level around the hyoid bone in our case, which corresponds with results of previous studies [1,3]. This fact may suggest the relevance between hyoid bone, which can be displaced by pharyngeal contraction, and positional changes in the carotid artery, but the details of this physiology cannot be confirmed.

Maxillectomy for upper gingival cancer (squamous cell carcinoma) has only a minimal effect on the alternation of superficial planes, whereas neck dissection would directly influence the anatomic structure of the carotid sheath. In our case, only a maxillectomy was performed without a neck dissection. Neck relapse may also lead to local structural changes around the carotid sheath. In these serial CECT studies, however, there has been no neck relapse.

The physiology of reciprocating positional changes in the bilateral carotid artery in our case remains unclear.

In conclusion, we describe the first case in which serial CECT studies revealed a reciprocating positional change (wandering) in both carotid arteries. It is important for clinicians to recognize a wandering carotid artery to avoid fatal and unpredictable complications. Imaging plays an important role to identify such a critical anatomic variant as an incidental finding.

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