

# A Rare Case of Symptomatic Carotid Stenosis Caused by Mechanical Stimulation by Thyroid Cartilage and Frequent Swimming

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*Background:* Bony structures around the carotid artery such as the styloid process and hyoid bone can cause dissection, compression, plaque formation, and plaque rupture of the carotid artery. To the best of our knowledge, this case is the first finding of thyroid cartilage being the cause of a lesion corresponding to adjacent common carotid artery (CCA) atherosclerosis. *Case Description:* A 51-year-old man with a history of hypertension and dyslipidemia suddenly experienced right facial numbness and dysphasia while front crawl swimming, which he usually did 3 times weekly. Diffusion-weighted magnetic resonance imaging showed high intensity areas in the left frontal and parietal lobes. He was diagnosed with acute cerebral infarction and was administered with tissue plasminogen activator. Angiography of the left CCA revealed mild stenosis with an intravascular filling defect, and carotid duplex ultrasonography of the CCA on the second day after symptom onset showed plaque and intraluminal thrombus at the stenotic site. Plain and contrast-enhanced computed tomography showed that thyroid cartilage contacted the left CCA at the stenotic site, and the left CCA moved backward and forward with the thyroid cartilage during neck rotation. We determined that mechanical stimulation by the thyroid cartilage had induced the plaque during the frequent neck rotation that is a feature of front crawl swimming. *Conclusions:* Evaluation of anatomical interactions between the carotid artery and bony structures including the thyroid cartilage is important to ensure that appropriate treatment is selected to prevent further ischemia.

**Key Words:** Acute cerebral infarction—carotid stenosis—thyroid cartilage—swimming

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Overextension and rotation of the neck associated with sports activity and trauma might cause carotid injury. These injuries are caused by the anatomical interaction of the carotid artery and adjacent bony structures. Renard

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et al. reported that repetitive head rotation in normal daily life associated with mild carotid compression by the hyoid bone seemed to have led to the formation of an atheromatous plaque and potentially also to mechanical plaque rupture. The first case of symptomatic common carotid atheromatous stenosis caused by mechanical stimulation of the thyroid cartilage and frequent swimming activity is reported.

## Case Report

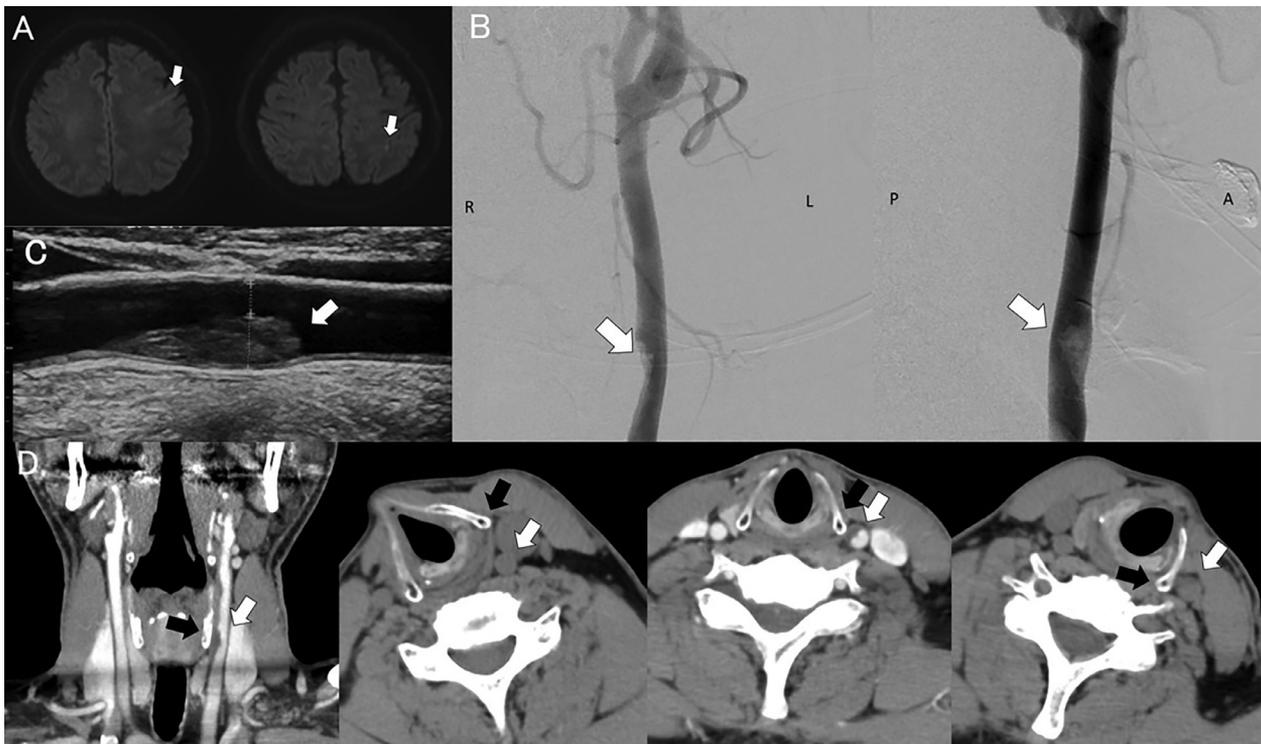
A 51-year-old man with a history of hypertension and dyslipidemia developed sudden onset of right facial numbness and dysphasia during free-style swimming. He was a smoker (20 cigarettes per day) and had a habit of swimming (front crawl) 3 times per week. Diffusion-

weighted magnetic resonance imaging showed high intensity areas in the left frontal and parietal lobes (Fig 1, A). The patient was diagnosed with acute cerebral infarction. Tissue plasminogen activator was administered, and diagnostic cerebral angiography was performed to identify the etiology of his cerebral infarction. A left common carotid angiogram showed mild stenosis with an intravascular filling defect suggesting intramural thrombus at the proximal portion of the common carotid artery (CCA; Fig 1, B). Carotid duplex ultrasonography on the second day from onset showed plaque and intraluminal thrombus at the stenotic site of the left CCA (Fig 1, C). Plain and contrast-enhanced computed tomography showed that the thyroid cartilage made contact with the left CCA at the stenotic site, and the left CCA moved back and forth of the thyroid cartilage with rotation of the neck (Fig 1, D). It was determined that the plaque was induced by the mechanical stimulation of the thyroid cartilage during frequent neck rotation on swimming. The patient was treated by oral antiplatelet agents (aspirin and cilostazol) and a statin (rosuvastatin calcium) based on the diagnosis of artery-to-artery embolism. Carotid duplex ultrasonography obtained on the sixth day from onset showed the disappearance of intramural thrombus by the aforementioned medical treatment. The patient was discharged on the 10th day from onset. The patient has never

experienced any further ischemic symptoms and intramural thrombus has not recurred during 18 months of follow-up by carotid duplex ultrasonography.

## Discussion

Bony structures around the carotid artery such, as the styloid process<sup>1,2</sup> and hyoid bone,<sup>1,3-7</sup> can cause dissection, compression, and plaque formation, as well as plaque rupture, of the carotid artery. In the present case, the thyroid cartilage adjacent to the CCA was considered responsible for plaque formation. Mechanical stimulation induced by frequent neck rotation in swimming may also promote plaque and thrombus formation in the affected CCA. To the best of our knowledge, this is the first case in which the thyroid cartilage was determined to be the lesion corresponding to the adjacent CCA atherosclerosis. Although our case was successfully treated by best medication, surgical resection of thyroid cartilage would be a potential therapeutic option because the mechanical stimulation could be continuous. It is important to evaluate the anatomical interaction between the carotid artery and bony structures, including the thyroid cartilage, in order to choose the appropriate treatment for the prevention of further ischemia.



**Figure 1.** Diffusion-weighted imaging shows high intensity areas in the left frontal and parietal lobes (A). Left CCA angiogram shows proximal mild stenosis of the left CCA and an intravascular filling defect suggesting intramural thrombus (B). Carotid duplex ultrasonography demonstrates plaque and intraluminal thrombus at the stenotic site of the left CCA (C). Carotid plain and contrast-enhanced computed tomography shows that the thyroid cartilage (black arrow) makes contact with the left CCA at the stenotic lesion (white arrow), and the left CCA moves back and forth of the thyroid cartilage with rotation of the neck (D). Abbreviation: CCA, common carotid artery.

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