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Article type: Clinical vignette

Received: February 12, 2021

Accepted: June 20, 2021

Published online: June 22, 2021

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Internal carotid artery stent fracture likely caused by hyoid bone compression

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Short title: Carotid stent fracture

Conflict of interest: None declared.

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A 70-year-old male patient visited the clinic for a regular check-up. Targeted medical history included a history of carotid artery stenting (CAS) (Xact carotid stent, Abbott Vascular, USA), 15 months before coronary artery disease, and diabetes mellitus. The carotid intervention did not have dissection, oversized stent, or stent fracture (Figure 1A). Routine Duplex ultrasonography follow-up indicated that the patient was compatible with right internal carotid artery (ICA) asymptomatic restenosis (peak systolic velocity [PSV]: 360 cm/s, ICA/common carotid artery (CCA) PSV ratio >4.15). Residual, mixed plaque without calcification was present outside the stent. Computed tomography angiography (CTA) demonstrated a fractured right ICA stent (Figure 1B–C). Notice that the tip of the greater horn of the hyoid bone (HoB) is passing between the right ICA and the right external carotid artery. Three-dimensional image reconstruction of CTA indicated that the right ICA was traversing between the greater horn of the HoB and the transverse process of the C4 vertebra. The fractured stent was compressed by
the HoB at its origin (Figure 1D). In contrast, the left carotid bifurcation and ICA were lateral to the HoB. Moreover, CTA did not show tortuosity and calcification in the right ICA. Cinefluoroscopic examination indicated a type-4 stent fracture (i.e., a complete transverse linear fracture with stent displacement) [1] in the right ICA (Figure 1E). Surgery was recommended because ICA stenosis due to extrinsic compression was contraindicated for endovascular therapy. Hence, the patient was scheduled for right carotid endarterectomy under general anesthesia. Vascular structures were clamped after 5000 units of intravenous unfractionated heparin. The carotid endarterectomy was performed (Figure 1F). A fractured and thrombosed stent was revealed and excised (Supplementary material, Figure S1) and the right ICA segment reconstruction required a poly-patch use. He was discharged on the 6th day without any adverse clinical events. At the 20th month of follow-up, Duplex ultrasonography indicated normal findings (right ICA PSV <125 cm/s, right ICA/CCA PSV <2).

Anatomically, the carotid arteries are located a fibrous layer on the neck that allows them to follow muscle movements properly [1]. The elongation and excessive tortuosity of the ICA can change the vessel route in this layer, causing it to be in proximity with the HoB and consequently undergo mechanical stress [2]. Mechanical stress of the carotid artery by bone structures — HoB — is an extremely rare clinical entity. Three components are needed to realize this mechanical pressure: I) a long HoB horn protruding dorsally from the larynx; II) a lower level of separation of the ICA from CCA; III) kinking of ICA, which tends to deform stents placed in the vascular structure [3, 4]. Moreover, this mechanical compression can cause endothelial damage and consequently atheromatous plaque formation and thromboembolic events. Previously, Mori et al. [5] reported that an ischemic cerebrovascular event with the occlusion and recanalization of a non-atherothrombotic ICA due to HoB compression. Extrinsic compression of the carotid artery contraindicated the endovascular treatment of ICA stenosis. Hence, two main treatment options can be considered in this pathology: I) Hyoid bone resection plus re-CAS [4]; II) carotid endarterectomy, which including excising the fractured stent and then closing with the poly-patch.

REFERENCES


Figure 1. A. Conventional carotid angiography shows a 80%–90% stenotic lesion in the right internal carotid artery and successful stent implantation. B. and C. Coronal and sagittal images show the fractured right internal carotid stent. Notice the tip of the greater horn of the hyoid bone is passing between the right right internal carotid artery and right external carotid artery (arrowhead). D. Three-dimensional image shows medialized right internal carotid artery traversing between the greater horn of the hyoid bone and the transverse process of the C4 vertebra and notice that the greater horn of hyoid bone passing between external and internal carotid arteries. The left carotid bifurcation and internal carotid artery passing lateral to the hyoid bone (arrowhead). E. Cinefluoroscopic image indicates the fracture of the right internal carotid artery stent (arrowheads). F. The intraoperative image indicates that the internal carotid artery was explored.

Abbreviations: L-CCA, left common carotid artery; L-ICA, left internal carotid artery; R-CCA, right common carotid artery; R-ICA, right internal carotid artery