



## Symptomatic Bilateral Carotid Artery Occlusion: An Uncommon Pattern of Carotid Pathology

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We report an unusual case of an 83-year-old man who was admitted with dizziness and repeated drop attacks. He was diagnosed with bilateral carotid artery occlusion and he underwent a left subclavian to left carotid bypass with ringed polytetrafluoroethylene graft. The patient's postoperative course was uneventful and no symptoms presented during a 6-month follow-up. Finally, we discuss on proper management of such patients.

**Key Words:** Carotid arterial diseases, Common carotid artery, Internal carotid artery, Vertebrobasilar insufficiency

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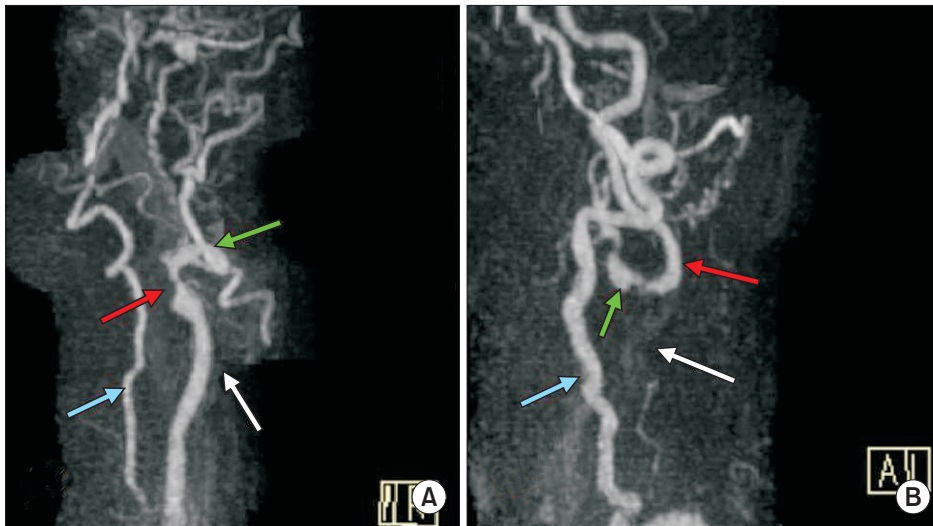
### INTRODUCTION

Patients with internal or common carotid artery occlusion (CCAO) remain at risk for hemispheric transient ischemic attack, ischemic stroke or vertebrobasilar insufficiency [1]. CCAO is categorized into four types: type 1A involves a patent internal carotid artery (ICA) and external carotid artery (ECA); type 1B a patent ECA and an occluded ICA; type 1C a patent ICA and an occluded ECA; type 2 involves a total CCA, ICA and ECA occlusion [2]. Concerning bilateral ICAO (BICAO), Persoon et al. [3] have found that the annual stroke rates range between 0% and 13%, while Wade et al. [4] found an ischemic event rate of 15% per patient per year. Moreover, contralateral ICAO increases the risk of patients undergoing carotid endarterectomy [5], and as a result, treating such patients remains a challenge. However, data on precise prevalence and treatment of CCAO with contralateral ICAO are limited in literature. Therefore, aim of this report is to present an unusual case of bilateral ca-

rotid occlusion and discuss on proper management.

### CASE

An 83-year-old patient, relatively active, referred to our vascular surgery department complaining of dizziness and repeated episodes of drop attacks during the last bimester. Two weeks ago, he was admitted to a secondary hospital care where they excluded the presence of cardiac arrhythmia and/or the presence of otolaryngology pathology. Duplex ultrasonography revealed severe bilateral carotid disease. In particular, ultrasound examination indicated an occlusion of right ICA (RICA) and occlusion of left CCA (LCCA) with presence of antegrade flow into the left ICA (LICA) from retrograde flow into left ECA (LECA). Both vertebral arteries appeared patent with antegrade flow into both vessels. The patient was discharged a few days later under recommendation for vascular surgeon consultation and treatment. His medical history included coronary artery

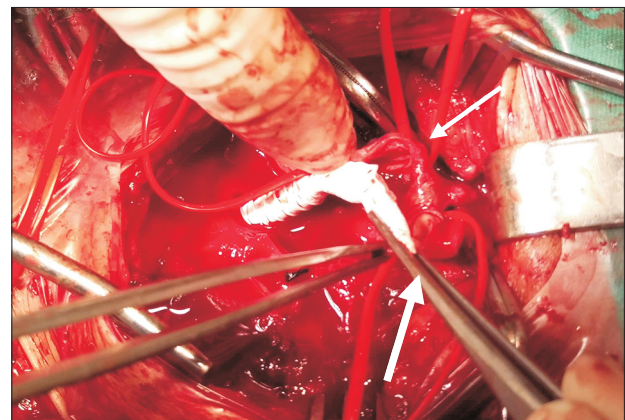


**Fig. 1.** Magnetic resonance angiography showing (A) a right internal carotid artery occlusion (red arrow), a patent right external carotid artery (green arrow), a patent right common carotid artery (white arrow) and a patent right vertebral artery (blue arrow); (B) a left common carotid artery occlusion (white arrow), a patent left external carotid artery (green arrow), a patent left internal carotid artery (red arrow) and a patent distended left vertebral artery (blue arrow).

disease (treated with percutaneous coronary intervention ten years ago), senile dementia and depression (diagnosis made a year ago) and benign prostatic hyperplasia. His medical treatment consisted of acetylsalicylic acid, clopidogrel, carvedilol and valsartan, among others.

On clinical examination, there was no neurological deficiency. Additionally, there were no signs of peripheral artery disease (palpable arteries on upper and lower extremities). On admission, the patient underwent magnetic resonance angiography of cervical arteries (Fig. 1) which confirmed the findings of color Duplex scan, and magnetic resonance imaging (MRI) of the brain that did not reveal any lesions. Hence, the LCCA ostium was totally occluded (type 1A), the dominant vertebral artery was the left-sided whereas the right vertebral artery was hypoplastic, and there was cross-filling of the anterior cerebral circulation through the vertebrobasilar system. Blood tests were within normal reference range, except from elevated immunoglobulin E levels (prior investigations included a full immunology testing). These atypical symptoms of the patient could be attributed to a low cerebral perfusion of the posterior circulation, due to significant bilateral carotid disease. However, no retrograde vertebral artery flow was detected on Doppler examination that could justify a possible steal syndrome.

We decided to proceed with open surgery repair of left CCAO (LCCAO). A left subclavian artery to left carotid bifurcation bypass was performed. With the patient under general anesthesia, the subclavian artery was exposed through a supraclavicular incision, transecting the clavicular head of the sternocleidomastoid muscle and the anterior scalene muscle, after carefully retraction of the phrenic nerve out of harm's way. Through a separate incision, we exposed the carotid bifurcation retracting the internal, external and CCA with vessel loops. After administration of heparin, the



**Fig. 2.** Performing the distal anastomosis at the left carotid bifurcation after completing a proper endarterectomy and ligation of the common carotid artery stump. Thin arrow shows the orifice of the external carotid artery and thick arrow indicates the orifice of the internal carotid artery.

subclavian artery was clamped proximally and distally, and an end-to-side anastomosis of a reinforced polytetrafluoroethylene (polytetrafluoroethylene [PTFE] graft, 6 mm diameter) graft was performed using 6-0 nylon suture. The graft was tunneled beneath the sternocleidomastoid muscle and internal jugular vein. We cross-sectioned the carotid bifurcation and ligated the CCA stump, proceeded to endarterectomy of ICA and ECA, and eventually completed the anastomosis in an end-to-end manner using 6-0 Nylon suture (Fig. 2).

The patient had an uneventful recovery and was discharged on the fourth day under dual antiplatelet therapy. One month follow-up consisted of computed tomography (CT) angiography of cervical arteries (Fig. 3) and CT scan of the brain which showed good patency of the graft, the



**Fig. 3.** Computed tomography angiography image showing the patent synthetic graft (on the left side of the patient).

carotid bifurcation and cerebral circulation. The patient declared complete resolution of his dizziness with no new events of drop attacks. Six-month follow-up consisted of duplex ultrasonography and clinical examination with normal findings.

## DISCUSSION

This report presents the successful treatment of a symptomatic patient with CCAO and contralateral ICAO who underwent proper ipsilateral open repair with subclavian artery to carotid bifurcation bypass leading to optimal results.

Stenosis of carotid artery can be generated by atherosclerosis, dissection, radiation, and angiitis. However, blood tests in our patient were within normal reference excluding possible autoimmune diseases. Hypertension, smoking, hypercholesterolemia, diabetes mellitus, ischemic heart disease, age, and male gender are well established risk factors for atherosclerosis and extracranial carotid disease [2,6]. However, our patient was neither a smoker nor diabetic, and all other risk factors were adequately modified under best medical treatment. Regarding the pattern of carotid disease, it is estimated that CCAO is presenting in ~3% of patients undergoing angiography for symptomatic cerebrovascular disease, although the prevalence of contralateral ICAO in such patients remains unclear [6]. As aforementioned, there are four types of CCAO and this patient falls in the first type (1A type) which was found to be the most common in a recent systematic review [2]. In a study by Mead et al. [7], only eight (0.4%) of 2,228 patients with transient ischemic attack/complete stroke had BICAO. However, there was no

report of contralateral CCAO in this large cohort study.

Occlusion of carotid artery leads to cerebral perfusion interruption, either due to hypoperfusion or due to micro-embolism originated from the distal tail of occluded artery [1]. The collateral circulation consists mainly from the vertebrobasilar system with cross-filling of the middle cerebral artery through the circle of Willis or through an ECA-ophthalmic artery anastomosis. Patients who occlude their carotid artery may present asymptomatic, especially if they have gradually developed an excessive collateral network, although the majority of such patients is symptomatic according to recent pooled data [2,8]. In the acute setting, most of them experience neurological defects ranging from amaurosis fugax or transient ischemic attack to a major disabling stroke. However, our patient presented with atypical symptoms that could be attributed to a possible low posterior cerebral perfusion without any ischemic lesion detected on MRI imaging.

Regarding treatment, open surgical management in symptomatic patients with ipsilateral CCAO is a safe and effective therapy [2]. The most frequent revascularization procedure is surgical bypass followed by endarterectomy, concurring with our strategy. However, some extreme therapeutic procedures have also been described, such as vertebral artery to middle cerebral artery bypass using radial artery, and transposition of CCA to subclavian artery (with or without endarterectomy) [2,9]. Endovascular recanalization has been described in limited cases as well. This is justified as chronic atherosclerotic plaques are usually calcified and guidewire and emboli protection devices may not be possible to cross the lesion [2,8]. We believe that this therapeutic approach should be considered only in extremely high-risk patients and by endovascular surgeons/interventional specialists who have large experience. Our patient underwent an unconventional subclavian to carotid bypass using a synthetic (PTFE with external rings) graft. The main advantage of the specific graft is its resistance to kinking during flexion of neck. We also decided to proceed to an end to end anastomosis for better hemodynamic behavior and eliminate the possibility of embolization. Regarding patency rates, Ziomek et al. [10] suggested that prosthetic grafts have superior patency rates compared to vein grafts. However, other studies have not found any difference between venous and synthetic grafts [2]. Finally, Sullivan [11] has reported promising early and late outcomes of a similar case series with 'isolated' carotid bifurcations treated with bypass grafting. After a mean follow-up of almost 40 months, 75% of patients remained asymptomatic with a null perioperative death/stroke risk. However, none of the patients had a contralateral ICAO, such as in our case.

In conclusion, bilateral carotid occlusion represents an uncommon pattern of atherosclerotic disease requiring a challenging treating strategy. Open surgery with bypass grafting seems to be the safest and most efficient strategy for cases with bilateral occlusion as well, although literature data remain limited.

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