



Life-threatening bilateral internal carotid artery and unilateral vertebral artery total occlusion presenting with dizziness: a case report

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Introduction: It is well known that whereas bilateral occlusion is less common, unilateral internal carotid artery blockage happens regularly. Asymptomatic to fatal ischemic stroke can be the clinical presentation, depending on whether there is adequate collateral blood flow. Internal carotid artery occlusion is often associated with significant neurologic events, both at the time of initial occlusion and during follow-up.

Case presentation: The authors describe a patient's experience of dizziness followed by a fall. The hyperdense position of the basilar artery near its bifurcation was identified following a computed tomography (CT) scan. Furthermore, the pons, midbrain, and medial parts of the right temporal lobe showed numerous small hypodensities suggestive of an ischemic injury. The patient had medical treatment without surgery after it was determined that they had bilateral internal carotid arteries and a blocked right vertebral artery. After taking dual anti-platelet therapy for 5 days, the patient recovered without incident and was discharged from the hospital.

Discussion: In a young patient with bilateral internal carotid arteries occlusion (BICAO), the authors highlighted the significance of prompt diagnosis of stroke-like symptoms, diagnostic possibilities, and treatment options. Options for diagnosis include brain MRI and CT head to check for ischemia and CT angiography (CTA) head and neck to assess for artery obstruction. Options for treatment include severe medical and surgical treatments, such as carotid endarterectomy, stent implantation, or balloon angioplasty, or medical management alone, such as dual anti-platelet medication and thrombolysis.

Conclusion: BICAO is associated with a grave prognosis and significant cerebrovascular complications. High-quality studies are needed to establish the best treatment strategy, considering the complex and individualized nature of the condition.

Keywords: bilateral internal carotid arteries, case report, dizziness, stroke, unilateral, vertebral artery occlusion

Introduction

It is commonly known that unilateral internal carotid artery blockage occurs frequently, whereas bilateral occlusion is less common^[1]. Depending on whether there is sufficient collateral blood flow, the clinical presentation might vary from asymptomatic to deadly ischemic stroke^[2]. Significant neurologic events are frequently linked to internal carotid artery occlusion, both during the initial occlusion and during subsequent follow-up^[3]. Approximately 99.6% of stroke patients have unilateral internal carotid artery blockage, whereas 0.4% of stroke patients have

HIGHLIGHTS

- It is well known that whereas bilateral occlusion is less common.
- Regarding bilateral internal carotid artery occlusion medicinal or surgical management, as well as its natural history, very little has been reported.
- Bilateral internal carotid arteries occlusion associated with unilateral vertebral artery occlusion is a rare presentation.

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bilateral internal carotid artery occlusion^[4]. Regarding bilateral internal carotid artery occlusion medicinal or surgical management, as well as its natural history, very little has been reported. It's possible that the degree of cerebrovascular insufficiency caused by this occlusion is not discovered until these people experience a catastrophic or incapacitating stroke that requires medical intervention^[5]. The work has been reported in line with the SCARE 2023 criteria^[6].

A helpful diagnostic tool for identifying between normal and severely stenotic arteries is brightness modulation (B Mode) ultrasonography. One of the most sensitive and specific tests for determining the presence of complete carotid blockage is carotid duplex ultrasonography. MRA with gadolinium and computed tomography angiography (CTA) are thought to be equally sensitive as ultrasonography. whereas digital subtraction angiography is the gold standard imaging technique; this invasive test is often used

only when near or total occlusion cannot be distinguished by MRA and ultrasound^[7]. Uncertainty surrounds the final BICAO therapy^[8]. Combining dual anti-platelet therapy (90 days) with statin therapy and surgical revascularization is one strategy; going it alone with medicine is another.^[11] In this study, we report the case of a patient who developed dizziness followed by falling. After a CT scan, the basilar artery's hyperdense location at its bifurcation was detected. Furthermore, many minor hypodensities indicative of an ischemic insult were seen in the pons, midbrain, and medial aspects of the right temporal lobe. This patient was diagnosed as having a bilateral internal carotid artery occlusion and was treated via medical treatment without surgical intervention. On day five of receiving dual anti-platelet medication, the patient underwent a smooth recovery and was released from the hospital.

Case presentation

A 64-year-old male patient, relatively active but a heavy smoker (2 packets daily), presented with sudden-onset dizziness followed by falling down. He has no history of loss of consciousness or syncope. An ECG conducted at the hospital showed sinus bradycardia. Subsequently, he was referred to the critical care unit (CCU) department of another hospital for further evaluation. His medical history includes coronary artery disease, for which he underwent three catheterizations in the past five years and received a drug-eluting stent in the left anterior descending artery (LAD) artery. He also has chronic obstructive pulmonary disease (COPD), hypertension, and type 2 diabetes mellitus. His medication regimen prior to the event consisted of acetylsalicylic acid (100 mg once daily), clopidogrel (75 mg once daily), rosuvastatin (10 mg once daily), and bisoprolol (2.5 mg once daily).

At the secondary hospital, clinical examination revealed no neurological deficiencies, and there were no signs of peripheral artery disease, as indicated by palpable arteries in the upper and lower extremities. Upon admission, another ECG showed atrial flutter, leading the doctor to suspect sick sinus syndrome. The patient later returned to normal sinus rhythm. However, due to a history of dizziness and fatigue, a brain CT scan was performed, revealing evidence of a hyperdense basilar artery near its bifurcation. Additionally, multiple small hypodensities were noted in the pons, midbrain, and medial aspect of the right temporal lobe, suggestive of an ischemic insult as shown in (Fig. 1). Consequently, a CT Brain angiogram and diffusion MRI were conducted.

The CT brain angiogram revealed complete occlusion of the cervical and petrous portions of both internal carotid arteries, followed by distal refill via multiple collaterals arising from both external carotid branches, indicating chronic occlusion (Fig. 2). Additionally, a filling defect was observed at the basilar top, consistent with basilar occlusion at its bifurcation. The Diffusion MRI showed multiple scattered areas of true restricted diffusion, characterized by high Diffusion-weighted imaging (DWI) and corresponding low apparent diffusion coefficient (ADC) values, located at the left side of the pons, subcortical regions of the right inferior temporal and right occipital lobes, as well as the right periventricular area, indicating acute infarction in the territory of the posterior circulation (Fig. 3).

A neck CT angiogram was performed to rule out vertebral artery stenosis or occlusion, revealing atherosclerotic changes at the origin of the right vertebral artery, indicated by soft plaque suggestive of right vertebral artery total occlusion as shown in



Figure 1. Axial brain computed tomography scan show: hyperdense basilar artery (black arrow) and focus of hypodensity (blue arrow).

(Fig. 4). There was no significant stenosis observed in the rest of the right vertebral artery or in the left vertebral artery. Blood tests yielded results within the normal reference range, except for an elevated troponin level (55.7 ng/l). Furthermore, comprehensive immunology tests were administered, all showing normal results. The patient's unusual symptoms may be linked to diminished cerebral perfusion in the posterior circulation, possibly stemming from significant bilateral carotid disease.

Consultations with neurosurgery and vascular surgery specialists were conducted, leading to the decision to pursue medical treatment without surgical intervention. Throughout the admission, the patient received the following medication: heparin (5000 IU twice daily), Haloperidol (2.5 mg IM once daily for 2 days), cinnarizine (25 mg orally twice daily), and Neuro-B's 500 (orally once daily), Ceftriaxone (2 g IV once daily), Candesartan (8 mg twice daily), Hydrocortisone (100 mg), Metronidazole (500 mg IV three times a day), budesonide nebulizer (0.5 mg twice daily), salbutamol nebulizer (2 mg four times a day) and citricoline (1 g orally once daily), in addition to continuing with his previously prescribed medications. The patient experienced an uneventful recovery and was discharged on the fifth day while on dual anti-platelet therapy.

One of the things that helped us in this case is that the patient was followed up in a well-qualified tertiary center, which was concentrated on his case, with grateful family support.

After approximately three and a half months since the patient's discharge from the hospital, he began monthly visits to the supervising doctor. It was noted that the patient showed significant clinical improvement. The patient continues to take the following medications: acetylsalicylic acid (100 mg once daily), clopidogrel (75 mg once daily), Valzadepine (Valsartan + Amlodipine 160/5 mg orally once daily), rosuvastatin (20 mg once daily), bisoprolol (1.25 mg once daily), esomeprazole (40 mg once daily), Neuro-B's 500 (orally once daily), Ultibro Breezhaler nebulizer (once daily), cinnarizine (25 mg orally twice daily), and Guna BDNF (20 drops twice daily). Additionally, the patient is prescribed prednisolone, starting with 40 mg once daily for 5 days, then reducing to 20 mg once daily for another 5 days.

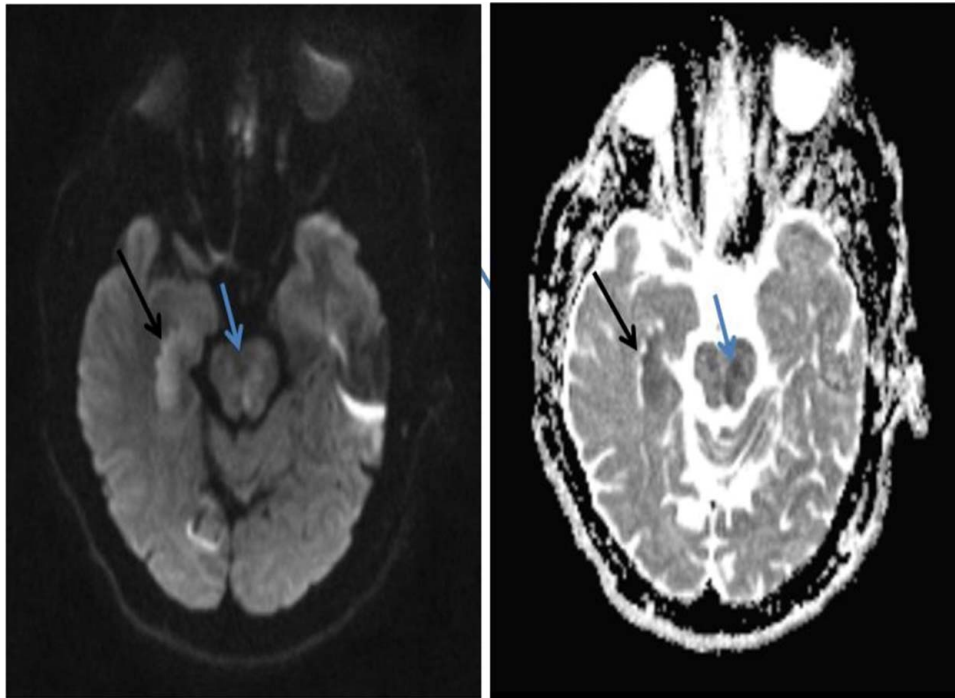


Figure 2. DWI (left) and ADC (right) sequences of brain MRI show small areas of restriction diffusion. ADC, apparent diffusion coefficient; DWI, Diffusion-weighted imaging.

Discussion

Bilateral occlusion of the internal carotid arteries is an extremely uncommon occurrence, and it poses a serious prognosis^[1]. Mead

et al.^[9] reported that only eight cases (0.4%) out of 2228 individuals experiencing transient ischemic attacks or completed strokes were diagnosed with bilateral internal carotid artery occlusion (BICAO). Persoon *et al.*^[10] discovered that the yearly

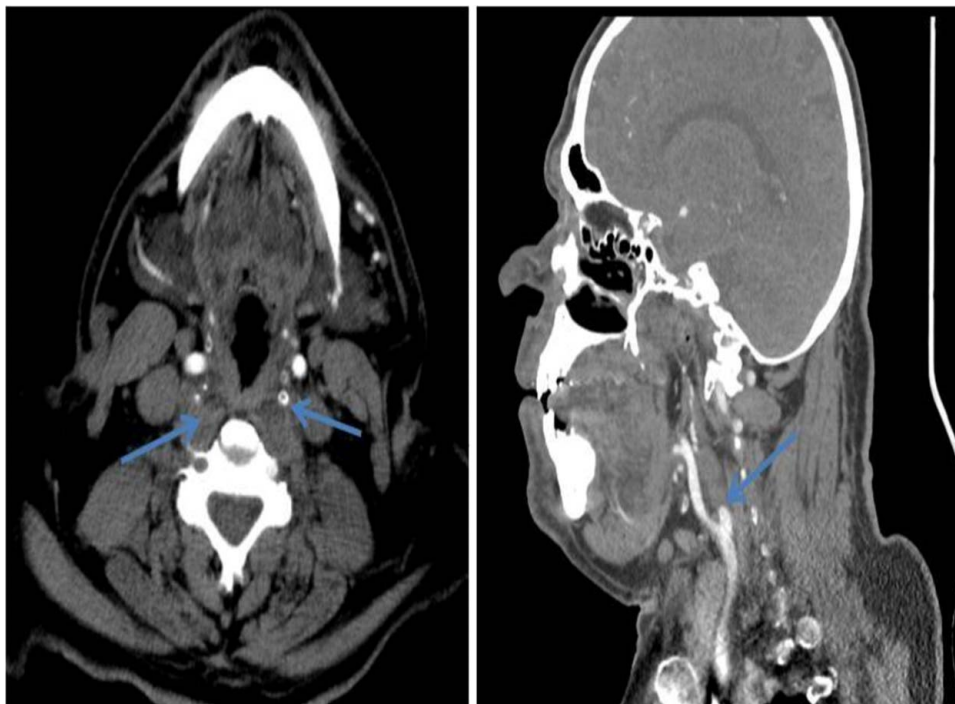


Figure 3. Axial and sagittal views of neck computed tomography angiography show occlusion in both internal carotid arteries (ICAs).

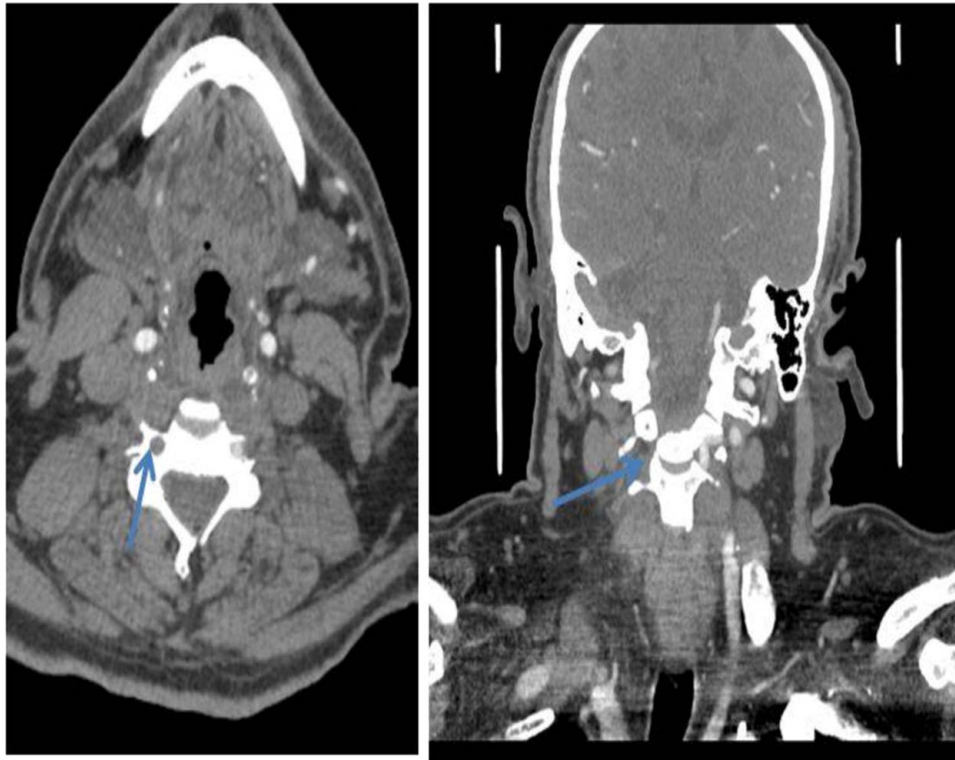


Figure 4. Axial and coronal views of neck computed tomography angiography show complete occlusion in right vertebral artery.

incidence of strokes among individuals with BICAO varies from 0 to 13%. BICAO can result in severe cerebrovascular complications, including recurrent ischemic strokes or mortality^[3]. According to reports, 52% of 21 patients with BICAO, who were monitored for 1–11 years with an average follow-up duration of 6 years, experienced mortality^[11].

The collateral circulation, recognized as an important aspect of cerebral circulation, significantly influences the risk of stroke and various features of stroke presentation, including stroke patterns in patients with carotid artery disease^[12]. In patients with BICAO, collateral circulation is predominantly sourced from the vertebrobasilar (VB) system. This involves the redirection of blood flow to the middle cerebral artery, facilitated by mechanisms such as the circle of Willis, anastomosis between the external carotid artery and the ophthalmic artery, or a combination thereof^[13]. It's suggested that in patients with BICAO who survive without major stroke, efficient collateral blood flow maintains cerebral perfusion^[14]. However, a study proposes that extensive collateral blood flow pathways must have already developed at the time of initial presentation for survival without a major stroke^[10]. The long-term prognosis of bilateral carotid artery occlusion and the risk of stroke are substantial and have a higher rate of cerebrovascular events and mortality^[15], so close monitoring and preventive measures are crucial. Hemodynamic parameters, such as regional cerebral blood flow (rCBF) and cerebrovascular reactivity (CVR), predict outcomes. Patients with decreased rCBF and CVR face higher annual risks of total and ipsilateral strokes^[16]. Unilateral occlusion develops a compensatory mechanism of blood flow through collaterals and posterior circulation, which is more common, but transient

ischemic attacks (mini-strokes) and warning signs should not be ignored^[17].

Atherosclerosis is recognized as the predominant factor underlying arterial occlusion or stenosis^[18,19], while hypoperfusion and embolism are identified as primary contributors to ischemic stroke in cases of bilateral internal carotid artery occlusion. In this context, diminished cerebral perfusion and inadequate collateral circulation can exacerbate the impact of embolism by impeding washout in hypoperfused areas, thereby precipitating symptomatic brain ischemia^[19–21]. The presence of major risk factors for atherosclerosis, including dyslipidemia, hypertension, diabetes, obesity, and cigarette smoking, significantly heightens the susceptibility to these vascular complications^[22].

Multiple factors decrease ischemic stroke recurrence. To begin with, changing one's lifestyle entails giving up smoking or avoiding secondhand smoke, as well as boosting physical activity to at least 120–150 min of aerobic physical exercise per week. Additionally, guidelines for medical health optimization recommend screening for diabetes mellitus using an oral glucose tolerance test, fasting plasma glucose measurement, or A1C measurement. They also recommend starting antihypertensive medications if the target blood pressure is less than 130/90 mmHg or the systolic is greater than 90 mmHg several days after the event and starting high-intensity statins in people who are thought to have atherosclerotic origins^[6]. Also, studies suggest that carotid endarterectomy shows low adverse events perioperatively and low long-term stroke risk up to 5 years^[23].

Regarding the importance of anti-platelet therapy, aspirin-clopidogrel long-term therapy reduces the ischemic events

by 4–1%, and the risk of major bleeding increases in parallel by 0.9–1.7%^[15]. They are effective, especially for atherosclerosis and in those with known symptomatic cerebrovascular disease. The monitoring of adherence could be through scheduled interviews, self-reported questionnaires^[24], lab monitoring of the INR, and platelet function testing through agonist-induced platelet aggregation, thromboxane B2 (TxB2), and vasodilator-stimulated protein phosphorylation (VASP)^[25].

One of the challenges in treating patients with BICAO is the lack of consensus on the optimal treatment strategy^[11], as the available literature on optimal management and long-term prognosis is limited by small sample sizes and predominantly short-term follow-up periods in most studies^[5,14]. Moreover, the existing studies show conflicting results on the comparative effectiveness and safety of different treatment modalities for BICAO. For example, a meta-analysis conducted by Mylonas and colleagues found no significant difference in therapeutic efficacy between medical therapy and revascularization interventions^[22]. On the other hand, Persoon *et al.*^[10] observed that among 57 patients with BICAO treated with medical therapy, a more favorable prognosis was achieved compared to those who underwent surgical interventions. In contrast, AbuRahma and Copeland analyzed and followed up 21 patients with BICAO for an average duration of 6 years, ranging from 1 to 11 years. Thirteen patients underwent various forms of vascular surgical interventions. The overall mortality rate was 52%, with a lower rate of 38% observed in the surgical group compared to 75% in the medical group. In the medical group, 75% of patients experienced multiple ischemic strokes, while only 15% of patients in the surgical group encountered a single ischemic stroke^[11].

We present a case of a patient with bilateral internal carotid arteries (BICAO) and unilateral vertebral artery occlusion who only experienced dizziness and falling down. Collateral blood flow from both external carotid arteries was noted. Treatment included the initiation of dual anti-platelet therapy with acetylsalicylic acid 100 mg daily and clopidogrel 75 mg daily for management of stroke and BICAO, along with anticoagulant therapy comprising heparin 5000 IU administered twice daily for the initial 12 days post-stroke, followed by apixaban 5 mg twice a day for concurrent atrial flutter. The patient demonstrated significant clinical improvement and was discharged walking. The optimal treatment for BICAO patients remains complex and uncertain. More high-quality studies with larger sample sizes and longer follow-up periods are required to determine the best treatment strategy for BICAO patients.

Generally, the outcomes of the BICAO vary between individuals based on individual factors, including aneurysm size, patient health, and timely intervention. Some patients may have small aneurysms that remain stable over time, necessitating close monitoring without immediate intervention. Others may experience rapid aneurysm growth, requiring treatment to prevent complications such as embolization and blockage of the blood flow to the brain and true and false aneurysm formation that may cause thrombus, rupture, or mass effect by large aneurysms. All of these would cause severe interruption of blood flow to the brain, so scheduling a carotid ultrasound could enable early detection of the strokes.

Conclusion

The prognosis for bilateral internal carotid artery occlusion is grave and incredibly rare. Studies showed that people with BICAO experience strokes at different rates, underscoring the seriousness of the condition's cerebrovascular consequences. The danger of vascular problems is greatly increased in BICAO patients who have high-risk factors for atherosclerosis. Because there is disagreement about the best course of action and inconsistent findings in the literature, treatment options for BICAO are still controversial. To find the best course of action, more studies with larger sample sizes and longer follow-up times are required.

Ethical approval

Not applicable.

Consent

Written informed consent was obtained from the patient family for reporting this case and its associated images. The consent is available for review on request.

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Author contribution

Writing the manuscript: A.W.M.J., H.J.M.W., M.Y.H.A., B.Y.H.A., F.B.Y.S. Imaging description: B.A., B.A., A.A.A., M.I.S. Reviewing and editing the manuscript: A.W.M.J., H.J.M.W.

Conflicts of interest disclosure

There is no conflict of interest to declare.

Research registration unique identifying number (UIN)

Not applicable.

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Data availability statement

Data are available upon request.

Provenance and peer review

Provenance and peer review not commissioned, externally peer-reviewed.

References

- [1] AbuRahma A, Copeland SE. Bilateral internal carotid artery occlusion: natural history and surgical alternatives. *Cardiovasc Surg* 1998;6: 579–83.

- [2] Doshi M, Muley A, Kumar S, *et al.* A case of bilateral internal carotid artery complete occlusion. *J Integr Health Sci* 2019;7:65–8.
- [3] Karki M, Devarakonda PK, Dhulipalla L, *et al.* Bilateral internal carotid artery occlusion, an unusual clinical entity in a young adult. *Cureus* 2021; 13:e15971.
- [4] Fought WE, van Bemmelen PS, Mattos MA, *et al.* Presentation and natural history of internal carotid artery occlusion. *J Vasc Surg* 1993;18: 512–23; discussion 524.
- [5] Friedman SG, Lamparello PJ, Riles TS, *et al.* Surgical management of the patient with bilateral internal carotid artery occlusion. *J Vasc Surg* 1987; 5:715–8.
- [6] Sohrabi C, Mathew G, Maria N, *et al.* The SCARE 2023 guideline: updating consensus Surgical CAse REport (SCARE) guidelines. *Int J Surg Lond Engl* 2023;109:1136.
- [7] Adla T, Adlova R. Multimodality imaging of carotid stenosis. *Int J Angiol* 2015;24:179–84.
- [8] Derdeyn CP, Chimowitz MI, Lynn MJ, *et al.* Aggressive medical treatment with or without stenting in high-risk patients with intracranial artery stenosis (SAMMPRIS): the final results of a randomised trial. *Lancet* 2014;383:333–41.
- [9] Mead GE, Wardlaw JM, Louis SC. No evidence that severity of stroke in internal carotid occlusion is related to collateral arteries. *J Neurol Neurosurg Psychiatry* 2006;77:729–33.
- [10] Persoon S, Klijn CJM, Algra A, *et al.* Bilateral carotid artery occlusion with transient or moderately disabling ischaemic stroke: clinical features and long-term outcome. *J Neurol* 2009;256:1728–35.
- [11] Amin OSM. Bilateral atherosclerotic internal carotid artery occlusion and recurrent ischaemic stroke. *BMJ Case Rep* 2015;2015:bcr2014207341.
- [12] Romero JR, Pikula A, Nguyen TN, *et al.* Cerebral collateral circulation in carotid artery disease. *Curr Cardiol Rev* 2009;5:279–88.
- [13] Lai SL, Chen YC, Weng HH, *et al.* Bilateral common carotid artery occlusion —a case report and literature review. *J Neurol Sci* 2005;238:101–4.
- [14] Verhaeghe R, Naert J, Vermeylen J. Bilateral carotid artery occlusion: clinical presentation and outcome. *Clin Neurol Neurosurg* 1991;93: 123–6.
- [15] López-Cancio E, Matheus MG, Romano JG, *et al.* Infarct patterns, collaterals and likely causative mechanisms of stroke in symptomatic intracranial atherosclerosis. *Cerebrovasc Dis* 2014;37: 417–22.
- [16] Merchut MP, Gupta SR, Naheedy MH. The relation of retinal artery occlusion and carotid artery stenosis. *Stroke* 1988;19:1239–42.
- [17] Caplan LR, Hennerici M. Impaired clearance of emboli (washout) is an important link between hypoperfusion, embolism, and ischemic stroke. *Arch Neurol* 1998;55:1475–82.
- [18] Bozzao A, Floris R, Gaudiello F, *et al.* Hemodynamic modifications in patients with symptomatic unilateral stenosis of the internal carotid artery: evaluation with MR imaging perfusion sequences. *AJNR Am J Neuroradiol* 2002;23:1342–5.
- [19] Prasad K. Pathophysiology and medical treatment of carotid artery stenosis. *Int J Angiol* 2015;24:158–72.
- [20] Lazarides M, Kalodiki E, Williams M, *et al.* Natural history of chronic bilateral internal carotid artery occlusion. *Int Angiol* 1991; 10:209–12.
- [21] Wade JP, Wong W, Barnett HJ, *et al.* Bilateral occlusion of the internal carotid arteries. Presenting symptoms in 74 patients and a prospective study of 34 medically treated patients. *Brain* 1987;110(Pt 3):667–82.
- [22] Mylonas SN, Antonopoulos CN, Moulakakis KG, *et al.* Management of patients with internal carotid artery near-total occlusion: an updated meta-analysis. *Ann Vasc Surg* 2015;29:1664–72.
- [23] Rothenberg KA, Tucker LY, Gologorsky RC, *et al.* Long-term stroke risk with carotid endarterectomy in patients with severe carotid stenosis. *J Vasc Surg* 2021;73:983–91.
- [24] Care NCCfP. Interventions to increase adherence to prescribed medicine. In *Medicines Adherence: Involving Patients in Decisions About Prescribed Medicines and Supporting Adherence [Internet]*. 2009. Royal College of General Practitioners (UK).
- [25] Seidel H, Rahman MM, Scharf RE, *et al.* Monitoring of antiplatelet therapy. Current limitations, challenges, and perspectives. *Hamostaseologie*. 2011;31:41–51.