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Case Report

Transcervical approach for carotid artery stenting without flow reversal: A case report ☆

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ABSTRACT

Current treatment options for high-risk patients with severe carotid artery stenosis include transcarotid artery revascularization, transfemoral carotid artery stenting, and carotid endarterectomy. Transfemoral carotid artery stenting is associated with high perioperative stroke risk, and recent studies and trials have identified transcarotid artery revascularization as a new technique able to minimize the stroke risk associated with high-risk procedures. Moreover, the transcervical approach allows easy access to the carotid artery in cases with an anatomically tortuous aortic arch. Therefore, determining the optimal approach to achieve arterial access during carotid stenting is important for successful procedures and positive outcomes. We report a clinical case of ischemic stroke due to severe stenosis of the left internal carotid artery indicated for stent deployment. After transfemoral carotid artery stenting failure, the patient's symptoms progressed from minor stroke to hemiplegia and Broca's aphasia. The transcervical approach was used to perform transcarotid artery revascularization after several days. The procedure was both safe and prevented recurrent stroke occurrence. Although transfemoral access is the classic approach used for carotid stenting, the transcervical approach can be used as an alternative and safe choice in cases with complex vascular anatomy, such as the one described here.

☆ Competing Interests: None.

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Introduction

Carotid artery stenosis refers to the narrowing of the major carotid arteries, which are located on each side of the neck, providing blood to the head, face, and brain. Constriction is often due to atherosclerosis, a disease in which plaque deposits build within the arteries. The progression of carotid artery stenosis can lead to the eventual blockage of blood flow through the artery, increasing stroke risk [1–3].

Symptomatic carotid artery stenosis in high-risk patients is often treated by carotid artery stenting (CAS), which is a less invasive method than carotid endarterectomy (CEA), but stenting is associated with considerable periprocedural risk [1–3]. Femoral artery access is commonly used during CAS procedures, but the femoral approach is associated with increased risks of cerebral embolization and arterial dissection in cases with tortuous aortic arches in the common carotid artery (CCA) anatomy [4,5]. A transcervical approach may represent an effective alternative in high-risk patients. We report a case who was found to be at high risk of complications when using the femoral approach for CAS who instead underwent successful stenting using a transcervical approach.

Case report

A 54-year-old woman was admitted to our hospital with right hemiparesis. The patient's medical history revealed uncontrolled hypertension for 5 years and minor ischemic stroke resulting in right hemiparesis 1 month prior to admission. The patient had no previous history of diabetes, cardiac pathologies, strokes, transient ischemic attacks, thromboembolism, or other vascular pathologies.

On examination, blood pressure was 120/80 mmHg, heart rate was regular at 90 bpm, respiratory rate was 20 breaths/min, and blood sugar level was 111.7 mg/dL. The glomerular filtration rate was normal. Daily pharmacological therapy included dual antiplatelet therapy (75 mg clopidogrel and 81 mg acetylsalicylic acid); 20 mg rosuvastatin; 2.5 mg bisoprolol; 10 mg amlodipine, 160 mg valsartan, and 40 mg pantoprazole.

Magnetic resonance imaging (MRI) of the brain using a 3 Tesla scanner revealed hyperintense lesions on the left hemisphere, affected by severe ipsilateral internal carotid artery stenosis (Fig. 1). The patient was indicated digital subtraction angiography. After 3 hours of the procedure, we attempted balloon angioplasty using a 2.0 × 8 mm NeuroSpeed percutaneous transluminal angioplasty balloon (Acandis) and a Jade 3.5 × 80 mm balloon (OrbusNeich), but the stent could not reach the stenosis site due to the presence of a tortuous type III aortic arch in the left CCA (Fig. 2). CAS failure progressed the patient's symptoms from hemiparesis to hemiplegia, and MRI demonstrated an increase in hyperintense lesions in the left hemisphere compared with the initial MRI and near occlusion in the left internal carotid artery (Fig. 3).

One month later, we decided to attempt the transcervical approach to perform stenting. The patient was placed under general anesthesia, the head was turned to the right, and a small incision was made extending the length of the thyroid gland (Fig. 4).

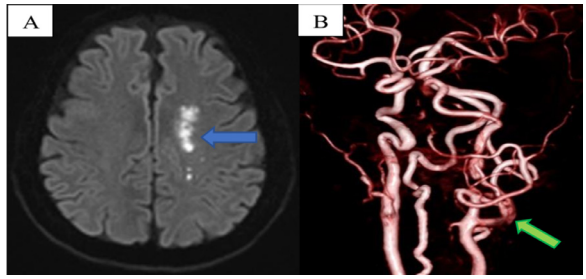

Fig. 1 – First cerebral magnetic resonance imaging results. (A) Hyperintense lesions were observed in the left hemisphere (blue arrow). (B) Severe ipsilateral internal carotid artery stenosis was identified (green arrow).

After the left CCA was exposed, an 8F sheath (Terumo) was used to access the artery, followed by the insertion of a coaxial system consisting of a Ballast 088 Long Sheath (Balt) catheter with Vertebral 5F (Merit Medical) diagnostic catheter and a 0.035-inch wire (Terumo), to make map the access pathway. A Traxcess 0.014″ (MicroVention) microwire was used to approach the petrous segment of the internal carotid artery, and a JADE 3.5 × 40 mm balloon (OrbusNeich) was dilated at the stenosis site. A BeSmooth 6.0 × 58 mm Peripheral Stent System (Bentley) and a CGuard 7.0 × 40 mm Embolic Prevention System (InspireMD) were deployed, but restenosis occurred. Angioplasty was eventually realized using a Vecchio 5.0 × 18 mm balloon (cNovate Medical). Angiography revealed successful recanalization, with thrombolysis in cerebral infarction grade 3 (Fig. 5). No complications occurred associated with the revascularization procedure, and the patient improved to good functional status, with a modified Rankin Scale (mRS) score of 1 assessed 3 months after discharge.

Discussion

Each year, 6.5 million strokes are reported. Stroke is the leading cause of premature mortality and morbidity for both men and women and represents the second-highest cause of death overall. Atherosclerotic carotid artery stenosis, which is responsible for 20% of all strokes, commonly develops at the divergence of the internal and external carotid arteries. Unfortunately, carotid atherosclerosis often remains undetected until the occurrence of a deadly or severely incapacitating stroke. Risk factors for carotid artery atherosclerosis development include the presence of vascular disease, smoking, hypertension, diabetes mellitus, and hyperlipidemia. Although not all individuals with carotid atherosclerosis have an elevated risk of stroke, a significant correlation has been identified between stenosis severity and stroke risk [6–9]. In the described case, the patient's symptoms did not recover despite aggressive medical management due to the failure to successfully resolve severe internal carotid artery stenosis,

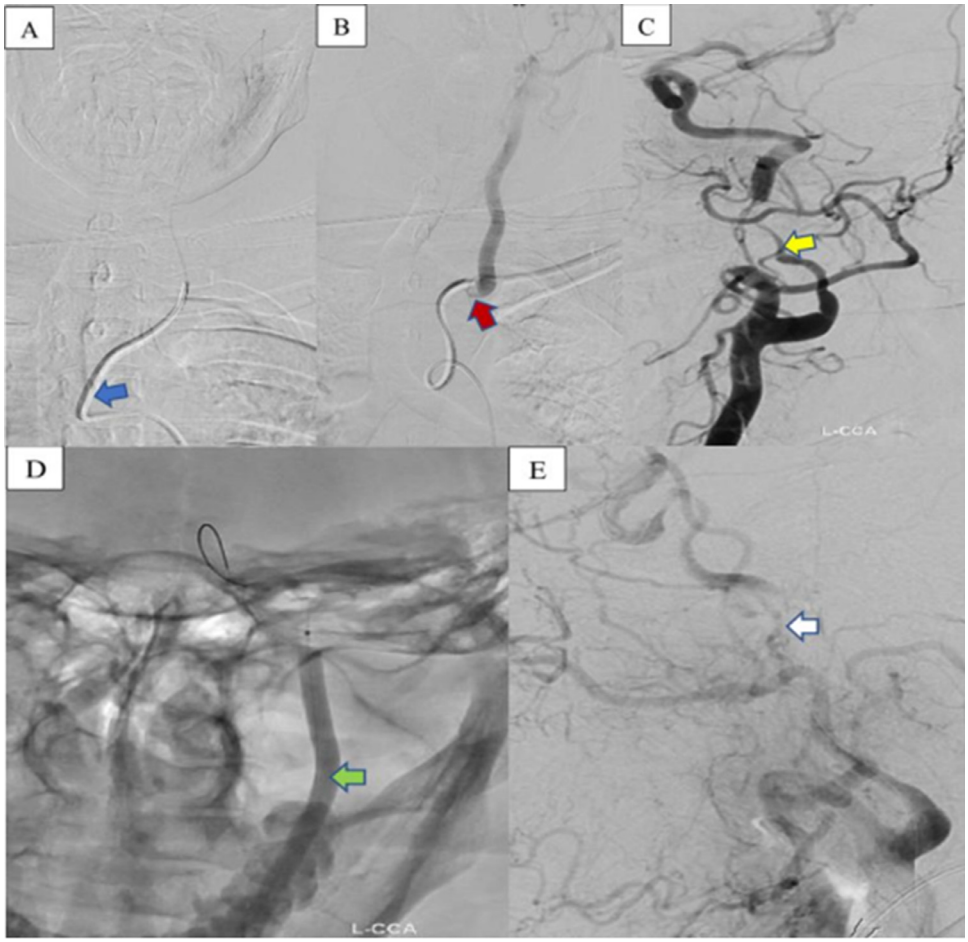

Fig. 2 – First endovascular therapy. (A) A tortuous type III aortic arch was approached using a 5F IMPRESS Simmons 2 Catheter (Merit Medical) (blue arrow). (B) The tortuous CCA (red arrow). (C) The perpendicular origin, showing severe internal carotid artery stenosis (yellow arrow). (D) Angioplasty (green arrow). (E) Restenosis of the internal carotid artery (white arrow).

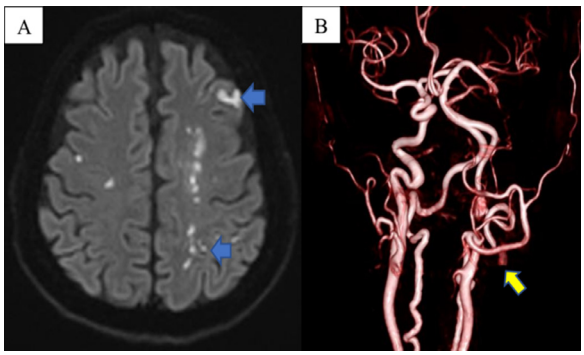

Fig. 3 – Second cerebral magnetic resonance imaging results. (A) An increase in hyperintense lesions was observed in the left hemisphere compared with the initial magnetic resonance imaging results (blue arrow). (B) Near occlusion of the ipsilateral internal carotid artery was observed (yellow arrow).

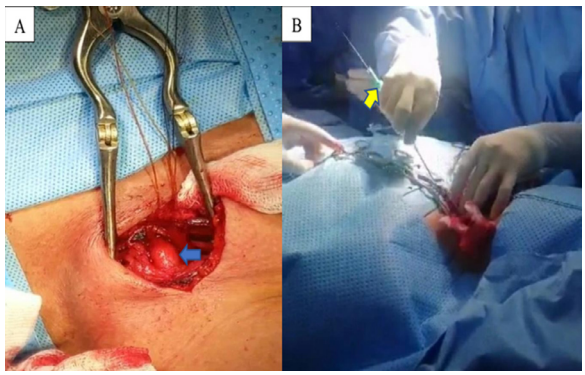

Fig. 4 – Transcervical carotid artery stenting approach. (A) Exposure of the common carotid artery (blue arrow). (B) An 8F sheath was introduced into the CCA (yellow arrow).

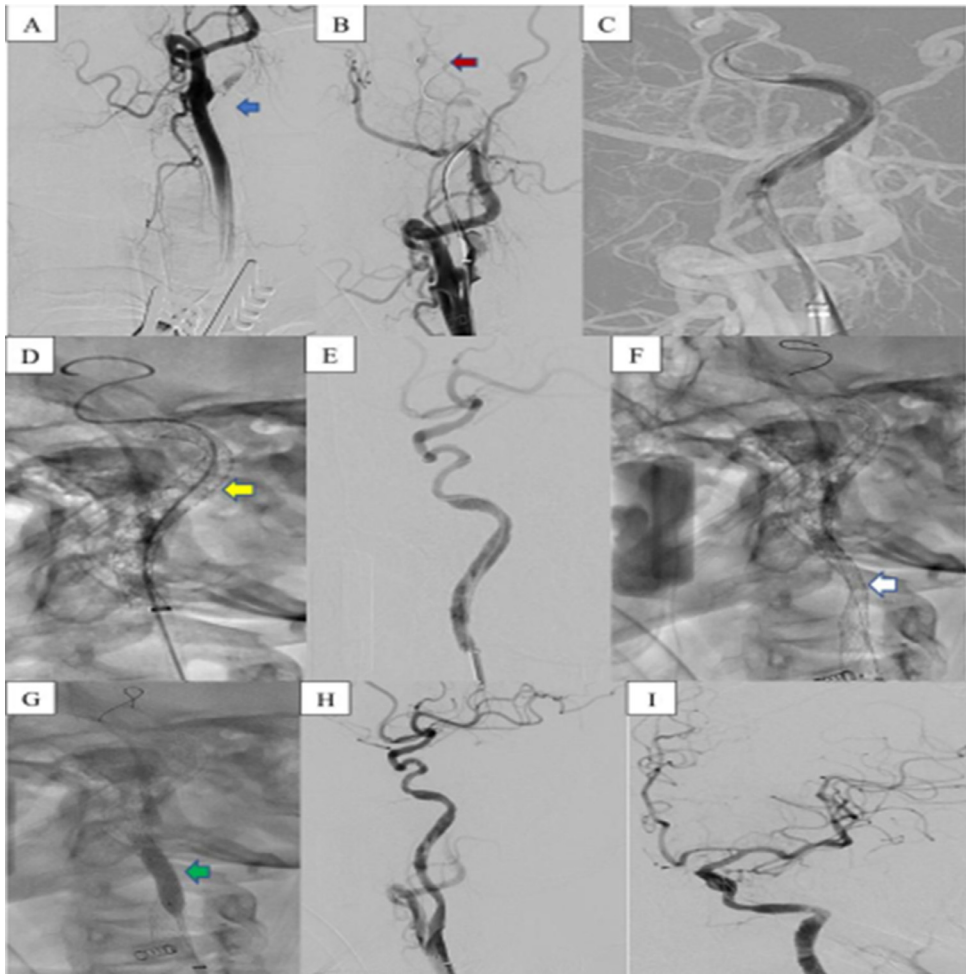

Fig. 5 – Second endovascular therapy. (A) Near occlusion of the internal carotid artery (blue arrow). (B) A microwire was advanced into the petrous segment of the internal carotid artery (red arrow). (C) First angioplasty. (D) Unsheathing the first stent (yellow arrow). (E) Angiography after the first stent. (F) Deployment of the second stent (white arrow). (G) Angioplasty after in-stent restenosis (green arrow). (H and I) Left anterior circulation after carotid stenting in the lateral (H) and anteroposterior planes (I).

leading to the indication for CAS to prevent recurrent ischemic stroke.

CEA is currently considered the gold standard treatment for severe carotid stenosis, but CAS is considered a more appropriate approach to stenosis management than CEA among older adult patients [10]. Femoral access is most commonly the preferred approach for CAS, offering interventional neurologists a typically easy-to-manipulate pathway. However, in rare cases with complex vascular anatomy, such as aortic arch (type III arch, severe arch atheroma, bovine arch, arch elongation), CCA tortuosity, coiling or kinking, the risk of embolic events increases during CAS procedures, leading to technical failure in approximately 9% of attempts [11]. In this described case, the aortic arch and CCA were so tortuous that approaching the site of severe stenosis required approximately 2 hours. Although carotid angioplasty was performed, stenosis was not resolved, leading to increased severity of neurological deficits. A transcervical approach can reduce the risk of procedure-related embolic events in cases with complex anatomy. Many recent studies have demonstrated that transcarotid artery revascularization techniques lead to significant reductions in the risks of procedure-related stroke or death because the CCA is proximally clamped and a filter is used, which prevents the flow of high-risk atherosclerotic plaque debris to the brain, resulting in continuous flow reversal from the CCA to the internal jugular vein or femoral vein [12,13]. In addition, a distal embolic filter with antegrade flow is used to reduce cerebral embolization when performing angioplasty and stenting procedures using the transcervical approach [14,15]. However, in the described case, the first angioplasty performed using the transfemoral approach compressed the plaque against the arterial wall, removing the need for filter control or embolic protection devices during the second endovascular procedure, which shortened the procedure time and reduced periprocedural risks.

Conclusion

Transfemoral CAS is the most commonly selected treatment option for high-risk patients with severe carotid stenosis. However, the transcervical approach represents an alternative

option for cases with arterial tortuosity that can decrease the risks of periprocedural thromboembolic events.

Authors' contribution

Do Duc Thang, Le Minh Thang, and Nguyen Minh Duc contributed to write original draft. Tran Chi Cuong, Nguyen-Luu Giang, Ngo Minh Tuan, Nguyen-Dao Nhat Huy, Le Minh Thang, Duong-Hoang Linh, and Mai-Van Muong contributed to undergo embolization procedure, collect, and interpret the imaging. Nguyen-Van Trang, Nguyen-Luu Giang, and Le Minh Thang contributed to perform exposure of common carotid artery and wound closure. Nguyen Luu Giang, Le Minh Thang, and Nguyen Minh Duc made substantial contributions to collect patient data and clinical data analysis. All authors have read, revised, and approved the final published version of the manuscript. All authors were responsible for submission of our study for publication.

Statement of ethics

Ethical approval was not necessary for the preparation of this article.

Patient consent

Written informed consent was obtained from the patient for publication of this case report and any accompanying images.

Data availability statement

All data generated or analyzed during this study are included in this article and/or its online supplementary material files. Further enquiries can be directed to the corresponding author.

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