Article published online: 2023-11-07

A Case of Symptomatic Common Carotid Artery Occlusion Treated by a Bridging Bypass Using Short Saphenous Vein Graft

Rikiyoshi Yamamoto[1] Tomohiro Iida[1] Naoki Oka[1] Jouji Kokuzawa[1] Yasuhiko Kaku[1]

[1] Department of Neurosurgery, Asahi University Hospital, Gifu, Japan

Asian J Neurosurg 2023;18:796–799.

Address for correspondence Rikiyoshi Yamamoto, MD, Department of Neurosurgery, Asahi University Hospital, Hashimoto-cho 3-23, Gifu 500-8523, Japan (e-mail: rikiyoshi.yamamoto@gmail.com).

Abstract

An 86-year-old woman with initially asymptomatic severe right common carotid artery stenosis had frequent transient left hemiparesis 2 years after the initial diagnosis. Magnetic resonance angiography and three-dimensional computed tomography angiography demonstrated short-segment occlusion of the right carotid bifurcation with significant circumferential calcification, while magnetic resonance imaging demonstrated no ischemic lesions. No collateral blood flow through the anterior communicating artery and posterior communicating artery was observed. A bridging bypass from the distal common carotid artery to the proximal cervical internal carotid artery using a saphenous vein graft was made. There were no ischemic symptoms following the procedure. Bridging bypass using the short saphenous vein graft might be useful for short-segment common carotid artery occlusion.

Keywords

- common carotid artery occlusion
- vascular reconstruction
- saphenous vein graft

Introduction

Common carotid artery (CCA) occlusion is relatively rare, being reported in 2 to 4% of patients with symptomatic cerebrovascular disease.[1] As rich collateral blood flow often forms during the occlusion process, cerebral ischemia is considered to be relatively rare. However, CCA occlusion can induce dynamic changes in angio-architectural conditions. Once CCA occlusion becomes symptomatic due to hemodynamic cerebral ischemia or distal embolization from the occlusion site, it may be refractory to medical therapy.[2–4] Surgical treatment of symptomatic CCA occlusion should be considered and planned according to the cerebral hemodynamic conditions.

We herein report the successful treatment of symptomatic CCA occlusion that was revascularized by bridging bypass using a saphenous vein graft (SVG) between the distal CCA and proximal cervical internal carotid artery (ICA).

Case Illustration

An 86-year-old woman experienced transient faintness. Screening magnetic resonance angiography (MRA) revealed severe stenosis of the right distal CCA, while magnetic resonance imaging (MRI) demonstrated no cerebral ischemic lesions. Three-dimensional computed tomography angiography (3D-CTA) demonstrated severe right distal CCA stenosis with circumferential calcification and a corkscrew-like irregular lumen. Observation and conservative therapy with antiplatelet drugs were initially conducted.

Two years after the initial consultation, the patient developed frequent transient left hemiparesis. MRA revealed

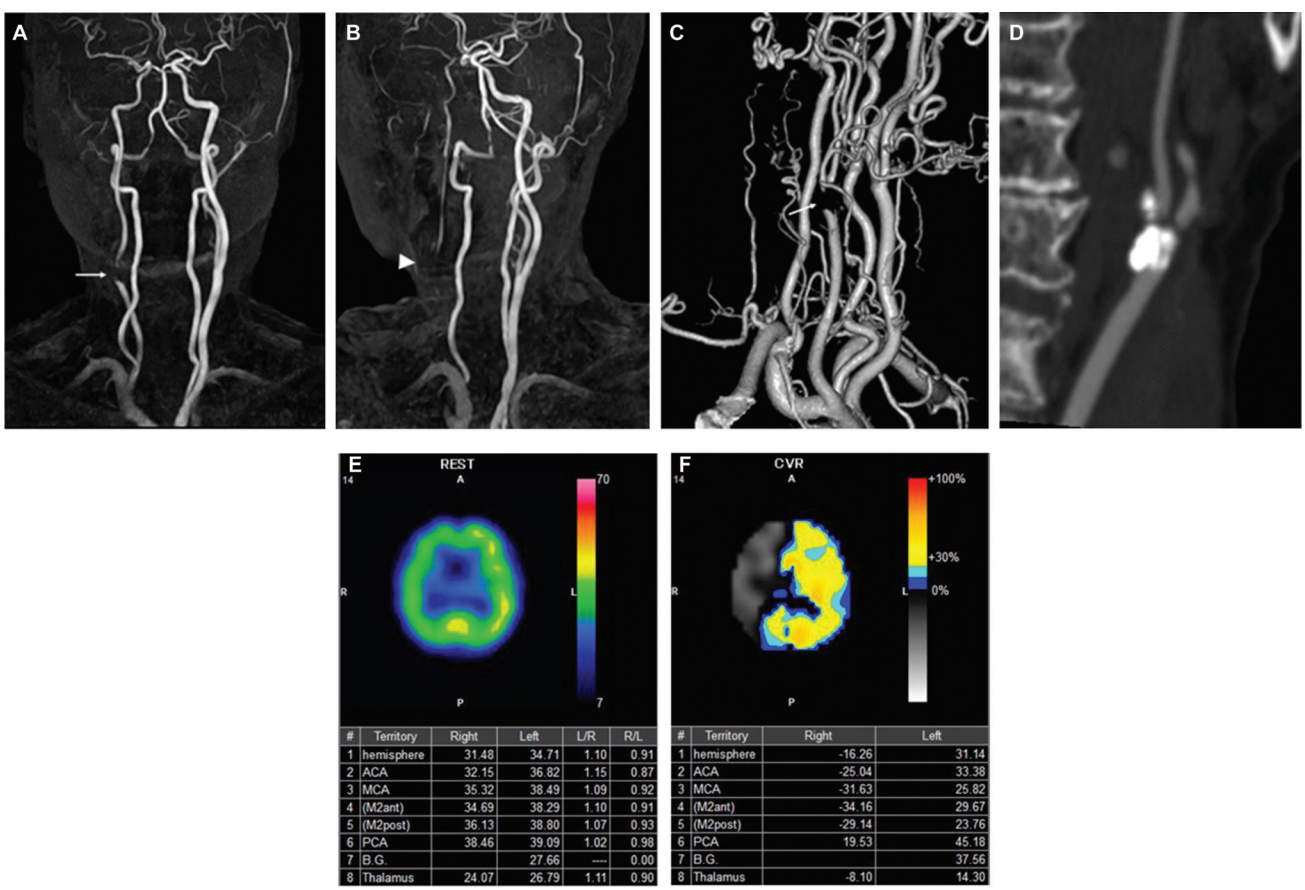
article published online
November 7, 2023

DOI https://doi.org/10.1055/s-0043-1775587.
ISSN 2248-9614.

Thieme Medical and Scientific Publishers Pvt. Ltd., A-12, 2nd Floor, Sector 2, Noida-201301 UP, India

short-segment occlusion of the right distal CCA to the proximal cervical ICA (►**Fig. 1A**), while diffusion-weighted imaging (DWI)-MRI demonstrated no ischemic lesions. 3D-CTA demonstrated short-segment occlusion of the right distal CCA to the proximal cervical ICA 3 cm in length with circumferential bulky calcification (►**Fig. 1B, C**). There was no significant collateral blood flow via the anterior communicating artery or posterior communicating artery. I^{123} N-isopropyl-p-iodoamphetamine single-photon emission computed tomography (IMP-SPECT) demonstrated a decreased resting cerebral blood flow (CBF) in the territory of the right ICA to 90% of the contralateral ICA territory, and the CBF with Diamox challenge showed a remarkable decreased cerebrovascular reserve capacity to −25% (►**Fig. 1D**). We planned bridging bypass from the CCA to cervical ICA using a short SVG without manipulating the occlusion site with circumferential bulky calcification. A 5-cm transverse right cervical skin incision 2 cm below the mandibular angle was made, and the skin incision was then elongated 3 cm to the rostral side along the anterior border of the sternocleidomastoid muscle (►**Fig. 2A**). The carotid bifurcation was exposed between the proximal cervical ICA 3 cm distal to the bifurcation and the distal CCA 3 cm proximal to the bifurcation. A 6 cm SVG was then harvested from the medial condyle of the right lower leg (►**Fig. 2B**). A total of 3,000 units of heparin was administered intravenously. A 2.8-mm-diameter hole was made with a vascular punch at the distal CCA 3 cm below the bifurcation after clamping the CCA. End-to-side anastomosis between the SVG and distal CCA was made using 6–0 Goatex sutures (clamping time: 20 minutes; ►**Fig. 2C**). Another 2.8-mm-diameter hole was then made with a vascular punch at the proximal cervical ICA 2 cm distal to the bifurcation after clamping the ICA. End-to-side anastomosis between the SVG and the proximal cervical ICA was made using 6–0 Goatex sutures (clamping time: 24 minutes) (►**Fig. 2D**). Indocyanine-green video angiography confirmed the patency of the graft.

The patient tolerated the operation well. She had no neurological symptoms. Postoperative DWI-MRI demonstrated no ischemic lesions, and MRA (►**Fig. 3A**) and 3D-CTA demonstrated an excellent bypass flow (►**Fig. 3B**). Postoperative IMP-SPECT demonstrated a normal perfusion in the right ICA territory. The patient experienced no transient ischemic attacks following the operation for more than 1 year.



#	Territory	Right	Left	L/R	R/L
1	hemisphere	31.48	34.71	1.10	0.91
2	ACA	32.15	36.82	1.15	0.87
3	MCA	35.32	38.49	1.09	0.92
4	(M2ant)	34.69	38.29	1.10	0.91
5	(M2post)	36.13	38.80	1.07	0.93
6	PCA	38.46	39.09	1.02	0.98
7	B.G.		27.66	----	0.00
8	Thalamus	24.07	26.79	1.11	0.90

#	Territory	Right	Left
1	hemisphere	-16.26	31.14
2	ACA	-25.04	33.38
3	MCA	-31.63	25.82
4	(M2ant)	-34.16	29.67
5	(M2post)	-29.14	23.76
6	PCA	19.53	45.18
7	B.G.		37.56
8	Thalamus	-8.10	14.30

Fig. 1 (**A**) A screening magnetic resonance angiography (MRA) 2 years before the onset of transient ischemic attacks (TIAs) demonstrating a severe stenosis of the right distal common carotid artery (CCA; arrow). (**B**) MRA obtained after the onset of TIAs demonstrating an occlusion of right distal CCA to carotid bifurcation (arrowhead) without significant collateral flows. (**C**) Three-dimensional computed tomography angiography demonstrating the occlusion of right distal CCA to carotid bifurcation (arrow) with patent proximal cervical internal carotid artery (ICA) and external carotid artery. (**D**) A circumferential bulky calcification on the occlusion site. (**E**) I^{123} N-isopropyl-p-iodoamphetamine single-photon emission computed tomography demonstrating a decreased resting cerebral blood flow (CBF) in the territory of the right ICA to 90% of the contralateral ICA territory. (**F**) CBF with Diamox challenge showing a remarkable decreased cerebrovascular reserve capacity to −25%.

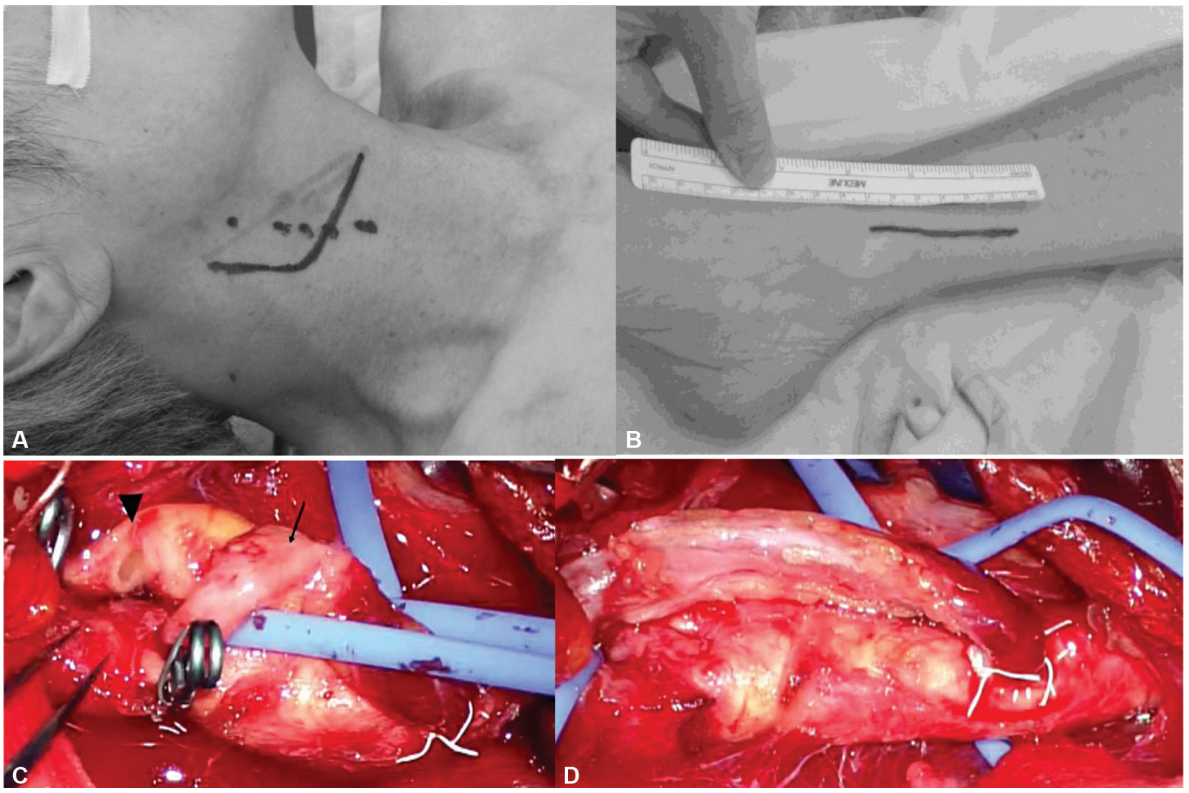


Fig. 2 (**A**) A 5 cm of transverse right cervical skin incision 3cm below the mandibular angle was made, then elongated 3cm to the rostral side along the anterior border of the sternocleidomastoid muscle. (**B**) A 6 cm of saphenous vein graft (SVG) was harvested in the medial condyle of the right lower leg. (**C**) Intraoperative photograph demonstrating the SVG (arrow) anastomosed with the distal common carotid artery (CCA) and arteriotomy in the proximal cervical internal carotid artery (ICA; arrowhead). (**D**) A bridging bypass between the distal CCA and the proximal cervical ICA was completed using short SVG.

Discussion

Symptomatic CCA occlusion is relatively rare because of the rich collateral vessels that develop during the occlusion process.[2] Once it becomes symptomatic, however, it is often refractory to medical therapy. Riles et al first classified CCA occlusion based on its angioarchitecture and noted differences in the surgical revascularization for each type of angioarchitecture.[5] Surgical revascularization should be determined based on a comprehensive understanding of the hemodynamics, including the occlusion site, length of occlusion, and calcification of the vascular wall.[6] The present case had distal CCA to carotid bifurcation occlusion with a patent proximal cervical ICA and external carotid artery. The length of occlusion was relatively short (3 cm) with severe circumscribed calcification. Carotid artery stenting through the occluded segment was thought to have difficulty obtaining satisfactory dilatation because of the severe circumscribed calcification.[7] Carotid endarterectomy was also thought to carry a significant risk.[8] We, therefore, decided to perform bridging bypass from the distal CCA to the proximal cervical ICA using a SVG without manipulating the occlusion site with circumferential bulky calcification. The bridging bypass was accomplished safely using a relatively short SVG, and a sufficient bypass flow was confirmed on MRA and 3D-CTA. The short SVG is easy to handle with proximal and distal anastomotic sites in a single operative field. The radius of the vessel and the length of the graft influence blood flow, and the length of the vessel influences the blood flow inversely, that is, a shorter graft length provides more blood flow. A short SVG is also expected to prolong patency. Bridging bypass using a short SVG might be useful for cases of short-segment CCA occlusion. As the cervical carotid bifurcation was already totally occluded in this case, we might not have to care about the occlusion time for making the bridging bypass. We should rather focus on good quality of bypass.

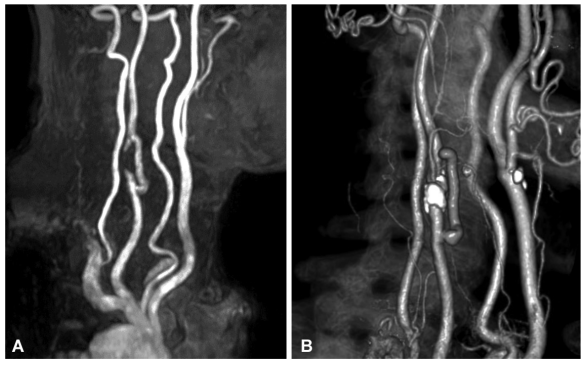


Fig. 3 Postoperative magnetic resonance angiography (**A**) and three-dimensional computed tomography angiography (**B**) demonstrating the good patency of the bridging bypass.

Conclusion

Precise evaluations of the extent of the occlusion and collateral flow are important for the treatment of symptomatic CCA occlusion, and the surgical strategy should be determined based on the angioarchitecture and nature of the vascular wall. Bridging bypass using the short SVG might be useful for short-segment CCA occlusion.

Conflict of Interest
None declared.

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