

**Progressing Takayasu arteritis successfully treated by
common carotid-internal carotid crossover bypass grafting: Case report**

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ABSTRACT

OBJECTIVE: This report describes a unique case of Takayasu arteritis with occlusion of the left common carotid artery (CCA) and the right internal carotid artery (ICA), which was successfully treated by right CCA-left ICA crossover bypass grafting using the saphenous vein. The histological findings of the original occluded prosthetic graft are also described.

CLINICAL PRESENTATION: A 63-year-old woman with a history of Takayasu arteritis was admitted to our hospital because of progressive dizziness, frequent syncopal attacks, and repetitive blurred vision in the left eye. She had undergone repeat transthoracic bypass surgeries including grafting using Gore-tex prosthesis between the left external ilio-axillary bypass and the left CCA. However, cerebral angiography demonstrated a total occlusion of the left CCA, the right ICA and the bilateral subclavian arteries. On admission, ¹²³I-iodoamphetamine (IMP) single-photon emission computed tomography (SPECT) showed a decreased cerebrovascular reactivity to acetazolamide in the bilateral cerebral hemispheres. Moreover, cerebral angiography revealed an occlusion of the Gore-tex graft, while the left ICA was opacified through the retrograde filling in the left external carotid artery.

INTERVENTION: Crossover bypass grafting was performed using the saphenous vein between the right CCA and the left ICA. The Gore-tex graft was partially removed, in which myointimal hypertrophy with an inflammatory response around the wall was found histologically. The postoperative course was uneventful. A normalized cerebrovascular reserve in both cerebral hemispheres was demonstrated on IMP SPECT.

CONCLUSION: Although it is not frequently indicated, crossover bypass grafting using the saphenous vein between bilateral carotid arteries is considered to be a feasible alternative procedure in patients with Takayasu arteritis.

RUNNING TITLE: Carotid-carotid crossover bypass grafting

KEY WORDS: Carotid-carotid crossover bypass, Prosthesis, Takayasu arteritis, Vein graft

ABBREVIATIONS LIST: CCA: common carotid artery. ICA: internal carotid artery.

IMP: ¹²³I-iodoamphetamine. SPECT: single-photon emission computed tomography.

3DCTA: three-dimensional CT angiography. PTA: percutaneous transluminal angioplasty.

Takayasu arteritis is a chronic disease characterized by the nonspecific inflammation of the aorta and its branches (10). Various procedures have been attempted to prevent ischemic signs in the brain and the retina that are refractory to medical treatments.

This report presents a unique case of Takayasu arteritis with occlusion of the left common carotid artery (CCA) and the right internal carotid artery (ICA), which was successfully treated by right CCA-left ICA crossover bypass grafting using the saphenous vein. The histological findings of the occluded prosthetic graft are also described.

CASE REPORT

A 63-year-old woman with a history of Takayasu arteritis was admitted to our hospital because of progressive dizziness, frequent syncopal attacks, and repetitive blurred vision in the left eye. She had undergone bypass grafting between the right external iliac artery and the right axillary artery at 37 years of age, and the one between the left external ilio-axillary bypass and the left CCA at 38 years of age, respectively, using a Dacron prosthesis. The former had become occluded at 40 years of age. The latter remained patent until she was 44 years old, when she underwent new bypass grafting using a Gore-tex prosthesis between the left external ilio-axillary bypass and the

left CCA. She was found to have an aneurysmal formation at the junction of the left carotid graft and the left external ilio-axillary bypass which required the replacement of the Gore-tex graft at 62 years of age. Despite the oral intake of warfarin and aspirin, she had begun to have blurred vision in the left eye and dizziness six months before the admission. Cerebral angiography demonstrated a total occlusion of the left CCA, the right ICA and the bilateral subclavian arteries (*Fig.1, A and B*), and in-graft stenosis in the left carotid graft (*Fig. 1C*). She continued the oral intake of warfarin and aspirin until she experienced massive gastrointestinal bleeding three months before the latest admission.

At the time of admission, ¹²³I-iodoamphetamine (IMP) single-photon emission computed tomography (SPECT) showed a decreased cerebrovascular reactivity to acetazolamide in the bilateral cerebral hemispheres (*Fig.4, A and B*). Cerebral angiography showed the Gore-tex graft to be occluded (*Fig. 2A*), while the left ICA was opacified through the retrograde filling in the left external carotid artery (*Fig. 2B*). Three-dimensional computed tomographic angiography (3DCTA) source image also demonstrated the patency of the left cervical ICA (*Fig. 2C*). Although both the erythrocyte sedimentation rate and the serum C-reactive protein level were normal, a direct approach to the aorta seemed compromised because she had undergone repeat

transthoracic surgeries and clamping of the aorta might affect the cerebral blood flow. Therefore, crossover bypass grafting was performed using the saphenous vein between the right CCA and the left ICA under general anesthesia. A subcutaneous tunnel was made by blunt dissection across the neck in a plane anterior to the trachea. The saphenous vein graft was tunneled in a gentle curve, ensuring placement without kinks (*Fig. 2D*). The Gore-tex graft was partially removed, in which myointimal hypertrophy with inflammatory response around the wall was found histologically (*Fig.3*).

The postoperative course was uneventful, and her symptoms completely disappeared. One month after the surgery, a normalized cerebrovascular reserve in both cerebral hemispheres was demonstrated on IMP SPECT (*Fig.4, C and D*). The patency of the bypass was confirmed using duplex ultrasonography during the two-year follow-up after the surgery.

DISCUSSION

Surgical revascularization can be applied for stenotic or occlusive lesions in patients with Takayasu arteritis, especially in those in whom a hemodynamic compromise is clearly demonstrated on either SPECT or positron emission tomography (3, 4). In the present case, the neurological symptoms had become refractory to medical treatments

and SPECT after acetazolamide administration revealed a decrease in cerebrovascular reserve in bilateral hemispheres, although the modality used was semiquantitative.

Percutaneous transluminal angioplasty (PTA) with or without stenting might be useful, however at present, the long-term patency remains unclear in Takayasu arteritis (12, 13). Therefore, we did not select endovascular treatment in this case based on due to difficulty in endovascular manipulation and the possibility that distal embolisms and restenosis might occur.

The largest body of experience comes from bypass grafting for Takayasu arteritis, where a good long-term outcome has been reported (7). However, Berguer et al. (2) reported high morbidity and mortality with transthoracic surgery for lesions involving the common carotid and the innominate arteries. Extrathoracic bypass grafting for such lesions have become more widely accepted because of technical ease, a low morbidity, and a possible long-term patency (1, 11). In the present case, an extrathoracic bypass was selected to avoid an additional thoracotomy. Because both cerebral angiography and 3DCTA demonstrated the patency of the left cervical ICA, despite the occlusion of the left CCA, the crossover bypass was placed between the right CCA and the left ICA. Some reports have revealed the efficacy of the carotid-carotid bypass for such atherosclerotic lesions (1, 6, 9, 11), while only a few cases of Takayasu arteritis have

been demonstrated (11). In our case, we placed the bypass in a subplatysmal plane anterior to the trachea. Manart et al. (9) reported a similar technique to ours, to treat branch occlusions of the aortic arch.

No significant difference in the long-term patency has been reported between a prosthesis and a good quality vein for extrathoracic carotid bypass grafting (1). However, a suture-line aneurysm formation would be an unremitting threat in bypass grafting using a prosthesis (10). In our case, we did not use prosthetic grafts because they had been repeatedly occluded and an aneurysmal formation had occurred at the anastomosis site of the bypass. In Takayasu arteritis, the vasa vasorum in injured and thickened arteries could proliferate and penetrate as deep as the intima (5), later intimal hyperplasia resulting in occlusive lesions would occur by the production of growth factors such as platelet-derived growth factor and vascular endothelial growth factor in the inflammatory infiltrates (8). In the present case, the inflammatory response was observed around the wall of the Gore-tex graft. Whether this was due to Takayasu arteritis or to prosthetic materials itself had not been determined. Nevertheless, the use of the saphenous vein graft for bypass grafting is considered to be useful in patients with Takayasu arteritis.

CONCLUSION

Although it is not frequently indicated, crossover bypass grafting using the saphenous vein between bilateral carotid arteries is considered to be a feasible alternative procedure for the treatment of patients with Takayasu arteritis.

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FIGURE LEGENDS

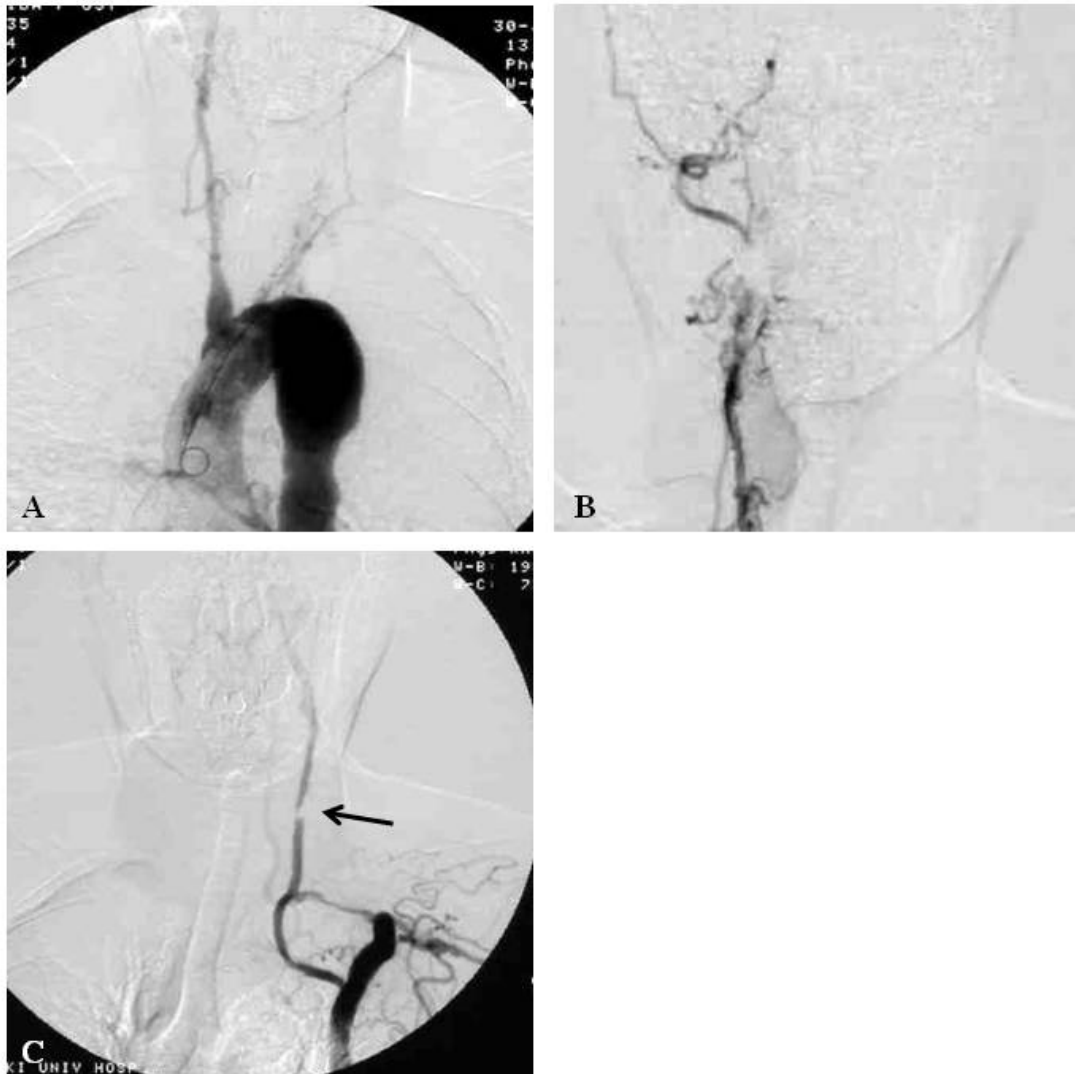


FIGURE 1. Aortography demonstrating an occlusion of the left CCA, and the bilateral subclavian arteries (A) and an angiogram from the right CCA showing an occlusion of the right ICA (B). An angiogram from the left external ilio-axillary bypass showing in-graft stenosis in the left carotid graft (arrow) (C).



FIGURE 2. An angiogram at the time of admission showing an occlusion of the Gore-tex bypass (A). Lateral view of the angiogram revealing the anterograde filling in the left ICA (arrow) through the retrograde filling in the left external carotid artery (B). 3DCTA source image demonstrating an occlusion of the right ICA and the patency of the left cervical ICA (white arrow) (C). Postoperative aortography showing a good flow through the right CCA-the left ICA crossover bypass (D).

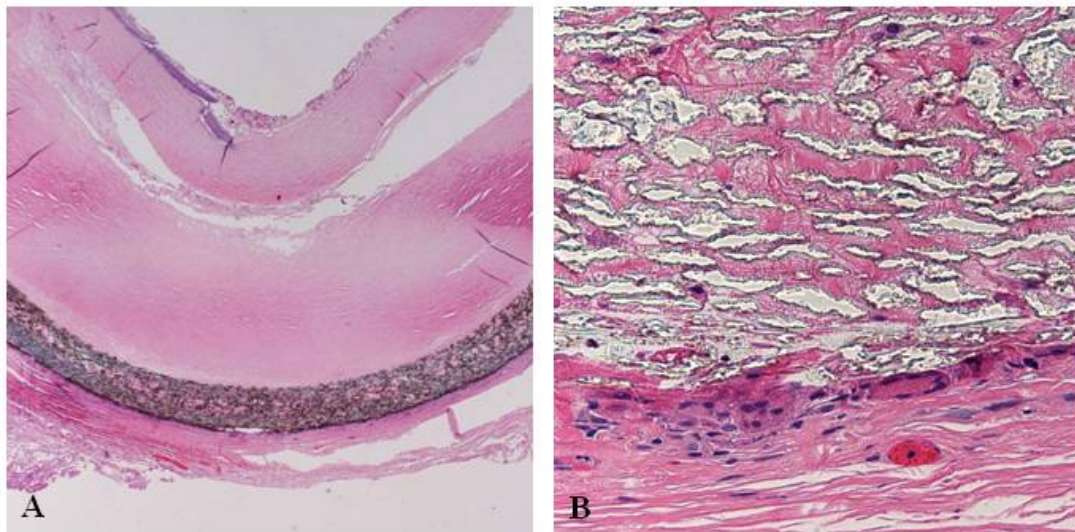


FIGURE 3. Hematoxylin-eosin staining demonstrating myointimal hypertrophy with an inflammatory response around the wall in the Gore-tex graft (A: original magnification \times 20, B: original magnification \times 200).

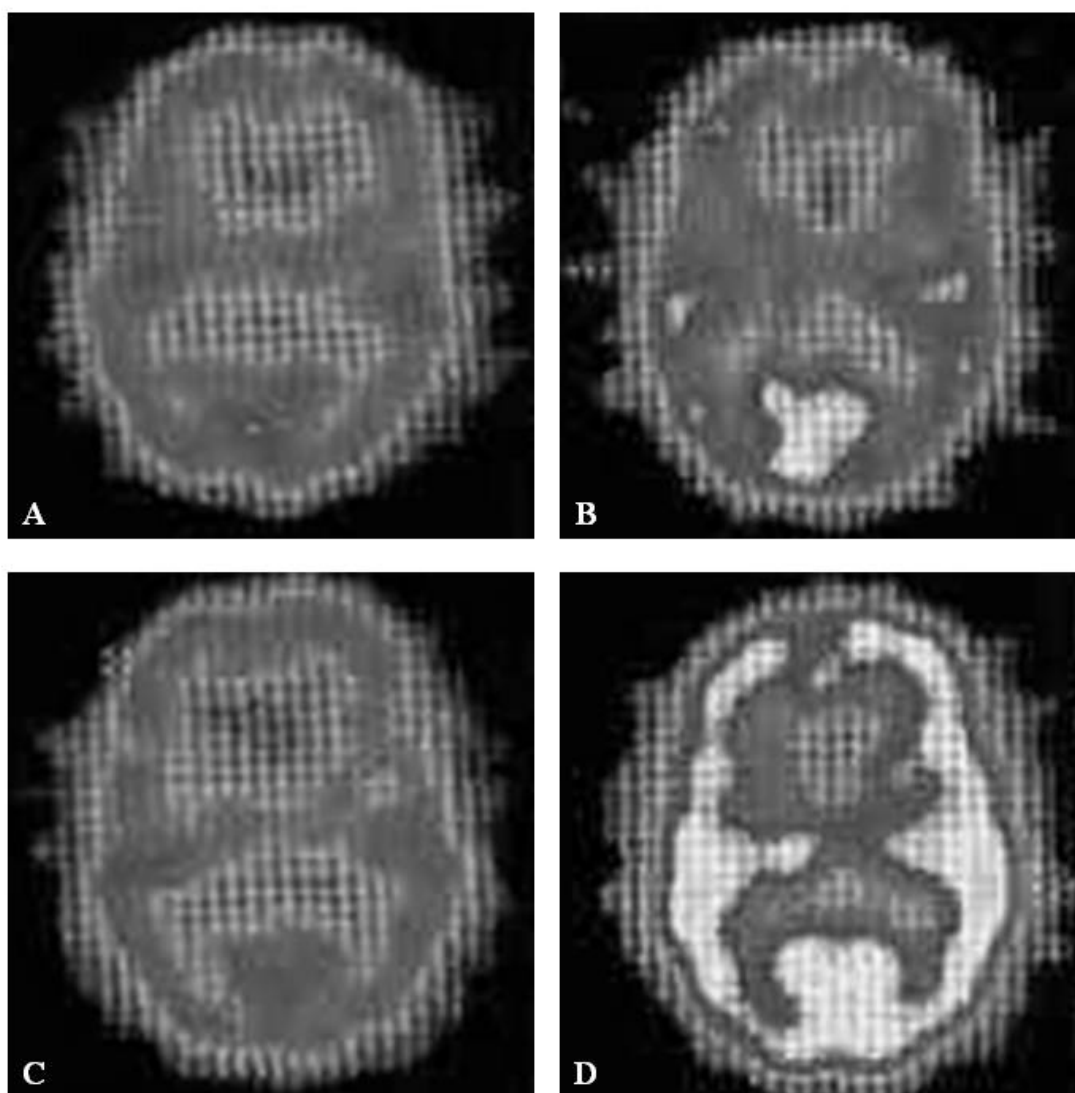


FIGURE 4. Preoperative IMP SPECT showing a decreased cerebrovascular reactivity to acetazolamide in bilateral cerebral hemispheres (A: basal study, B: acetazolamide study). IMP SPECT obtained one month after the surgery demonstrating a normalized cerebrovascular reserve in both cerebral hemispheres (C: basal study, D: acetazolamide study).

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