# Internal carotid artery-to-posterior cerebral artery bypass for revascularization of the brainstem

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ABSTRACT

We describe a novel bypass technique used to revascularize the brainstem by anastomosing the internal carotid artery (ICA) to the posterior cerebral artery (PCA) using a radial artery graft, effectively creating a functional alternative to the posterior communicating artery. A 72-year-old male patient presented with rapidly progressive neurological symptoms attributable to brainstem compression; imaging showed a giant, fusiform, partially thrombosed, vertebrobasilar artery aneurysm. An Alcock's test revealed no significant collateral circulation from the posterior communicating arteries. To revascularize the top of the basilar artery, we performed an ICA-to-PCA bypass using a radial artery interposition graft. Specifically, we used the radial artery graft to connect the supraclinoid ICA to the P2 segment of the PCA. The basilar artery was subsequently occluded during the same operation by placing a clip below the superior cerebellar arteries. Although the bypass remained patent, the patient suffered an acute thrombosis of the aneurysm, resulting in fatal pontine infarction.



## 1. Background and importance

With the publication of results from the Extracranial/Intracranial Bypass Study [1] and the Carotid Occlusion Surgery Study [2], reliance on cerebral revascularization techniques has greatly decreased. The advent of, and the continual improvement in, endovascular techniques have also resulted in significantly less dependence on bypass techniques to treat patients with complex cerebral aneurysms [3]. Nonetheless, in a small cohort of patients, cerebral revascularization remains a cornerstone of therapy [4,5]. One such group of patients is the subset of those with fusiform vertebrobasilar artery aneurysms [6,7].

Here we describe a novel bypass option that could be used to revascularize the brainstem. This novel technique provides a new treatment option for these challenging lesions.

## 2. Clinical presentation

A 72-year-old man was referred with rapidly progressive symptoms consistent with brainstem compression. Imaging revealed a giant, fusiform, partially thrombosed, vertebrobasilar artery aneurysm (Fig. 1). An Alcock's test was performed, revealing that the posterior communicating arteries were not providing adequate collateral circulation. Given the lack of collaterals and the rapidly progressive nature of the patient's symptoms, we proceeded with flow reversal and revascularization of the top of the basilar artery.

The patient underwent an orbitozygomatic approach for a planned internal carotid artery (ICA)-to-posterior cerebral artery (PCA) bypass using a radial artery interposition graft (Fig. 2) followed by clip ligation of the basilar artery below the superior cerebellar arteries (SCA). Postoperatively, the patient was neurologically unchanged, and imaging on postoperative day 1 revealed thrombosis of the aneurysm (Fig. 3A–C). On postoperative day 3, the patient experienced neurological decline and became obtunded. Imaging revealed brainstem infarction, despite patency of the bypass (Fig. 3D, E).

## 3. Discussion

Several authors have reported on revascularization options for the posterior circulation [4,8–10]. The most commonly applied techniques include the superficial temporal artery (STA)-to-PCA or the STA-to-SCA bypass [7]. Our intracranial-to-intracranial vessel bypass option using a radial artery interposition graft to create a communicating conduit between the ICA and the PCA allows for revascularization of the posterior circulation without the need for a long conduit.

## 4. Conclusion

The authors present a novel option for revascularizing the brainstem by anastomosing the ICA to the PCA using a radial artery graft.

## Conflicts of Interest/Disclosures

The authors declare that they have no financial or other conflicts of interest in relation to this research and its publication.

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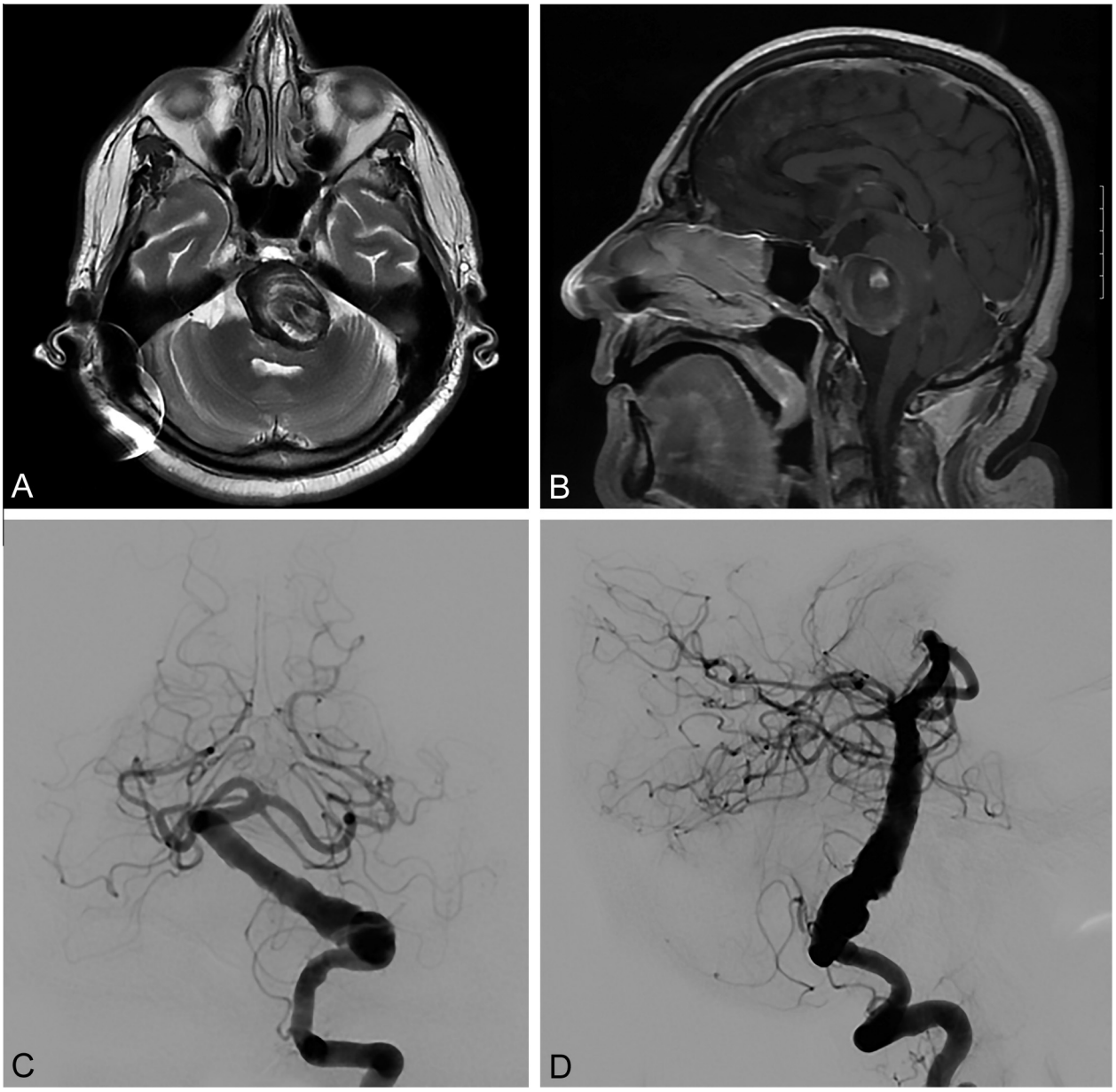


**Fig. 1.** (A) Axial T2-weighted and (B) sagittal T1-weighted MRI scans reveal a giant partially thrombosed aneurysm. (C) Townes and (D) lateral angiographic views reveal the dysplastic nature of the aneurysm. *Used with permission of Barrow Neurological Institute, Phoenix, Arizona.*