



## Radial Artery Bypass for Intractable Vertebrobasilar Insufficiency: Case Series and Review of the Literature

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■ **BACKGROUND:** Vertebrobasilar insufficiency resulting from embolism, atherosclerosis, or arterial dissection has long been a challenge for successful management and outcomes. The main treatment options include medical therapy, angioplasty and stenting, and surgical revascularization. Unlike cardiac or peripheral vascular revascularization, large randomized trials with cerebrovascularization have not revealed favorable outcomes. In patients who have failed maximal medical therapy, and having persistent debilitating symptomatology, cerebral revascularization may still be a viable option.

■ **METHODS:** We report 3 patients who presented with symptoms of vertebrobasilar ischemia. The diagnosis was verified by computerized tomographic arteriography and digital subtraction angiography.

■ **RESULTS:** These patients subsequently underwent revascularization with a radial artery graft. We also present a comprehensive review of the literature of treatment for vertebrobasilar insufficiency.

■ **CONCLUSIONS:** Surgical revascularization should be considered in the posterior circulation in the rare subset of patients with VBI, who remain symptomatic despite having

a protracted course of maximal medical therapy with large- and medium-sized vessel occlusions and poor collateral circulation.

### INTRODUCTION

Vertebrobasilar ischemia (VBI) is most often caused by embolism, large artery atherosclerosis, and arterial dissection.<sup>1,2</sup> Treatment options include medical therapy, intracranial and extracranial angioplasty and stenting, and surgical revascularization. Medical therapy should always be the first-line of treatment. In those patients with embolic source originating from the heart, prevention of cerebrovascular events is accomplished by anticoagulation with warfarin<sup>1</sup> or pradaxa.<sup>3,4</sup> In patients with noncardioembolic stroke, warfarin and aspirin have been shown to be equally effective in secondary prevention, with aspirin having a lower risk.<sup>5</sup> Many investigators consider antiplatelet therapy with agents, such as aspirin, ticlodipine, clopidogrel, dipyridamole, and aggrenox, as first-line therapy in both anterior and posterior circulation noncardiac-generated transient ischemic attacks (TIAs).<sup>1,2</sup> In those patients who fail maximal medical therapy and have evidence of stenosis of the vertebrobasilar system, extracranial and intracranial angioplasty and

### Key words

- Dizziness
- Radial artery
- Revascularization
- Vertebrobasilar insufficiency

### Abbreviations and Acronyms

- AICA:** Anterior inferior cerebellar artery  
**CCA:** Common carotid artery  
**COSS:** Carotid Occlusion Surgery Study  
**CTA:** Computerized tomographic angiography  
**EC-IC:** External carotid to internal carotid artery  
**JET:** Japanese EC-IC Bypass Trial  
**mRS:** Modified Rankin scale  
**OA:** Occipital artery  
**P2:** Second segment of the posterior cerebral artery  
**PCA:** Posterior cerebral artery  
**PICA:** Posterior inferior cerebellar artery  
**PTAS:** Percutaneous transluminal angioplasty and stenting  
**SAMMPRIS:** Stenting and Aggressive Medical Management for Preventing Recurrent stroke in Intracranial Stenosis

- SCA:** Superior cerebellar artery  
**STA:** Superficial temporal artery  
**TIA:** Transient ischemic attack  
**VBI:** Vertebrobasilar ischemia

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stenting is considered a viable option. The benefits of stenting in patients diagnosed with intracranial stenosis has recently been questioned by the results of Stenting and Aggressive Medical Management for Preventing Recurrent stroke in Intracranial Stenosis (SAMMPRIS) trial, which demonstrated that in patients with intracranial arterial stenosis, aggressive medical management was better than percutaneous transluminal angioplasty and stenting (PTAS) to prevent recurrent stroke.<sup>6</sup> This trial was stopped after 451 patients were enrolled, because the 30-day rate of stroke or death was 14.7% in the PTAS group and 5.8% in the medical management group. In their medical management group, only 32.2% represented posterior circulation vessels; the PTAS group included 38.8%. In the reported results, no distinction was made between anterior and posterior circulation. With regard to extracranial stenting, the safety and long-term durability of catheter-based therapy for symptomatic vertebral artery stenosis has also been investigated. Jenkins et al<sup>7</sup> reported on 105 consecutive symptomatic patients (112 arteries) who underwent stent placement for extracranial (91%) and intracranial (9%) vertebral artery stenosis. At 1-year follow-up 79.3% (69 patients) remained symptom-free.

Surgery for cerebral ischemia have always been enticing to surgeons; however, the surgical results for the treatment for cerebral ischemia have been disappointing. Three major trials have been completed in this regard: the external carotid-to-internal carotid artery (EC-IC) Bypass trial, the JET (Japanese EC-IC Bypass Trial), and the COSS (Carotid Occlusion Surgery Study).<sup>8-10</sup> The trials evaluated revascularization in anterior

circulation ischemia and therefore in the posterior circulation. The role of surgical revascularization is largely undetermined. We present 3 cases in which we believe surgical revascularization should be considered in the posterior circulation. This is the rare subset of patients who presents with symptoms of VBI, and yet remain symptomatic despite having a protracted course of maximal medical therapy, with large- and medium-sized vessel occlusions and poor collateral circulation.

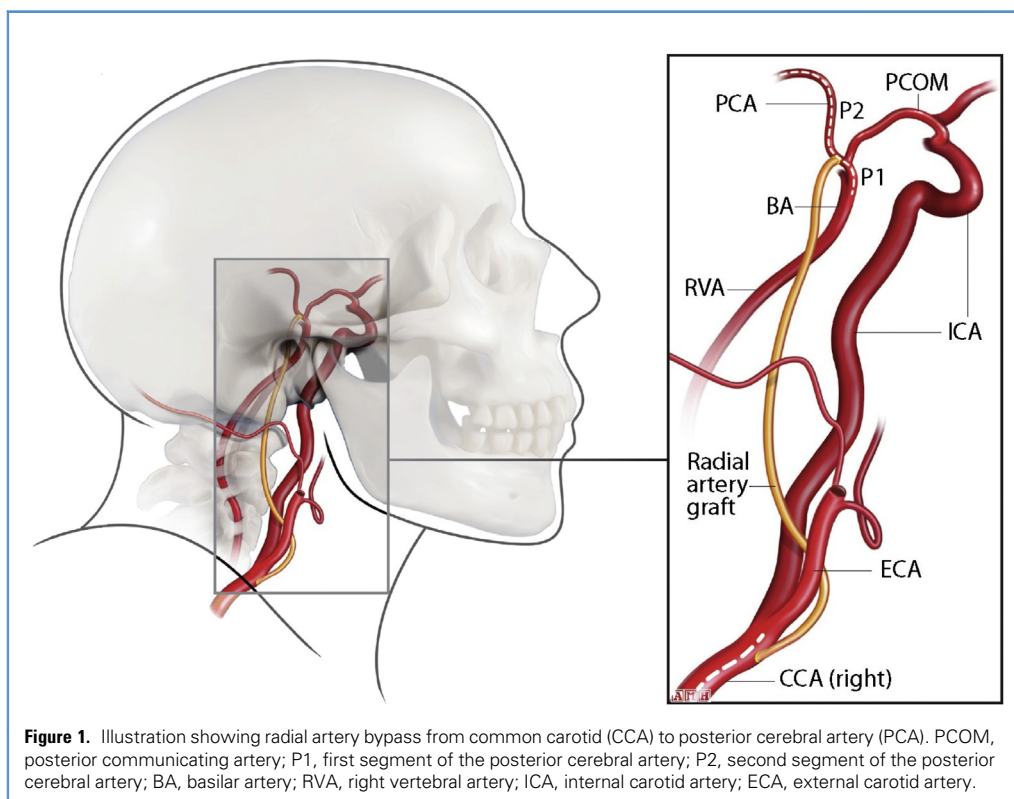
## METHODS

### Study Design

All patients underwent cerebral revascularization for posterior circulation ischemia by the senior author (G.W.B.) from May 2011 to October 2011 (Figure 1). Institutional review board approval for retrospective review of this posterior circulation bypass case series was obtained. Information regarding clinical symptoms and patients' functional status was collected directly from patients or from patients' medical records.

### Indications

In a rare subset of patients with VBI, in which the cause is complete occlusion of the vertebral arteries with small posterior communicating arteries and who fail maximal medical therapy, surgical revascularization may be considered as a viable option. In these patients, the symptoms were flow rather than embolic related, resulting in poor flow into the posterior circulation.



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