Vein Graft Replacement of the Distal Vertebral Artery

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Summary

Vein graft reconstruction of the cervical portion of the vertebral artery has been commonly used for the treatment of atherosclerotic arterial disease. In this article, we describe two instances of vein graft replacement of the distal portion of the vertebral artery. In the first case, the vein graft was placed from C2 transverse foramen to the intradural portion of the vertebral artery to replace an artery abnormally encased and involved by meningioma. The grafting was done in this case to preserve the cerebrovascular reserve in a young patient. In the second case, a vein graft was placed from the extradural C1 portion to the intradural artery beyond the posterior inferior cerebellar artery. This was done to replace a segment of the artery involved by a giant aneurysm, which could not be clipped without occluding the parent artery. In this case, the vein graft replacement was necessitated by changes of somatosensory evoked potentials after the aneurysm was clipped, demonstrating the need to preserve the patency of the artery. Vein graft replacement of the proximal intradural vertebral artery is feasible by the combination of standard cerebro-vascular techniques and the exposures afforded by skull base surgery.

Keywords: Saphenous vein; graft bypass; vertebral artery; meningioma; aneurysm.

Introduction

The saphenous vein has been used successfully as a graft for various intracranial and extracranial vessels of the cerebral circulation. The graft has been used to bypass giant aneurysms, basal tumours, and in occlusive disease of the carotid and vertebral circulation. In this report, we describe two cases of vein graft reconstruction of the distal portion of the vertebral artery. This type of graft reconstruction is a further evolution of the exposures afforded by modern skull base surgery.

Case Reports

Case 1

This 27 year-old woman noticed a lump at the junction of the posterior aspect of her head and high cervical region of six months. The mass was noticed to be progressively increasing in size over the period and she developed severe occipital headaches. She had occasional tingling paraesthesia in her left arm. There was no significant neurological deficit.

The computed tomography (CT) scan of the cervical spine and cranio-vertebral junction revealed a large mass causing bony erosion with intradural extension resulting in displacement of the cord (Fig. 1). Magnetic resonance imaging (MRI) scans revealed encaescence and narrowing of the extracranial vertebral artery (Fig. 2). Angiography showed that the mass was relatively avascular and narrowed the artery (Fig. 3). The ipsilateral vertebral artery was dominant but with good communication and flow from the other vessel. A balloon occlusion test of the vertebral artery was performed. She tolerated occlusion of the artery clinically, but a cerebral blood flow study could not be performed because she complained of severe neck pain with the balloon inflated. A pre-operative biopsy was not performed since it was felt that the lesion was benign.

The surgical procedure was carried out (by L.S.) using an extreme lateral transcondylar approach. The exposure involved left-sided mastoidectomy, retrosigmoid craniotomy, C1 laminectomy and parietal transcondylar approach. The exposure involved left-sided mastoidectomy, retrosigmoid craniotomy, C1 laminectomy and partial resection of the condyle of the occiput. The lateral mass, the transverse process, and the arch of the atlas were mostly destroyed by the tumour. The lateral mass of C2 was also dissected free of muscles, the foramen transversarium of C2 was unroofed, and the vertebral artery was exposed proximal to the tumour. Distal control of the vertebral artery was obtained in the subarachnoid space lateral to the medulla. After adequate dissection of the muscles, the large tumour was progressively debulked. Medially, the tumour extended intradurally into the posterior fossa in front of the spino-macular junction. Extradurally, it extended to the inferior nuchal line superiorly, into the jugular foramen anteriorly, and down to C2 inferiorly. The extradural vertebral artery was completely encased and narrowed by the tumour starting just below the transverse process of C1 to its entrance into the posterior fossa dura.

Dissection of the tumour was attempted to free it from the extradural vertebral artery. At the foramen transversarium of C2, the vertebral artery was displaced posteriorly by the tumour. At the foramen transversarium of C1, the artery was completely encased by the tumour, but there was an adventitial plane between tumour and artery. However, beyond this area, the artery was narrowed, and there was no plane of dissection between it and the tumour.
Fig. 1. Case 1. CT scan showing bony destruction and extent of the tumour. Right: C₁, Left: C₂ level

Fig. 2. Case 1. Right: MRI showing the encasement of the vertebral artery (arrow) by the tumour. Left: Sagittal view with arrow on the encased vertebral artery

not possible to preserve the vertebral artery here, and it was lacerated. Temporary clips were applied to the vertebral artery proximally at the foramen transversarium of C₂ and distally on the intradural portion of the artery. The tumour was then resected with the encased vertebral artery. The long saphenous vein had been previously exposed at the medial aspect of the knee and thigh. The vein was ligated and its lumen was flushed, and distended with heparinized saline solution. It was harvested and used without reversal.

The graft was anastomosed in an end-to-end fashion with 8-0 nylon interrupted sutures initially to the subarachnoid segment, and then to the extradural segment of the vertebral artery, with fishmouthing of the ends of the artery (Fig. 4). The size match between the vein and artery was adequate, the vein dilating to a slightly larger size when blood flow was resumed. The patient was given 5000 units of heparin during the 2 hour period of arterial occlusion, and the patient’s blood pressure was elevated about 40 torr. The patient’s brain was further protected by mild hypothermia and etomidate coma. She tolerated surgery well and awoke without any neurological deficits. Postoperative vertebral angiograms revealed patency of the saphenous vein graft (Fig. 5), but a probable dissection at the site of the balloon test occlusion. Pathologically the tumour was diagnosed as an atypical meningioma with prominent lymphoid infiltr-