Giant Thrombosed Vertebral Artery Aneurysm Treated by Extracranial-Intracranial Bypass and Aneurysmectomy
—Case Report—

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Abstract
A 42-year-old male presented with a giant thrombosed aneurysm of the left vertebral artery. The aneurysm was resected through a combined subtemporal and suboccipital approach after a saphenous vein bypass graft was placed between the right external carotid artery and the posterior cerebral artery. Intraoperative measurements of the blood flow volume and pressure demonstrated good blood flow in the bypass. Postoperatively, uncontrollable hypertension resulted in huge intracerebral hematoma formation and increased intracranial pressure. Control of systemic hypertension is essential in such patients.

Key words: extracranial-intracranial bypass, giant aneurysm, vertebral artery

Introduction
Giant aneurysms of the vertebral artery (VA) are difficult to manage surgically, because the operating field is small and usually surrounded by a markedly compressed brainstem and stretched cranial nerves. Giant VA aneurysms may cause subarachnoid hemorrhage, mass effects, or ischemic complications. Direct surgical treatment includes neck clipping, aneurysmectomy, or proximal parent artery occlusion, but the treatment depends on the characteristics of the aneurysm, hemodynamic conditions in the local arterial system, and the mechanisms causing the symptoms. Neck clipping is regarded as the best treatment, but is usually hindered by the frequent atherosclerotic, fusiform, or dissecting nature of the aneurysms, and intramural thrombosed masses. Proximal VA occlusion may achieve satisfactory results in patients with minimal neurological deficits due to mass effect and adequate collateral blood flow via the contralateral VA or anterior circulation. Aneurysmectomy is essential in patients with severe deficits due to mass effect. When the collateral circulation is poor in these patients, flow-enhancing procedures are mandatory for permanent or even temporary trapping before the aneurysmectomy.

We report a patient with a giant thrombosed aneurysm of the VA treated with a saphenous vein graft and aneurysmectomy.

Case Report
A 42-year-old male who was treated for polycystic kidney suffered from transient weakness in the right extremities in 1985 and 1986. He developed progressive gait disturbance and swallowing disturbance in December, 1991 and was referred to our hospital in January, 1992.

Neurological examination on admission revealed lateral gaze nystagmus in both directions, pareses of the 5th and 7th to 12th cranial nerves on the left and 9th to 12th cranial nerves on the right. Motor weakness, sensory disturbance, and hyperreflexia were also present bilaterally, greater on the right than the left. He could barely walk unassisted due to truncal ataxia. Laboratory data demonstrated that...
serum creatinine and blood urea nitrogen levels had increased to 7.5 mg/dl and 80 mg/dl, respectively, suggesting advanced renal dysfunction. His blood pressure was 180/130 mmHg despite heavy medication.

Magnetic resonance (MR) imaging demonstrated a largely thrombosed aneurysm about 4 cm in diameter on the right side of the posterior fossa (Fig. 1). Left vertebral angiography showed an aneurysmal lumen of fusiform shape located in the posteromedial portion of the mass (Fig. 2). Few vessels were observed branching from the artery or the aneurysm. The right VA was hypoplastic and terminated in the right posterior inferior cerebellar artery and anterior inferior cerebellar artery (AICA). Carotid angiography showed poor collateral circulation to the posterior fossa via the posterior communicating artery or leptomeningeal anastomosis. The balloon occlusion test of the left VA could not be tolerated.

Deterioration of the renal function necessitated hemodiafiltration early in September. Since standing and swallowing disturbances worsened progressively, he underwent surgery on September 29, 1992. A saphenous vein graft was harvested from the right thigh. A right temporosuboccipital craniotomy with C1 and C2 laminectomy was performed in the left recumbent position. The left VA was identified at the ventral side of the lower medulla. The aneurysm compressed the medulla, pons, and right 7th to 12th cranial nerves (Fig. 3). The saphenous vein bypass was placed between the P2 segment of the

Fig. 1 Preoperative MR images, gadolinium-enhanced T1-weighted (upper) and T2-weighted (lower) axial views, showing the aneurysm extended from the level of the foramen magnum (left) to the upper pons (right), displacing the medulla posteriorly and the pons posteromedially from the right.

Fig. 2 Preoperative left vertebral angiograms, anteroposterior (left) and lateral projections (right), showing the VA running from left to right, and the BA elongated horizontally.
right posterior cerebral artery (PCA) and the cervical portion of the right external carotid artery (ECA). Hemodynamic parameters were measured to evaluate the bypass under a mean radial blood pressure of 92 mmHg and carbon dioxide tension of 38 mmHg. The bypass flow volume was 20 ml/min when the blood flow in the left VA was 104 ml/min, and 70 ml/min after left VA occlusion. The mean stump pressure of the left VA was 24 mmHg before opening the bypass and 77 mmHg afterwards. The left VA was ligated after confirming that the bypass flow was stable with little change in vital signs for 30 minutes. Since the distal portion of the parent artery could not be identified through the suboccipital route, the aneurysm was approached subtemporally. Part of the intraaneurysmal thrombus was removed to yield a narrow space between the aneurysm and the pons, through which the basilar artery (BA) could be recognized and clipped temporarily. When a few perforators from the BA, bilateral AICAs, and distal end of the aneurysm were visualized, the clip on the BA was replaced closer to the distal end of the aneurysm. Further debulking of the thrombus and removal of the wall were accomplished through this route as well as through the space between the eighth and ninth cranial nerves.

Recovery from anesthesia was fairly smooth. He could respond appropriately to verbal commands on the following day, although pareses of the right cranial nerves were aggravated. He underwent hemodialfiltration every 2 days. His blood pressure increased to 180/120 mmHg, and was difficult to control. Postoperative computed tomography (CT) showed successful decompression of the posterior fossa (Fig. 4). Intermittent Doppler flowmetry (TC 2-64; EME, Überlingen, Germany) of the bypass showed that the mean flow velocity ranged from 16 to 24 cm/sec (Fig. 5). The blood flow volume was estimated to be above 126 to 186 ml/min assuming that the bypass diameter was 0.4 cm and the angle between the probe and the graft was more than 0 degree.

He suddenly fell into a deep coma with apnea on October 7 due to a large putaminal hemorrhage on the left. Although the bypass flow could be detected for several hours after the ictus, it disappeared afterwards. Since markedly increased intracranial pressure was suspected and both pupils became dilated, removal of the hematoma was abandoned.
He died on October 10.

Discussion

A combined suboccipital and subtemporal approach was necessary in this patient to trap the parent artery for aneurysmectomy, because although C1 and C2 laminectomy and partial removal of the occipital condyle visualized the bilateral VAs and lower half of the aneurysm, the distal parent artery could not be seen (Fig. 3). A saphenous vein graft was initially placed between the PCA and ECA. Hemodynamic measurement was valuable to evaluate the capacity of the bypass to substitute for the supply from the left VA. The bypass increased the stump pressure of the left VA from 24 to 77 mmHg and supplied a flow volume of 70 ml/min. These conditions were confirmed throughout surgery. The mean flow velocity was measured intermittently after surgery, and varied between 16 and 24 cm/sec. These conditions continued for 7 days, until a huge intracerebral hematoma and increased intracranial pressure developed. The hematoma was not considered due to the direct effect of the hemodynamic changes associated with the venous graft, but to possible previous damage to the wall of the lenticulostriate artery. Careful control of systemic hypertension is essential, especially in patients with severe renal dysfunction.

Wakui et al. reported satisfactory results in a similar patient where a saphenous vein graft was placed in the first operation. Since angiography on the following day showed an occluded bypass, another bypass procedure and aneurysmectomy had to be performed later. Our intraoperative measurements showed that the bypass flow volume depended greatly on the VA flow volume: 20 ml/min before VA occlusion and 70 ml/min after. Since slow graft flow is a cause of early graft occlusion, procedures for bypass placement and aneurysmectomy should be performed at the same time.

References


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