

Case Report

A Modified Surgical Technique for Transposition of the Vertebral Artery to the Common Carotid Artery

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Keywords

End-to-side anastomosis · Occlusion · Vertebral artery · Vertebrocarotid transposition

Abstract

A proximal occluded vertebral artery (VA) with reconstitution by muscular collateral vessels is a relatively common finding. However, due to inadequate intracranial anastomosis and hypoplasia or stenosis of the opposite VA, a number of patients develop symptoms of brain ischemia. In the current case, a 63-year-old man presented with repeat neurological symptoms such as dizziness, nausea, vomiting, dysarthria, left hemiparesis, and right hemianopsia. Magnetic resonance imaging revealed multiple posterior infarctions. Angiography revealed the VA to be occluded and reconstituted by collateral vessels. Considering the above results, we performed vertebral carotid artery transposition. However, several technical difficulties were encountered due to space limitations in the operative field and the limited length of the vessels to be anastomosed. To overcome such situations, we introduced a modified posterior wall end-to-side anastomosis technique.

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Introduction

The varied management of patients with vertebrobasilar insufficiency includes medical treatment such as anticoagulation therapy and antiplatelet agents, and surgical treatment

such as vertebral endarterectomy, vertebrocarotid transposition, and saphenous vein graft interposition [1–6]. The origin of the vertebral artery (VA) is a common location for atherosclerotic stenosing lesions, which ultimately lead to vertebrobasilar insufficiency [1]. Although a proximally occluded VA with reconstitution by muscular collateral vessels is a relatively common finding, the collaterals present in some cases do not provide sufficient distal perfusion [7].

Case Report

A 63-year-old man was admitted to the hospital with right hemianopsia. Magnetic resonance imaging on diffusion-weighted imaging showed multiple infarctions in the left posterior cerebral artery territory and the right cerebellar hemisphere. Conventional angiography showed bilateral proximal VA occlusions. However, the left VA was supplied by collateral vessels of muscular branches (Fig. 1). Medical therapy and scheduled endovascular management were administered. After 3 weeks, the patient was readmitted to our hospital with complaints of dizziness, nausea, and occasional vomiting, along with a left-sided hemiparesis and dysarthria. On diffusion-weighted imaging, acute infarctions were observed to have developed in the left midbrain, right cerebellar hemisphere, and vermis. A left vertebrocarotid transposition was performed and he recovered without any complications.

Surgical Technique

The patient was placed in the supine position, with the neck extended to the right side. Under general anesthesia, a 6- to 8-cm linear incision, centered at the clavicle head of the sternocleidomastoid muscle, was placed approximately 2.5 cm above and parallel to the clavicle. The platysma was incised and the sternocleidomastoid muscle separated from the peritrapeal muscles. The common carotid artery (CCA) was then isolated after opening the carotid sheath, and the internal jugular vein was retracted laterally alongside the sternocleidomastoid muscle. The VA was seen to enter the foramen transversarium at the level of C6. The transverse process of C6 was palpated to guide identification and localization of the vessel. On confirming the identification, the VA and CCA were isolated. The initial step in a VA-to-CCA transposition technique is ligation of the VA at its origin using hemoclips. On ligation, the vessel was divided, and we observed complete vessel occlusion by thromboatheroma. Conventional thromboendarterectomy is the chosen technique under such conditions. Next, we clamped the CCA proximal and distal to the planned level of arteriotomy, which was initiated using a No. 11 blade, and completed with a 4- to 4.5-mm diameter arteriotomy punch.

The outside vessel wall on the opposite side was not seen due to its anastomosis to the posterior wall. Furthermore, the short length of the VA made it unfeasible for it to be turned over to expose the posterior wall. Under such circumstances, we performed our modified technique of end-to-side microvascular anastomosis for the posterior wall. Briefly, the VA was set vertical to the CCA. The first stitch was inserted at the distal end of the vessels. For the second suture of the posterior wall, the needle was inserted into the CCA from the outside to the inside and inserted into the VA from the inside to the outside at the proximal end. Without interrupting the suture, the needle was then introduced from the CCA (outside to inside) to the VA (inside to outside) until the inside walls of the VAs and CCAs were seen. This process was repeated three or four times, from the proximal to distal direction. After the second stitch

on the back wall we were clearly able to see the lumen of the VA and the edge of the vessels, thereby providing easy suturing. The third suture was placed in the proximal ends and tied to the end of the second continuous suture. The anterior wall was then sutured by the conventional interrupted suture technique. Before closing the suture line, the distal VA was temporarily unclamped and allowed to backbleed. Pure heparin was used to irrigate the arterial lumen. All arterial clamps were then released. The closure was completed on achieving careful hemostasis (Fig. 2).

Discussion

Severe stenosis of the VAs causes symptoms of vertebrobasilar insufficiency, which is the primary clinical problem in patients with transient ischemic attacks. The successful correction of these vertebral lesions results in the disappearance of symptoms.

Most VA occlusive diseases are located near to their origin and can be relieved by vertebral carotid transposition. Edwards and Edwards [2] described the surgical transposition of the VA to the carotid artery. This procedure has been completed successfully in over 200 cases, with limited morbidity and mortality. The VA can also be transposed to other adjacent vessels, including the thyrocervical trunk or the subclavian artery itself [2].

Areas of atherosclerotic disease that affect the first portion of the VA can be handled successfully by direct transposition of the VA to the carotid artery [2]. In the current case, we encountered difficulty in mobilization due to an insufficient distance between the VA and the CCA, although the atheroma was removed at the first portion of the VA. Alternately, we could have considered removing the foramina transversarium and/or graft with other vessels. However, transposition of the VA to other vessels is generally much more difficult and has not been as successful as transposition to the carotid artery. Moreover, since other vessel grafts require more extensive dissection and longer operating time and increase local morbidity, their use is probably not warranted. We encountered several technical difficulties in microvascular anastomosis due to space limitations in the operative field and the limited length of the vessels to be anastomosed. To overcome such situations, we modified the existing technique.

We believe that the modified technique is useful for end-to-side microvascular anastomosis as well as for anastomosing vessels that are difficult to mobilize due to limited vessel length.

Conclusion

The most important advantage of our technique is that each suture can be clearly visualized and that it is possible to anastomose with a limited vessel length. We therefore advocate this method of posterior wall continuous technique in microvascular reconstruction using end-to-side anastomosis. This technique might render end-to-side microvascular anastomosis less stressful for the microvascular neurosurgeon.

Statement of Ethics

Informed consent to publish his case was obtained from our patient.

Disclosure Statement

The authors have no conflicts of interest to disclose.

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Fig. 1. **a** Conventional angiography of the right subclavian artery showed an occluded right vertebral artery. **b** Conventional angiography of the left subclavian artery revealed that the left vertebral artery origin was occluded and collateral circulation had developed through the muscular branches.

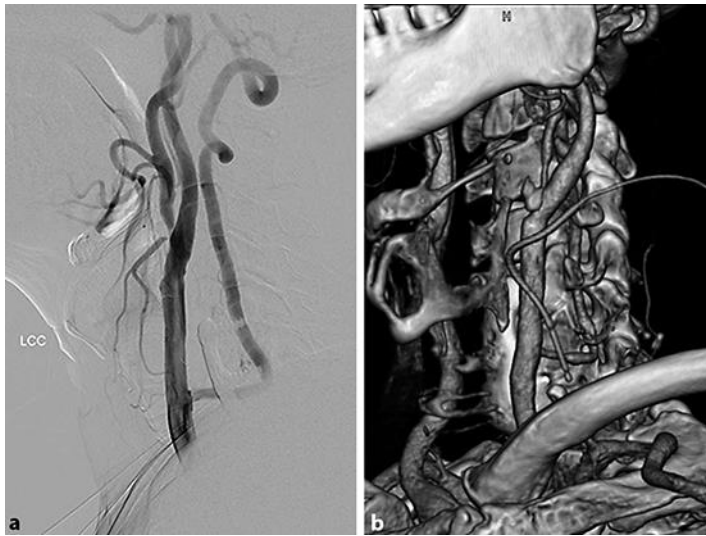


Fig. 2. **a** Postoperative angiogram of the left common carotid artery (LCC) showing vertebrocarotid transposition completed simultaneously with carotid endarterectomy. We found excellent flow into the left vertebral artery and complete reconstitution of the highly stenotic left internal carotid artery. **b** Computed tomography angiography revealed vertebrocarotid anastomosis related with surrounding structures.