Technical Note

The preparation of anastomosis site at the insular segment of middle cerebral artery

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Abstract

Background: An anastomosis at the insular segment of the middle cerebral artery (M2) is often required in cerebral reconstruction with high- or low-flow bypass. It is necessary to create a shallow, wide, fixed, and bloodless anastomosis field to achieve a safe and quick anastomosis for low surgical morbidity. We describe a method to perform a safe and quick anastomosis.

Methods: From 2009 to 2013, the technique was used in 20 procedures to create an extracranial M2 high-flow bypass. The Sylvian fissure was dissected wide open to expose the M2. A silicon sheet was laid under M2 and the absorbable gelatin-compressed sponges were inserted between M2 and the insula cortex to lift up the M2 and fix it. The rolling surgical sheets were placed at each edge of the dissected Sylvian fissure, instead of brain spatulas. Finally, a small suction tube was placed at the Sylvian fissure and cerebrospinal fluid was continuously sucked. The postoperative patency of the bypass was evaluated by three-dimensional computed tomographic angiography (3D-CTA) in the acute and chronic stages.

Results: In all cases, the operation field acquired for the anastomosis was adequate. The average time required for the procedure was 19 min 27 s. Good patency of all high-flow grafts was confirmed by postoperative three-dimensional computed tomography angiography (3D-CTA).

Conclusion: In our series, there were no technical complications related to the anastomosis at M2 performed according to our method.

Key Words: Anastomosis, high-flow bypass, middle cerebral artery

INTRODUCTION

Most internal carotid artery (ICA) aneurysms can be treated using direct surgical and endovascular methods; however, some aneurysms such as giant cavernous aneurysms and intracranial carotid dissection cannot be treated with these methods. In such cases, a high-flow bypass is necessary to achieve cerebral revascularization. In patients with complex ICA aneurysms, it is imperative to assess and perioperatively prevent graft problems that might cause severe ischemic complications. Graft occlusion can occur anytime, and early graft occlusion can be related to intraoperative problems and technical problems, usually a thrombus at the anastomosis...
site. Therefore, surgeons must acquire techniques of anastomosis to prevent graft complications. This article describes a technique used in the preparation of tissues for anastomosis between a graft and the middle cerebral artery.

**MATERIALS AND METHODS**

**Operative technique**

It is necessary to create a shallow, wide, fixed, and bloodless field for a safe anastomosis. The preparation of the field follows several steps.

First, Sylvian fissure is dissected widely and bloodlessly to expose the vessel from the horizontal segment of the middle cerebral artery (M1) to the distal M2 after conventional fronto-temporal craniotomy. Through a wide dissection of the Sylvian fissure, a wide anastomotic space can be created.

Second, a silicon sheet is laid under M2 [Figure 1] and wet absorbable gelatin-compressed sponges are inserted between M2 and the insular cortex [Figure 2] to lift up the M2 portion to the shallow field to facilitate manipulation. The amount of wet absorbable gelatin-compressed sponges should be enough to allow the fixation and elevation of M2. Moreover, the laid silicon sheet functions as further fixation during the anastomosis operation.

Third, it is necessary to hold the brain tissue apart to maintain the wide operative field. In general, spatulas are used as brain retractors by inserting them in parallel to the brain surface. However, the use of spatulas limits hand movement during the procedure because the direction of the spatulas is in line with that of the surgeon’s hands. To avoid such limitation, rolling surgical sheets are placed at each edge of the dissected Sylvian fissure, instead of brain spatulas [Figure 3]. The rolling sheets act as tension poles between the frontal and temporal lobes and maintain the operative field wide open without limiting hand movement.

Fourth, for good visualization, the edge of the anastomotic site is stained with gentian violet to visualize the arterial adventitia [Figure 4]. Good visualization enables correct intima-to-intima suturing of the vessel wall.

Finally, a small suction tube such as a neonatal feeding tube is placed at the bottom of the spread Sylvian fissure, and cerebrospinal fluid is continuously sucked to obtain a semi-wet and bloodless operative field [Figure 5].

After all the processes are completed, the anastomosis is performed. A running suture is used for anastomosing M2 with the free graft, which could be a segment of the radial artery or saphenous vein, using a 7-0 monofilament nylon under high magnification [Figure 6].

**RESULTS**

The technique was used from 2009 to 2013 in 20 cases of extracranial M2 high-flow bypass for unclippable
aneurysm. Patients comprised 3 men and 17 women (mean age 59 ± 15.8 years; range 10-80 years), and 11 radial artery grafts and 9 saphenous vein grafts were used. The average time for declamping M2 was 19 min 17s (range 11 min 13s to 34 min 30s). The incidence of permanent morbidity was 0% and all postoperative three-dimensional computed tomography angiography (3D-CTA) demonstrated good graft patency by 4 months after the operation.

**DISCUSSION**

Although there have been several reports describing the efficacy and techniques of cerebral reconstruction with high- or low-flow bypass,[1,3,4] no standard technique concerning the preparation for anastomosis has been reported. A safe and quick anastomosis is one of the important elements behind low surgical morbidity at bypass surgery, and it is necessary to create a shallow, wide, fixed, and bloodless anastomosis field. We prepared a field that met these conditions without the need for extra medical materials. Although the surgical sheet, absorbable gelatin-compressed sponge, silicon sheet, and neonatal feeding tube are standard medical materials and can be easily changed to match the size of the site, there are some technical points that must be addressed.

The wet absorbable gelatin-compressed sponge can be packed at the anastomosis site without causing stress for the brain. However, the surgeon must pay attention to the small cortical artery branching out from M2. If the cortical artery interferes with the packing sponge, it is necessary to cut the artery to lift the M2 segment. Although cutting of a small cortical artery does not cause symptomatic cerebral infarction in our cases, surgeons must keep in mind the existence of the long insula artery that derives from M2 and supplies the corona radiata.

When rolling surgical sheets are inserted into the Sylvian fissure, it is necessary that the Sylvian fissure be sufficiently dissected. The widely spread fissure allows the insertion of a large rolling surgical sheet without unnatural stress upon the frontal and temporal lobes and, thereby, forms a wide anastomosis field.

The shortened declamping time of M2 reduces the incidence of ischemic complications. Although the declamping time differs depending on the collateral circulation, around 30 min was empirically considered a safe period of time. In our experience, more than 30 min was required in one patient due to size discrepancy between M2 and the graft. However, the average time was within 20 min and the incidence of ischemic complications was 0%.

**CONCLUSION**

We described here a simple technique for anastomosis at M2 that improves safety and efficiency. We observed no thrombus at the anastomosis site when using this technique.
REFERENCES

1. Houkin K, Kamiyama H, Kuroda S, Ishikawa T, Takahashi A, Abe H. Long-term patency of radial artery graft bypass for reconstruction of the internal carotid artery. J Neurosurg 1999;90:786-90.

2. Kamiyama H, Takahashi A, Houkin K, Mabuchi S, Abe H. Visualization of the ostium of an arteriotomy in bypass surgery. Neurosurgery 1999;33:1109-10.

3. Patel HC, Teo M, Higgins N, Kirkpatrick PJ. High flow extra-cranial to intra-cranial bypass for complex internal carotid aneurysms. Br J Neurosurg 2010;24:173-8.

4. Sekhar LN, Natarajan SK, Ellenbogen RG, Ghodke B. Cerebral revascularization for ischemia, aneurysms, and cranial base tumors. Neurosurgery 2008;62 (6 Suppl 3):1373-408.