Continuous Suction Method in Superficial Temporal Artery-Middle Cerebral Artery Anastomosis Surgery

—Technical Note—

Jun-ichi KOYAMA, Yuichiro TANAKA, Tomomi IWASHITA*, Kazuo KITAZAWA**, and Kazuhiro HONGO

Departments of Neurosurgery and *Intensive and Critical Care Medicine, Shinshu University School of Medicine, Matsumoto, Nagano; **Department of Neurosurgery, Aizawa Hospital, Matsumoto, Nagano

Abstract

A new method was developed to maintain a bloodless microscopic operative field for superficial temporal artery-middle cerebral artery (MCA) anastomosis surgery. A silicone suction tube with multiple holes is placed circumferentially under the reflected dural flaps around the craniotomy. Blood and irrigated saline are continuously aspirated by the tube. Use of this method in nine patients significantly reduced the mean MCA trapping time (24.0 ± 2.8 min) compared with nine patients treated using the conventional method (30.1 ± 4.6 min). MCA trapping time is shortened because the surgery is not interrupted for manual suctioning of bloody cerebrospinal fluid.

Key words: continuous suction, cerebrospinal fluid, superficial temporal artery-middle cerebral artery bypass

Introduction

Superficial temporal artery-middle cerebral artery (STA-MCA) anastomosis is clearly needed in patients with MCA stenosis or internal carotid artery lesions causing obvious misery perfusion, although the cooperative study of extracranial-intracranial arterial anastomosis failed to demonstrate reduced risk of stroke in patients with cerebral ischemia. Ischemic complications due to prolonged MCA trapping should be avoided. Suturing accounts for most of the MCA trapping time and is often prolonged by bloody cerebrospinal fluid (CSF) because even a small amount of blood may interfere with the microscopic operative view. Bleeding may occur from the skin, temporalis muscle, dura mater, or soft tissue around the isolated STA, gradually accumulates on the epidural layer, and finally flows onto the brain surface. If we can prevent this blood inflow, the microscopic operative field will be completely bloodless. Elaborate hemostasis was the target before introduction of the operating microscope, but perfect interruption of the blood stream onto brain surface was hard to maintain during intradural procedures, despite an assistant cleaning the operative field.

Here we describe a continuous suction method to clean the operative field throughout the microscopic procedure.

Materials and Methods

Eighteen patients, six women and 12 men aged 39–74 years (mean 64.5 years), were treated with STA-MCA anastomosis surgery for symptomatic MCA stenosis between June 2002 and July 2004. Xenon-enhanced computed tomography cerebral blood flow studies in these patients confirmed hypoperfusion and steal phenomenon during acetazolamide stress in the related region of brain. The new continuous suction technique was used in nine consecutive patients who underwent STA-MCA bypass surgery. The MCA trapping time, which includes MCA incision and STA-MCA suturing, the anastomosis patency rate, and other surgical requirements were compared with nine cases treated with the conventional technique. All microscopic procedures were carried out by the same surgeon with experience of more than 50 cases of bypass
surgery assisted by a neurosurgeon.

**Operative Technique**

The scalp incision was made over a suitable STA branch and the artery was exposed and freed from the fascia of the temporalis muscle. The temporalis muscle was cut and bleeding was controlled carefully using a monopolar coagulator. A craniotomy of about 3 cm diameter was made. Bleeding from the middle meningeal artery and bone edge of the craniotomy was managed. The dura mater was carefully cut to prevent tearing of the arachnoid membrane and was tacked up with silk threads. At this stage, a silicone tube was prepared for cisternal drainage (Silascon® E-4L-12; KANEKA MEDIX Corporation, Osaka) by making 10 holes in the tube within 10 cm from the tip using scissors. The tube was laid circumferentially along the craniotomy under the reflected dural flaps (Fig. 1A). This suction tube completely aspirated blood from the skin, temporalis muscle, and epidural space, as well as saline injected by the assistant and CSF leaking outside the dura. Therefore, the operator was freed from the suction maneuver and could concentrate on the suturing procedure (Fig. 1B). After the anastomosis was completed, Doppler flow sonography was performed to confirm adequate blood flow in the donor and recipient arteries. The free bone flap was trimmed around the STA and fixed back with titanium plates. The temporalis muscle and fascia were reconstructed anatomically.

**Results**

Average time for MCA trapping in the cases with the continuous suction method (24.0 ± 2.8 min) was significantly shorter (p = 0.0038, unpaired t-test) than that in the cases using the conventional method (30.1 ± 4.6 min). Satisfactory patency of the anastomosis was confirmed by postoperative angiography in all 18 cases. There were no special surgical risks or complications in cases with the present method.

**Discussion**

Previously reported methods of continuous suction method provide a clean, dry operative field during suturing, but encourage the aspiration of bloody CSF from beneath the suture area. Our technique causes less overdrainage and subsequent brain sinking because only CSF leaking outside the dura is aspirated.

Turbidity caused by the blood in the intradural space arises from blood inflow from the extradural space, cranial diploe, muscle tissue, and skin. All possible efforts must be made to inhibit this inflow by hemostasis with dural tenting, bone waxing, and bipolar coagulation. However, such macroscopic procedures may not prevent the slight blood inflow which can interfere with the microscopic operative field. The present continuous suction method completely excludes blood from the extradural layer and allows artificial flushing of the extradural space. Some advantages of this method are as follows: Limited irrigation of the microscopic operative field can keep the most critical area free of blood; the need to change from microforceps to sucker is reduced; the assistant does not perform continuous aspiration; and brain sinking hardly occurs because of sporadic irrigation which maintains appropriate CSF at the anastomotic site.

We found this method shortened the MCA trapping time without complications. To maximize effectiveness of this method, we added some technical refinements: Brain surface should be horizontal as far as possible to prevent excessive aspiration of CSF, which may result in brain sinking; cotton tampons used to bridge the extra- and intradural spaces should be removed; and all holes in the suction tube should be covered with cotton sheet to obtain sufficient aspiration.

This new suction method is simple and can be easily applied with a widely used silicone tube. Clearance of the microoperative field is improved...
and perfect arterial suturing is possible in shorter times, with improved surgical outcomes for patients undergoing STA-MCA anastomosis surgery.

References


Address reprint requests to: J. Koyama, M.D., Department of Neurosurgery, Shinshu University School of Medicine, 3-1-1 Asahi, Matsumoto, Nagano 390-8621, Japan.
e-mail: koyaman@hsp.md.shinshu-u.ac.jp

Commentary

The authors have described a clever technique to maintain a dry and bloodless field during superficial temporal artery to middle cerebral artery anastomosis. As emphasized by the authors, meticulous technique is necessary to minimize occlusion time during extracranial to intracranial bypass surgery. Epidural and extracranial bleeding that flows into the operative field is annoying and prolongs the operation unnecessarily. The authors have modified a ventricular drainage tube, laid circumferentially beneath the reflected dural flaps, to continuously suction irrigation fluid in any blood oozing to maintain a dry field.

This technique is a variation on the technique originally described by Spetzler and Iversen. I have used the commercially available Spetzler suction for the same purpose during many vascular procedures, including carotid endarterectomy and extracranial to intracranial bypass, and have found the technique to be quite useful.

Daniel L. BARROW, M.D.
Department of Neurosurgery
Emory University
Atlanta, Georgia, U.S.A.

Koyama et al. from Shinshu University describe a simple yet refined method of maintaining a bloodless operative field for brain bypass surgery. I think that many neurosurgeons had been using this continuous epidural suction technique in performing not only bypass surgery but also various neurosurgical procedures. However, to my knowledge, this method has not yet been described precisely in the neurosurgical literature. The authors are to be commended for that and for their excellent description of the continuous suction method.

Kazuo MIZOI, M.D.
Department of Neurosurgery
Akita University School of Medicine
Akita, Japan

To minimize ischemic time and to improve successful rate in cerebral revascularization procedure, it is pertinent to keep a clean and dry operation field during the anastomosis of vessels. In this article, the authors proposed a technique of continuous suction method in superficial temporal artery-middle cerebral artery anastomosis surgery. A silicon tube from the ventricular drainage set was placed at the subdural space for continuous suction during the anastomosis. The authors found that the ischemic time needed for vessel anastomosis was significantly reduced when the interference of blood-tinged cerebrospinal fluid was minimized by this continuous suction method.

For many years, we also used a similar method for continuous suction during vascular anastomosis with satisfactory results in our institution. However, in our own technique, we use a much smaller caliber silicon tube from ventriculo-peritoneal shunt set or intravenous catheter set for parenteral nutrition. This is our feeling that using this small caliber tube is better and safer in anastomosis for deep seated vessels. The suction effect is also better when the anastomosis is at the depth of a sulcus during superficial temporal artery-middle cerebral artery anastomosis.

Yong-Kwang TU, M.D.
Department of Neurosurgery
College of Medicine and Hospital
National Taiwan University
Taipei, Taiwan, R.O.C.