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Technical Note

Usefulness of continuous suture using short-thread double-armed micro-suture for cerebral vascular anastomosis

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Abstract

Background: When microvascular anastomosis is performed in a deep, narrow operating field, securing space to throw knots is difficult. To simplify the procedure and avoid obstruction of the anastomosis, we use a continuous suturing with short-thread double-armed micro-suture.

Methods: Sixty-four patients (38 cerebral revasculazation, 16 moyamoya disease, and 10 aneurysm surgery) undergoing microvaucular anastomosis were included. During anastomosis, a continuous suture was placed with short-thread double-armed micro-suture.

Results: During 64 microanastomosis procedures, 64 consecutive continuous sutures were performed with 1-year follow up. All patients showed patency of anastomosis with long-term follow up.

Conclusions: This technique is especially useful for anastomosis in a deep, narrow surgical field, such as in superior cerebellar artery anastomosis.

Key Words: Anastomosis, continuous suture, double-armed micro-suture

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INTRODUCTION

During microvascular anastomosis, patency of the anastomosis is critical. However, when anastomosis is performed in a deep, narrow operating field, securing space to throw knots is difficult, even on the more easily accessible side of the vessel in the operating microscope field. To simplify the procedure and avoid obstruction of the anastomosis, we use short-thread double-armed micro-suture to place a running suture.

MATERIALS AND METHODS

Sixty-four patients (38 cerebral revasculazation, 16 moyamoya disease, and 10 aneurysm surgery) receiving microvascular anastomosis participated in the 5-year study at our institute [Table 1]. All patients were collected prospectively. After microvascular anastomosis, indocyanine green (ICG) videoangiography was performed to determine the patency of anastomosis.

Operative technique

We use 6 cm 10-0 nylon double-armed micro-suture (Bear Medic Corp., Tokyo, Japan) with a needle at both suture ends [Figure 1]. The needle types are 1/2 circle and 3/8 circle. The end of the donor vessel is cut obliquely and incised lengthwise. We use pyoktanin blue (crystal violet) to improve visibility of surfaces to be sutured. Anchoring sutures are applied on both sides of the lumen. To avoid obstruction of the anastomosis resulting from "purse string" and puckering effects, mattress sutures are used for anchoring. These sutures cause eversion of the vessel ends for easier attachment of the recipient endothelium to donor endothelium. It is possible to avoiding the "purse string" and puckering effects with a continuous suture in the bypass procedure, with correct lengthwise placement of suture on the donor and recipient vessels. If suturing is technically difficult in deep surgical areas, an initial running suture is placed on the least accessible side with the 1/2 circle needle. After the donor artery is situated in the reverse direction, the lumen of the opened vessel is inspected, to confirm that the contralateral sutures lie correctly. A second suture is applied on the more easily accessed side of the vessels. After suturing, temporary clips are removed and patency is confirmed by ultrasonography or intraoperative ICG videoangiography [Figure 2].

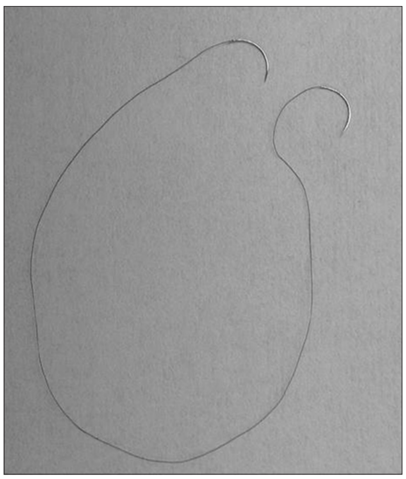

Figure 1: Photograph of short-thread double-armed microsuture (6 cm 10-0 nylon with a needle at both ends)

RESULTS

During the 64 anastomosis procedures, 64 consecutive continuous suture using short-thread double-armed microsuture were performed. An average occlusion time of recipient artery was 19-45 min [Table 1]. In all cases, intraoperative ICG videoangiography showed the patency of anastomosis. With one year follow-up, problematic obstruction of bypass was not seen in three-dimensional computed tomographic angiography (3D-CTA) or angiography and magnetic resonance angiogram (MRA).

Illustrative case: External carotid artery-superior cerebellar artery bypass with a saphenous vein graft

A 65-year-old male with right vertebral artery and basilar artery occlusion was suffering from progressive hemodynamic vertebra-basilar stroke in spite of medical treatment. To prevent progressive stroke, we treated the patient with external carotid artery-cerebellar

Table 1: Characteristics of patients undergoing continuous micro-suture

	Cases	Occlusion time (min)
Total	64	19-45
Cerebral revascularization	38	19-35 (ave 23)
Moyamoya disease	16	19-36 (ave 28)
Child case	6	
Aneurysm surgery	10	
High flow bypass with graft	12	26-45 (ave 35)
Postoperative ICG videoangiography	64	
Patency	100%	

ICG: Indocyanine green, ave: Average, min: Minute

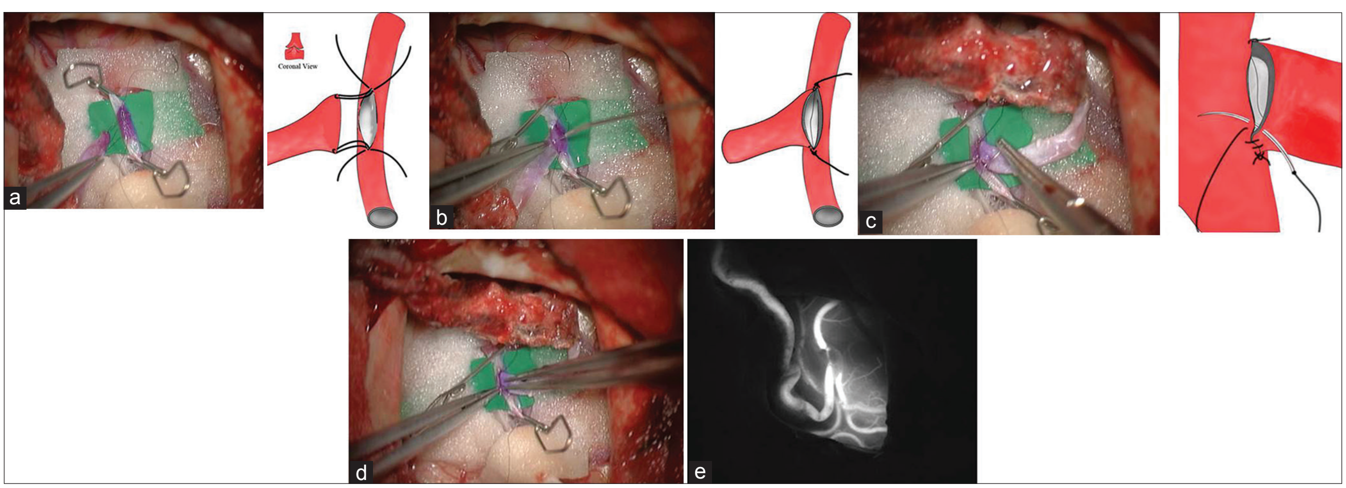

Figure 2: Intraoperative photographs of superficial temporal artery-middle cerebral artery anastomosis and schemas showing microanastomosis with short-thread double-armed microsuture. (a) Microsuture insertion. Out-in for donor artery, In-out for recipient artery. (b) Mattress sutures are placed for anchoring. This technique causes eversion of the vessel ends for attachment of recipient endothelium to the donor artery. (c) Running suture is placed without the "purse string" and puckering effects. (d) Vessel ends are visualized with pyoctanin (crystal violet) for attachment of endothelium. (e) Patency of anastomosis is confirmed by indocyanine green videoangiography

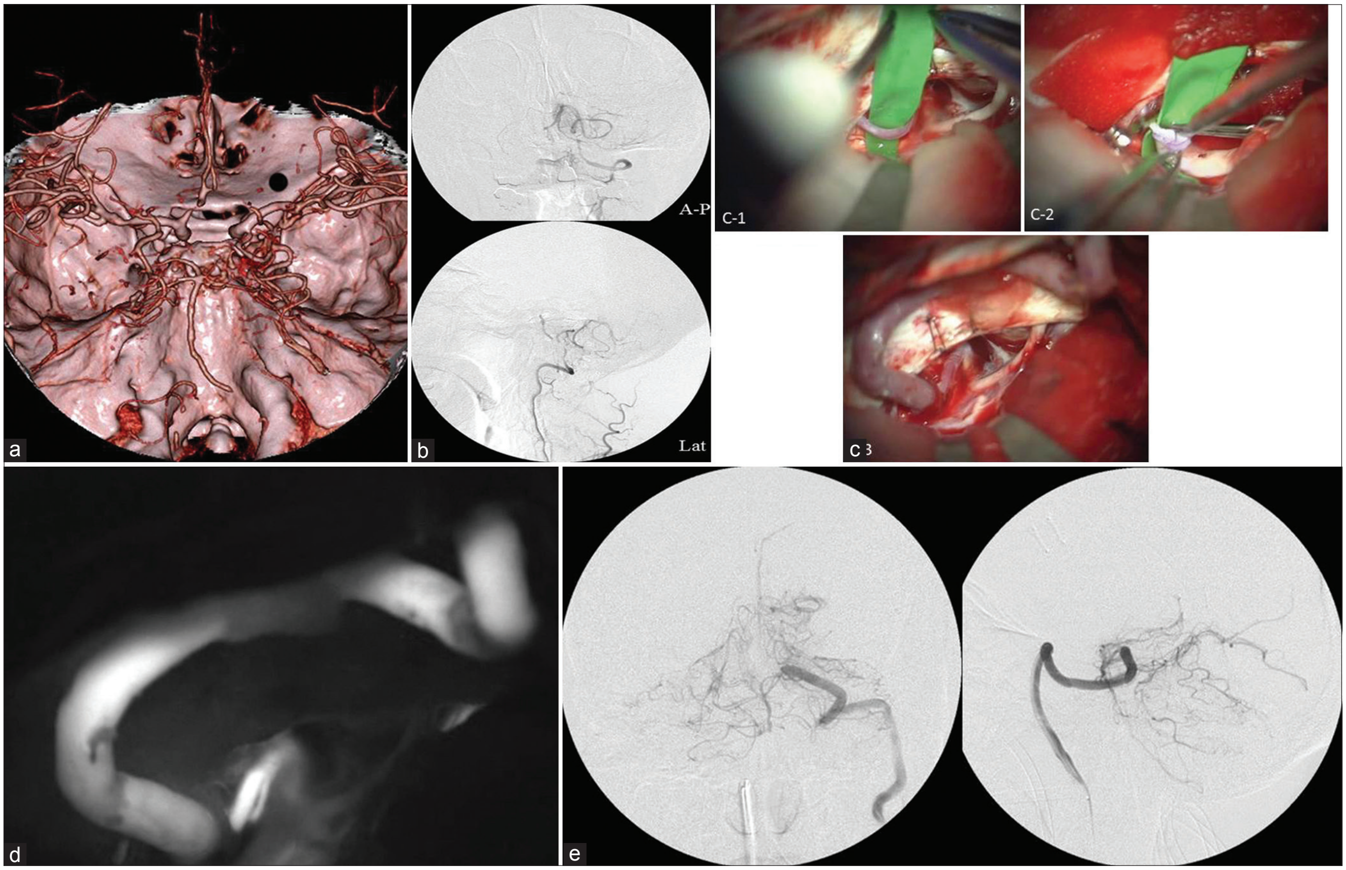

Figure 3: Illustrative Case: External carotid artery-superior cerebellar artery bypass with a saphenous vein graft (ECA-SV-SCA bypass). (a) Preoperative three-dimensional computed tomographic angiography. (b) Preoperative angiography of vertebral artery, right. (c) Intraoperative photographs of ECA-SV-SCA bypass. (d) ECA-SV-SCA with indocyanine green videoangiography. (e) Postoperative angiography of vertebral artery, right

artery high-flow bypass with a saphenous vein graft (ECA-SV-superior cerebellar artery [SCA] bypass).

A continuous suture was placed with short-thread double-armed microsuture. An occlusion time of SCA was 38 min. Flow through the SCA and the bypass was confirmed intraoperatively with ICG videoangiography [Figure 3]. The patient's postoperative course was uneventful.

DISCUSSION

Since its original description by Yaşargil[8] in 1969, intracranial bypass has remained a highly technical, demanding revascularization procedure. The ability to perform these technically challenging operations is also necessary in the treatment of giant aneurysms and skull base tumors, indications that were never critically evaluated.

The continuous suture technique is easier to perform, is associated with less anastomotic leakage, and requires less surgical time than other techniques.[1,3-7] The drawbacks of the continuous suture bypass procedure have been the "purse string" and puckering effects.[8] We can avoid these problems by using mattress sutures for anchoring. Recently, Aihara *et al*. also reported the mattress suture as a useful technique in microvascular anastomosis.[2] The use of mattress sutures causes eversion of vessel ends for easier attachment of recipient endothelium to the donor artery. However, interrupted horizontal mattress anastomosis required more time for occluding cerebral blood flow. We use mattress sutures just for anchoring. Following continuous suture shorten the surgical time. For high flow bypass in deep surgical field, an average occlusion time was 35 min. This technique had shorter time for occlusion than with a conventional anastomosis with interrupting suture in our institute.

A disadvantage of our procedure is it required many needles. Sometimes, it might be troublesome in a narrow deep surgical field. We think it improves by experience.

The creation of an intracranial micro-anastomosis within a deep and narrow surgical field is extremely technically difficult. Our technique allows for an easier and faster micro-anastomosis with less anastomotic leakage intraoperatively and good postoperative results.

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