

## Technical Note

# Rescue revision techniques for end-to-side anastomosis: Technical note

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## Abstract

**Background:** Extracranial-intracranial bypass operation is an essential procedure for cerebrovascular surgeons. Proper procedure of the bypass requires special skills, selected instruments, and training in the microsurgical laboratory. In spite of the high success rate for extracranial-intracranial bypass, a potential pitfall while performing an end-to-side anastomosis is poor blood flow or occlusion at the anastomotic site during surgery. If this happens, revision procedure is necessary.

**Methods:** We introduce our salvage techniques for anastomosis revision with or without recipient artery occlusion.

**Results:** With this method, ischemic complication related to revision procedure minimizes ischemic complications.

**Conclusions:** The present technique is a simple method for anastomosis revision.

**Key Words:** Anastomosis, bypass, occlusion, revision, surgery

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## INTRODUCTION

Superficial temporal artery-middle cerebral artery (STA-MCA) bypass has been used in the management of selected atherosclerotic cerebrovascular occlusive disease, moyamoya disease, artery involved tumors, and unclippable aneurysms.<sup>[1-6]</sup> STA-MCA bypass, especially in patients with moyamoya disease, demands a higher level of technical skill because the recipient arteries are usually small and fragile. Although the success rate for STA-MCA bypass is high, immediate donor occlusion occurs in a small number of patients and anastomosis revision is necessary in such cases. If immediate occlusion of the donor artery at bypass site is seen, surgeons usually reopen and simply revise the anastomosis [Figure 1a].<sup>[1]</sup> Although this simple technique achieves the patency of bypass flow in almost all cases, it does not work in a few cases and might result

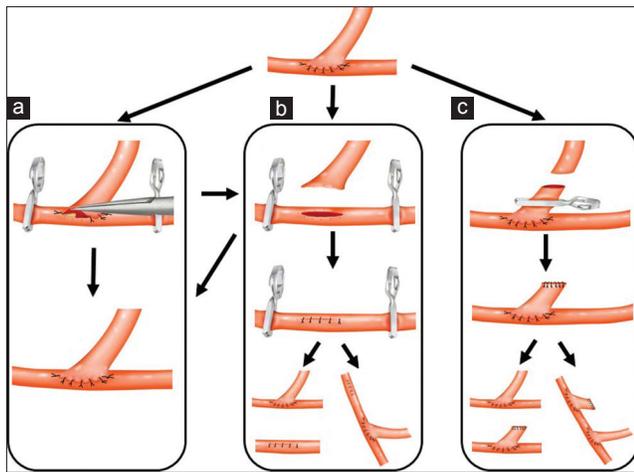
in recipient occlusion because surgical manipulation causes the endothelial injury of recipient artery. Additionally, this simple technique requires an additional recipient occlusion and it might take a long time compared with the initial anastomosis procedure.

In this technical note, we introduce salvage techniques if immediate occlusion happens at the end-to-side anastomotic site.

## DESCRIPTION OF THE TECHNIQUE

End-to-side anastomosis is performed in the standard manner as described elsewhere.<sup>[1,4,5]</sup> The bypass patency is checked with intraoperative indocyanine green (ICG) videoangiography and Doppler flow meter. When either poor filling or occlusion of the donor artery happens, revision

procedure is carried out with two methods as described below [Figure 1]. The anastomotic site is fully re-opened. The arteriotomy is simply closed with 10-0 or 11-0 nylon under temporary occlusion of the recipient artery [Figure 1b]. Then, the new end-to-side bypass was performed between the remote or near cortical artery and the same donor artery. Although this method could be applied in case of the donor and/or the recipient occlusion after the unsuccessful standard revision procedure, the additional recipient occlusion is needed [Figure 1]. Another revision technique requires no recipient occlusion. The donor artery is clipped and sectioned (upper column of Figure 1c). Then, the divided artery is closed with nylon suture and the clip is removed. The new end-to-side bypass is done at other site.



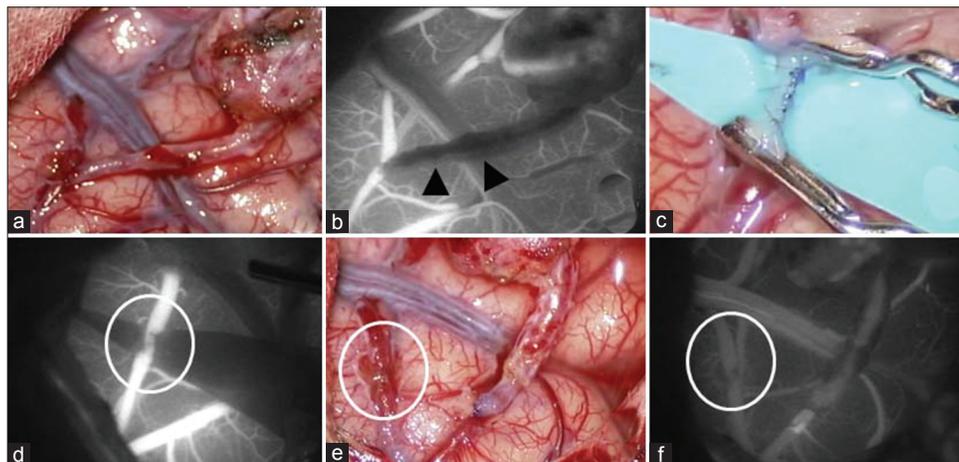
**Figure 1: Illustrations of traditional and present anastomosis revisions. The uppermost image shows the end-to-side anastomosis before revision. (a) Traditional revision technique. (b) One of the present revision techniques in case of the donor and recipient occlusions. (c) The new revision technique for the donor occlusion without additional parent artery occlusion**

## ILLUSTRATIVE CASE 1

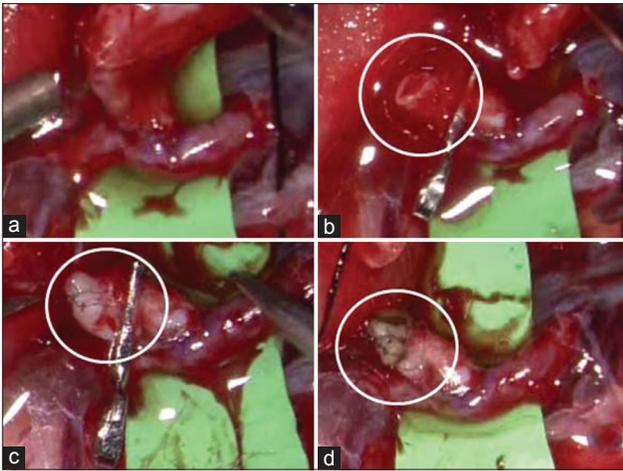
A 13-year-old boy complained of a transient ischemic attack and he was diagnosed as having a moyamoya disease. He underwent the direct and indirect revascularization surgery in both sides. During the right-sided surgery, ICG videoangiography showed donor occlusion after anastomosis [Figure 2a, b]. Therefore, the anastomotic site was partially opened and the re-anastomosis was performed after removing the intraluminal thrombus. However, the frontal cortical artery, in addition to the parietal branch of STA was not flowed. The parietal branch was detached and the longitudinal arteriotomy of the frontal cortical artery was simply closed [Figure 2c]. After confirmation of the blood flow of the occluded cortical artery [Figure 2d], the new bypass was successfully done at the remote site [Figure 2e, f]. Postoperative course was uneventful.

## ILLUSTRATIVE CASE 2

A 78-year-old man presented with a minor cerebral infarction caused by the left internal carotid artery occlusion. Cerebral blood flow study demonstrated the misery perfusion in the left MCA territory. STA-MCA bypass was scheduled. The parietal branch of STA was anastomosed to the cortical branch [Figure 3a]. The patency of the anastomosis was not confirmed on micro-Doppler probe and ICG videoangiography. Therefore, the parietal branch was sectioned after applying a microclip [Figure 3b] and the sectioned site was closed with 10-0 nylon suture [Figure 3c]. The applied clip was removed [Figure 3d] and the new bypass was made at the distal site. Postoperative three-dimensional computed



**Figure 2: (a) An end-to side anastomosis between the parietal branch and the frontal cortical artery. (b) Indocyanine green (ICG) videoangiography showing the donor occlusion (black arrowheads). (c) A simple closure of the linear arteriotomy after detachment of the donor artery. (d) Follow-up ICG showing the patency of the recipient and the stenosis (open circle). (e) The new end-to-side anastomosis at the remote artery. (f) Final ICG showing the patency of the new anastomosis**



**Figure 3: (a) The anastomotic site before revision. (b) Sectioning of the superficial temporal artery (white circle) after placing a microclip. (c) Tying of the sectioned artery (white circle). (d) The final view of the sutured superficial temporal artery after removing the microclip (white circle)**

tomographic angiography demonstrated the patency of the revised anastomosis and no abnormal finding at the sectioned and tied occluded anastomosis site.

## DISCUSSION

Intraoperative bypass occlusion may potentially lead to cerebral ischemia. Therefore, reliable rescue techniques for failure of the end-to-side anastomosis may decrease the surgical morbidity associated with bypass surgery. Salvage techniques are rarely cited in literatures describing how to perform the anastomosis revision. If the anastomosis is not patent, traditional rescue procedure would be the re-opening of the anastomotic site followed by the re-suture after careful inspection.<sup>[1]</sup> However, in a few cases, this might result in the recipient occlusion in addition to donor occlusion as shown in the illustrative case 1. In this situation, simple closure of the linear arteriotomy recovers the blood flow of the recipient artery (Case 1). However, this rescue technique needs further temporary occlusion of the recipient artery which will lead to an ischemic complication. Additionally, this rescue technique causes

recipient stenosis [Figure 2]. Since the re-opening of the occluded anastomotic site occasionally results in a recipient occlusion, new end-to-side bypass occasionally seems to be a safe technique in some cases. Regarding rescue technique as described in the illustrative case 2, further temporary occlusion of the recipient is not needed if the donor artery is sectioned near the anastomosis after placing a microclip. The clip removal after tying the sectioned donor is not a necessary procedure. However, clip removal eliminates a clip artifact at follow-up evaluation. This method would be effective in the small recipient without the recipient artery stenosis. Based on our experience, neither ischemic nor embolic complication related to sutured anastomotic site happened after surgery.

## CONCLUSION

Although immediate bypass site occlusion during surgery rarely happens, the vascular surgeon should know revision techniques. The technique described here minimizes ischemic complications related to the end-to-side anastomosis and is a simple method for anastomosis revision.

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