Superficial Temporal Artery Dissection: A Technical Note

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BACKGROUND: Dissection of the superficial temporal artery (STA) is often required in preparation for a bypass procedure. Traditionally, dissection of the STA involves a direct cutdown on the artery after marking the course of the artery on the skin with the help of a Doppler ultrasound probe.

OBJECTIVE: We describe a method that takes advantage of the position of the STA superficial to the temporal fascia.

METHODS: The technique was used in a total of 38 procedures in 32 patients to create synangiosis or extracranial-intracranial STA bypasses. The STA was dissected using a blunt malleable brain retractor that was inserted into the subgaleal plane directly over the STA, allowing creation of a linear incision and concurrent protection of the STA in its bed. Either computed tomography– or catheter-based angiography was used to evaluate the patency postoperatively.

RESULTS: All STA vessels were dissected without complications or injury to the graft vessel. The sole complication was a superficial wound breakdown in a synangiosis case. Postoperative angiography demonstrated patency in all but 1 of the 24 bypass cases (95.8%).

CONCLUSION: We describe a method that takes advantage of the position of the STA superficial to the temporal fascia to allow rapid, safe, and efficacious dissection. The incision is linear and easier to manage and close. In our series, there were no technical complications related to the dissection of the STA.

KEY WORDS: EC-IC bypass, Operative technique, Superficial temporal artery

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WHAT IS THIS BOX?
A QR Code is a matrix barcode readable by QR scanners, mobile phones with cameras, and smartphones. **The QR Code above links to Supplemental Digital Content from this article.**

It has been demonstrated in a multicenter trial that superficial temporal artery (STA)–to–middle cerebral artery bypass surgery does not improve the outcome of patients with symptomatic brain ischemia in the setting of so-called inaccessible occlusive arterial lesions. However, the role of cerebral revascularization surgery continues to be debated. The recent results of the Carotid Occlusion Surgery Study (COSS) trial suggest that the risk of stroke associated with carotid occlusion may not be as high as once thought; nevertheless, there still appears to be a subgroup of patients with unstable symptomatology that may benefit from revascularization.

Further, there is still a significant role for extracranial-intracranial (EC-IC) bypass when treating certain types of aneurysms in which high flow is not needed, as well as certain cases of moyamoya disease. The indication and patient selection for an EC-IC bypass is beyond the scope of this article, and we refer the reader to references for more detailed discussion.[1-3] Rather, this article presents a technique developed by the senior author that allows rapid and safe harvesting of the STA graft in preparation for a bypass procedure.

ABBREVIATIONS: EC-IC, extracranial-intracranial; **STA,** superficial temporal artery

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Anatomy and Technique Description

The STA is usually a terminal branch of the external carotid artery. It commonly divides into frontal and parietal branches.[4] The parietal branch is commonly used for the STA-middle cerebral artery bypass if it is found to have

a suitable diameter. The frontal branch takes an anterior and superior course toward the forehead, supplying the muscles and skin, and anastomoses with the supraorbital and frontal arteries. The parietal branch is usually larger than the frontal branch and takes a typical meandering course superiorly and slightly posteriorly along the side of the head. It runs superficial to the temporal fascia and forms anastomoses with the ipsilateral posterior auricular and occipital arteries (see Video, Supplemental Digital Content 1, http://links.lww.com/NEU/A514).

The course of the artery is mapped using a handheld Doppler ultrasound probe (Parks Medical Electronics, Aloma, Oregon) and marked with a skin marker after the hair over the approximate course has been removed with clippers (Figure, A). A direct cutdown is performed over the mid-portion of the artery, and the artery is identified in the subcutaneous tissue above the galea (Figure, B). Next, blunt dissection using curved Stevens Tenotomy scissors is performed for a short portion to develop the appropriate plane of dissection. With the appropriate plane above the STA identified, a blunt malleable 1/4-in. brain retractor is inserted into the created space to protect the STA (Figure, C, D). A 15 blade scalpel is then used to continue the incision proximally over the retractor (Figure, E). The incision is carried down only to the cuticular layer. A needle-tip Bovie is then used to complete the incision down to the retractor. Care should be taken to use a nonmetallic or covered retractor to avoid spreading of the current and thermal injury. This is repeated in segments traveling proximally and then distally until the entire STA is exposed (Figure, F). This technique developed by the senior author (C.A.D.) eliminates the need for the tedious stepwise dissection of the skin over the entire length of the STA that risks unintentional injury to the STA at every step. As the STA becomes smaller distally, the dissection may become more difficult, but we found that with this technique, the dissection can be carried out efficiently without increased risk of injury. Further, the use of the needle-tip Bovie once the skin has been superficially incised creates a more hemostatic operative field. The resulting linear incision provides for better skin approximation, closure, and healing. Once the skin has been opened over the approximate course, the STA can be dissected from its soft-tissue bed in 1 block. The artery is then sectioned at the desired length, the distal end is prepared, and the bypass procedure performed in the usual fashion.

RESULTS

From 2000 to 2012, the senior author used this technique in 38 procedures on 32 patients to create a synangiosis or EC-IC STA bypass. The STA was dissected using a blunt malleable brain retractor, which is inserted into the subgaleal plane directly over the STA, allowing the creation of a linear incision and concurrent protection of the STA in its bed. Either computed tomography—or catheter-based angiography—was used to evaluate the patency

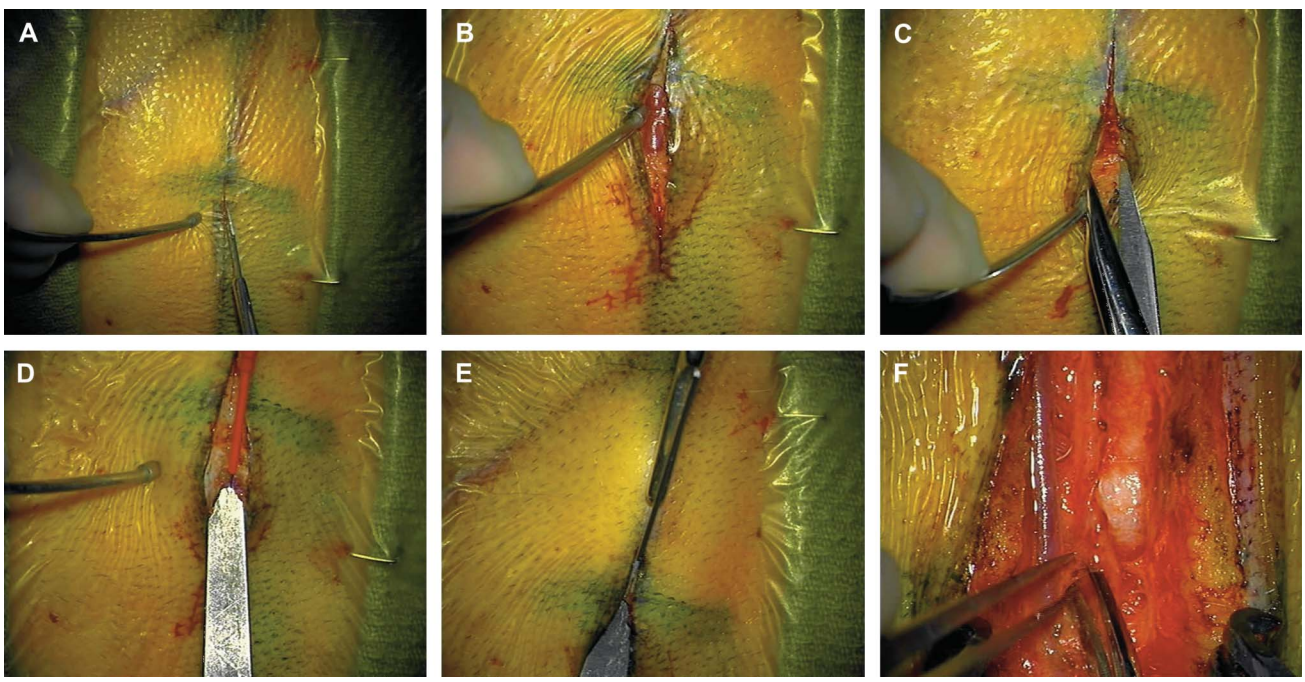

FIGURE. **A**, *initial careful incision over the midportion of the superficial temporal artery (STA) after marking the course with a handheld Doppler probe exposes the STA (**B**). Spreading of the soft-tissue plane overlying the artery using Tenotomy scissors (**C**) allows the introduction of a 1/4-in. brain retractor to protect the artery (**D**). A scalpel and needle-tip Bovie are then used to elongate the incision over the retractor (**E**), exposing the artery in a single step (**F**).*

postoperatively. All STA vessels were dissected without complications or injury to the graft vessel. The sole complication was a superficial wound breakdown in a synangiosis case. Postoperative angiography demonstrated patency in all but 1 of the 24 bypass cases (95.8%).

DISCUSSION

The STA has an important role as a donor vessel in cerebral revascularization. The technique described here allows for a more efficient, hemostatic, and safer harvesting of the STA. It takes advantage of the course of the STA in the subcutaneous tissue above the galea.[4] By using a retractor in the plane above the STA and a needle-tip Bovie, the vessel can be exposed and dissected quickly with little bleeding from the skin edges. After completing the exposure, the STA can then be isolated with its periadventitial tissue in 1 block. Critiques of the method include the possibility of the STA being damaged by the creation of the subcutaneous plane. The use of the needle-tip Bovie can also lead to burns of the skin edge if not performed carefully. We have not encountered these difficulties when using this technique in our patient series. We have shown the clinical application of this method with no evidence of injury to the STA as exemplified by our 96% patency. In our experience, the STA can be dissected in the distal direction with slightly greater difficulty due to the decreased size and more superficial course with respect to the galea but still with less risk of injury and efficiently. Burns to the skin edge are easily avoided by first cutting down through the cuticular layer and then carefully using skin hooks to maintain separation while carefully cutting down to the retractor with the needle-tip Bovie. Care should be taken to use a covered or nonmetallic malleable retractor to avoid spreading of the monopolar current and undesirable thermal injury.

CONCLUSION

We described a novel technique for dissection of the STA that adds safety, efficiency, and little to no bleeding to the usual tedious dissection. We have used this technique in a series of patients with results comparable to those with other more traditional methods.

Disclosures

Dr David is a consultant for Codman Neurovascular and a stock holder of Surpass Medical, Ltd. The other author has no personal financial or institutional interest in any of the drugs, materials, or devices described in this article.

REFERENCES

1. Baaj AA, Agazzi S, van Loveren H. Graft selection in cerebral revascularization. *Neurosurg Focus.* 2009;26(5):E18.
2. Smith ER, Scott RM. Surgical management of moyamoya syndrome. *Skull Base.* 2005;15(1):15-26.
3. Derdeyn CP, Grubb RL Jr, Powers WJ. Indications for cerebral revascularization for patients with atherosclerotic carotid occlusion. *Skull Base.* 2005;15(1):7-14.
4. Kawashima M, Rhoton AL Jr, Tanriover N, Ulm AJ, Yasuda A, Fujii K. Microsurgical anatomy of cerebral revascularization. Part I: anterior circulation. *J Neurosurg.* 2005;102(1):116-131.

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COMMENTS

In this paper, the authors have simplified the direct cutdown approach to the superficial temporal artery (STA) during bypass procedures, especially for moyamoya disease. The anatomy of the STA is relatively well defined, but variable in individuals. Proximally, it runs through the parotid gland, in close proximity to the facial nerve. Lateral to the zygoma, it lies deep to the deep fascia (galea), but more cranially, it penetrates the galea and lies between it and the skin. The parietal and frontal branches may vary in caliber, and an artery larger than 1 mm in diameter is normally preferred for the bypass. This, and other variations of anatomy of this artery, can be assessed by preoperative intra-arterial angiograms or computed tomography angiography.

Linking the microscope to frameless stereotactic navigation can help with the dissection of the artery. In most patients, and especially in patients in whom a bypass is planned for an aneurysm, I prefer the flap technique for the dissection of the STA, in which the artery is dissected from the inside. This technique is particularly useful if both branches of the STA are dissected. However, when that is done, there is a greater risk of flap necrosis. In such cases, it may be wise to base the skin flap on the occipital artery as well, so that there is an additional blood supply to the skin flap.

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The authors have described a clever and highly useful technique for harvesting the superficial temporal artery when performing an extracranial-to-intracranial bypass. I have actually used this technique many times after seeing the senior author make a presentation in which he illustrated the technique. Because of the anatomic location of the superficial temporal artery, this approach provides a rapid, safe, and bloodless method for harvesting the donor vessel.

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