Effects of Superficial Temporal Artery Branch Management on Cerebral Bypass Blood Flow

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Introduction

Selected patients with moyamoya disease (MMD) and steno-occlusive cerebrovascular disease (SOCD) can benefit from bypass to augment cerebral perfusion.[1-4] We have previously shown in a retrospective analysis that important variables for superficial temporal artery (STA)-to-middle cerebral artery (MCA) bypass flow include baseline penumbral volume as well as sacrifice of the non-donor branch of the STA.[5] Building on this work, we herein assessed the real-time effect of non-donor STA branch occlusion on STA-to-MCA bypass flow using an ultrasonic flow probe.

Methods and Materials

This was a single-institution observational study of consecutive patients undergoing direct STA-MCA bypass with indirect encephalo-duro-myo-synangiosis for MMD and SOCD over 1 year. Patients with significant intracranial collateralization from the STA were excluded. The real-time effect of non-donor STA branch temporary occlusion on direct STA-MCA bypass flow was assessed using a Charbel flow probe. Patient characteristics and perioperative and postoperative outcome data were reviewed.

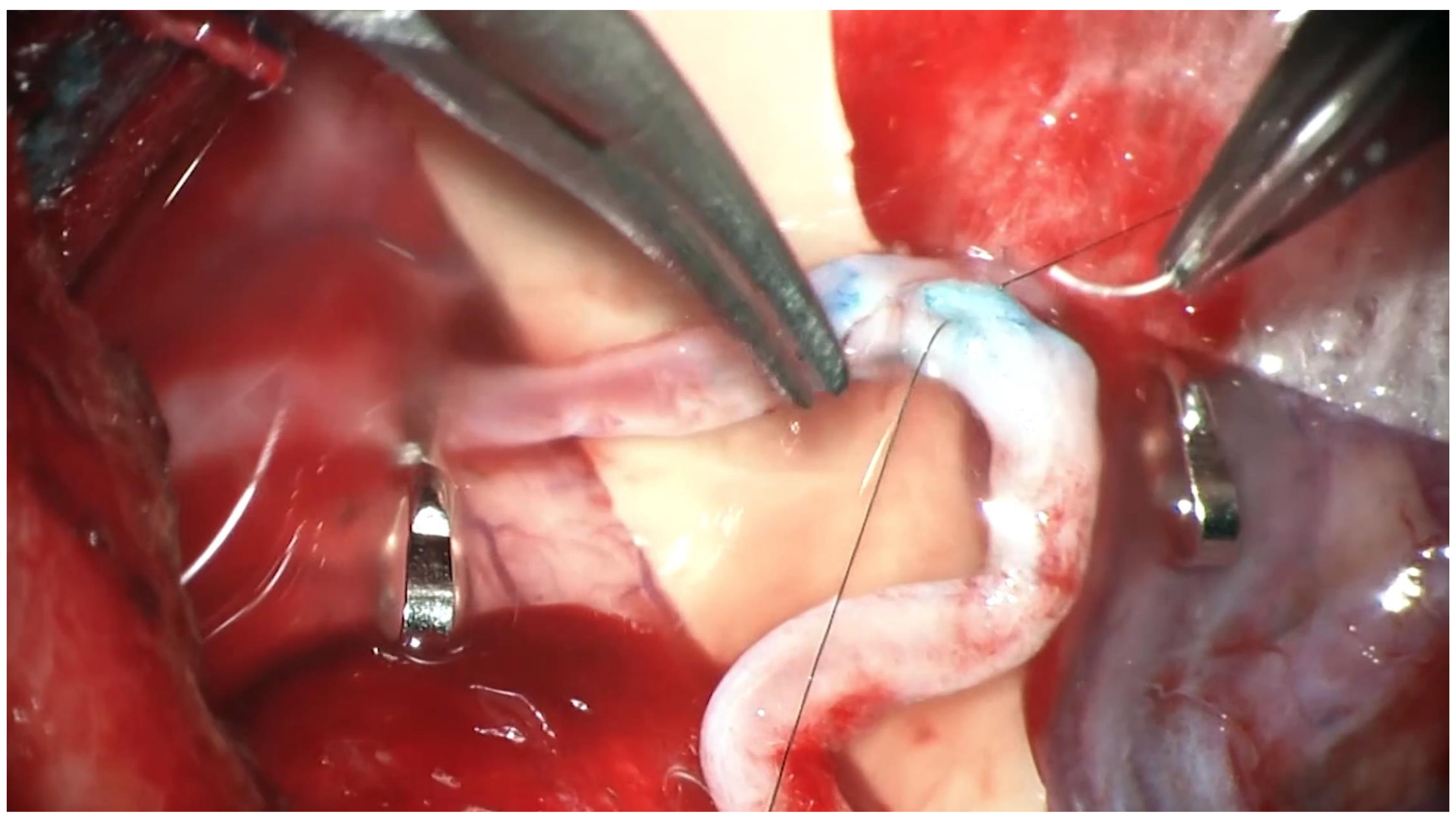

Figure 1. STA-MCA direct anastomosis.

Variable	Baseline flow, mL/min	Post-bypass flow, mL/min	Mean Flow Increase, mL/min	p-value
STA donor flow (mean ± SD)	4.91 ± 2.79	16.63 ± 11.92	11.7	0.015
	Post-bypass flow, mL/min	Post-bypass flow with non-donor STA clipped, mL/min		-
	16.63 ± 11.92	20.94 ± 10.63	4.31	0.002

Table 1. STA donor flow rates during non-donor branch manipulation.

Results

Eleven patients (5 MMD, 6 SOCD; mean age 53.5±15.3 years) that underwent combined revascularization (4 left, 7 right) were included in the study.

Results

Mean donor STA branch flow increased from 4.91±2.79 (baseline) to 16.63±11.92 mL/minute after anastomosis (p=0.015)**,** presumably from release of the investing fascia on the distal artery, transection before downstream vessel narrowing and branch points that limit flow, fishmouthing of the donor STA combined with a generous arteriotomy of the recipient MCA, and connection to a low-resistance hypoperfused recipient vascular bed.

Flow subsequently increased to 20.94±10.63 mL/minute after the non-donor STA branch was test occluded (p=0.002), which we hypothesized resulted from changes in flow dynamics, wherein blood is forced through the graft after the removal of a secondary outlet.

In 9 patients, the non-donor branches were subsequently sacrificed. Mean clamp time was 42.4±8.3 minutes. Bypass patency was 100%. The parietal STA branch was used as the donor in 8 (72%) cases.

Perioperatively, one patient experienced transient dysarthria (9.0%); there were no strokes or other major complications. The median hospital length of stay was 5.0 (interquartile range [IQR] 4.0, 7.0) days, with 81% of patients and all elective patients discharged to home.

Over a mean follow-up of 6.2±3.0 months, no patients had significant wound healing issues, and the median modified Rankin Scale score improved from 2 (IQR 1.0, 2.5) preoperatively to 0 (IQR 0.0, 0.0) (p<0.015).

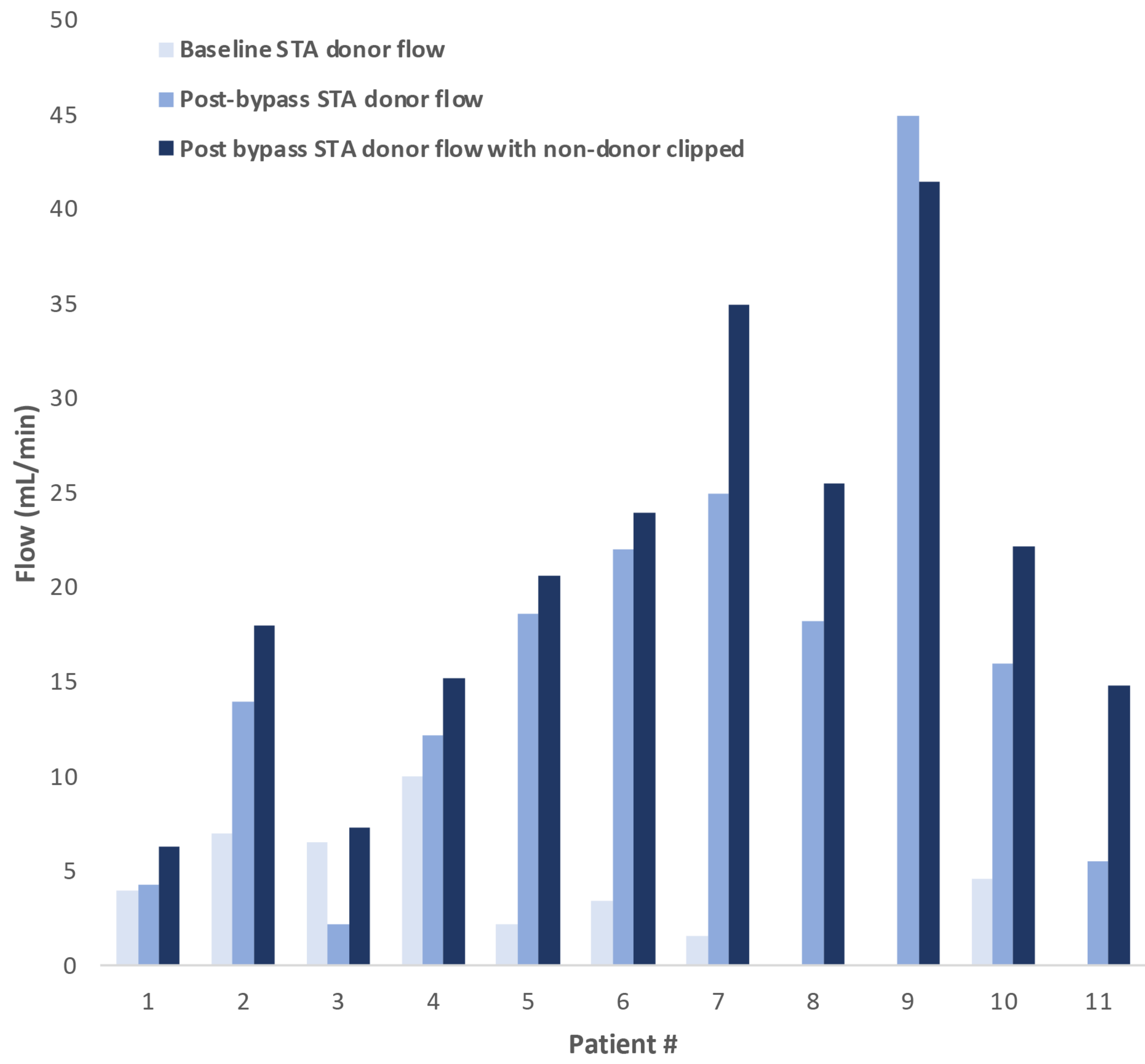

Figure 2. Bar graph of STA bypass flow rates at baseline (light blue), after bypass connection (blue), and after non-donor graft test occlusion (dark blue).

Conclusions

STA-MCA direct bypass flow may be optimized safely by sacrificing the non-donor STA branch in properly selected patients without STA-intracranial anastomoses.

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