Medical Note

Intraoperative Blood Flow Measurement during STA-M4/MCA Bypass Surgery for Moyamoya Revascularization

Introduction

One strategy to alleviate the symptoms of Moyamoya syndrome is the surgical creation of an arterial extracranial to intracranial (EC-IC) bypass from the superficial temporal artery (STA) to the M4 middle cerebral artery branch. The bypass is designed to augment flow in the intracranial territories (Fig. 1).

During surgery, the Charbel Micro-Flowprobe® is used to measure direct volume blood flow in the STA bypass and small target M4/MCA vessels. Intraoperative blood flow measurements confirm the quality of the anastomosis and assure that the target area is receiving sufficient blood from the bypass. Measurements also prompt revision if a technical error is suspected.

Flow Measurement Steps

Measure mean arterial pressure (MAP), end-tidal CO_2 and temperature. Record values on an Bypass Flow Record.

Pre-anastomosis: Intracranial Recipient Artery

1. Measure the diameter of the intracranial recipient artery (M4/MCA) and choose an appropriately sized Charbel Micro-Flowprobe® to measure recipient vessel flow.

Probe Size	Vessel Range, Outer Diameter
1.5 mm	1.0 - 1.5 mm
2 mm	1.5 - 2.7 mm
3 mm	2.5 - 3.7 mm

2. Measure recipient vessel (M4/MCA) flow.
3. Record flow and flow direction on EC-IC Bypass Record.

Extracranial Donor Artery

4. Dissect the extracranial STA artery free, and skeletonize a segment for application of the Flowprobe.
5. Measure the diameter of the extracranial donor artery (STA) and choose the appropriately sized Flowprobe to measure STA baseline flow.

Probe Size	Vessel Range, Outer Diameter
1.5 mm	1.0 - 1.5 mm
2 mm	1.5 - 2.7 mm
3 mm	2.5 - 3.7 mm
4 mm	3.3 - 4.7 mm
6 mm	4.4 - 6.6 mm

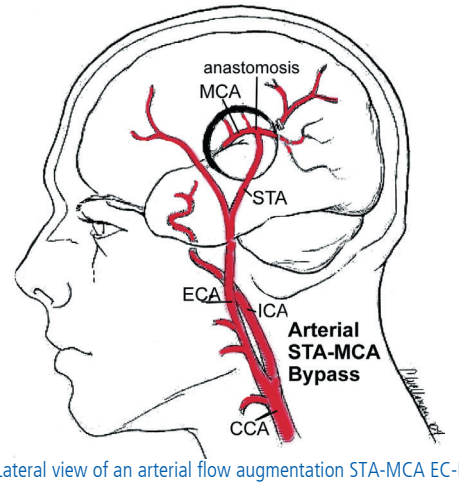

Fig. 1: Lateral view of an arterial flow augmentation STA-MCA EC-IC Bypass used to revascularize cranial territories for Moyamoya syndrome. The STA is exposed, cut and anastomosed to the MCA via an end-to-side anastomosis.

Post-anastomotic Flow Measurements

6. After construction of the STA-MCA bypass, measure post--anastomotic flows in the intracranial and extracranial arteries sequentially in the following order:
   1) distal M4/MCA (Fig. 3);
   2) proximal M4/MCA;
   3) distal STA;
   4) proximal STA.
7. If post-bypass flow in the recipient artery (sum of absolute values of distal and proximal M4/MCA flow) is not significantly above the pre-bypass flow, reexamine the anastomosis and the bypass for kinks or twists and redo, if necessary. Apply a vasodilator (papaverine) when there has been some vasospasm due to manipulation of the vessel and/or flow measurements seem to be low or absent.
8. Record flow rates and flow directions, MAP, end-tidal CO_2, and occlusion time on the EC-IC Bypass Record.

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Intraoperative Blood Flow Measurement during STA-MCA Bypass Surgery for Moyamoya Revascularization Cont.

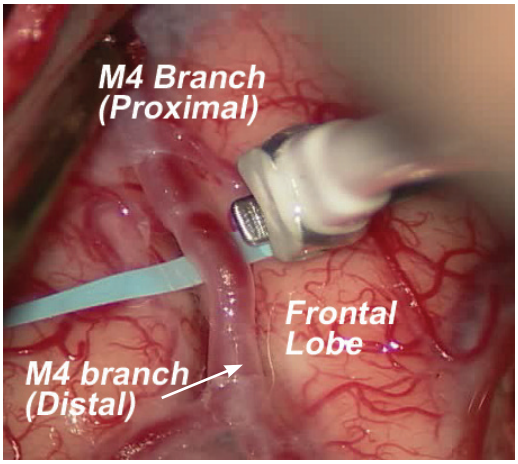

Fig. 2: Photo shows the M4/MCA site just before the Flowprobe is slipped around the vessel to measure baseline M4 flow before anastomosing the bypass to the vessel. The blue background is placed to help visibility during sewing the anastomosis and as the Flowprobe is applied to the vessel.

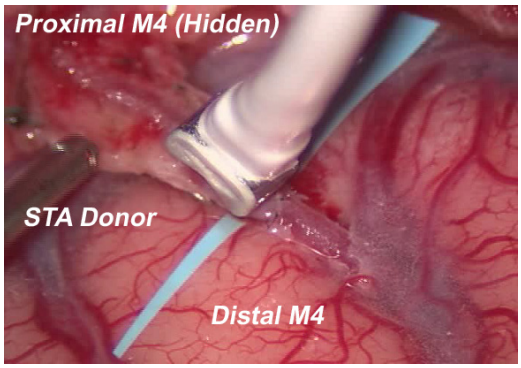

Fig. 3: Measuring blood flow in recipient M4/MCA artery after anastomosis to STA bypass.

Protocol: Flow Measurement during EC-IC Bypass Revascularization for Moyamoya Syndrome

Measure size of recipient intracranial artery (M4/MCA) and choose appropriate size Flowprobe.

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Measure baseline flow of recipient intracranial artery (M4/MCA) at anastomotic site. Record flow.

↓

Measure size of donor artery (STA) at distal end and choose appropriate size Flowprobe.

↓

Cut donor STA

↓

Optional: measure/record free (cut) flow in donor STA.

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Construct EC-IC bypass by anastomosing STA to M4/MCA.

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Measure post-bypass flows proximal and distal to the anastomosis in the recipient vessel and donor STA. Record all flow rates.

M4 flows did not increase	M4 flows increased	M4 flows increased significantly
↓	↓	↓
Examine anastomosis; examine bypass for kinks etc. Analyze recipient bed.	Good bypass.	Aggressive post-op management indicated to avoid complications.

References

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