

Flow-assisted Surgical Techniques and Notes*

Venous EC-IC Bypass Surgery Protocol

*Flow-Assisted Surgical Techniques ("F•A•S•T") and Protocols are drawn from surgical experiences by transit-time flow measurement users and passed along by Transonic for educational purposes. They are not intended to be used as sole basis for diagnosis. Clinical interpretation of each patient's individual case is required.

Introduction^{1,3-4}

When construction of an arterial extracranial to intracranial (EC-IC) bypass graft is contraindicated due to atherosclerosis, twisting or a poor section of the superficial temporal artery, the surgeon may elect to harvest a vein and construct a venous EC-IC Bypass graft to preserve or augment intracranial flow. Intraoperative flow measurements provide on-the-spot feedback as the surgeon identifies and defines the specific hemodynamic requirements for each case.

Venous Bypass¹

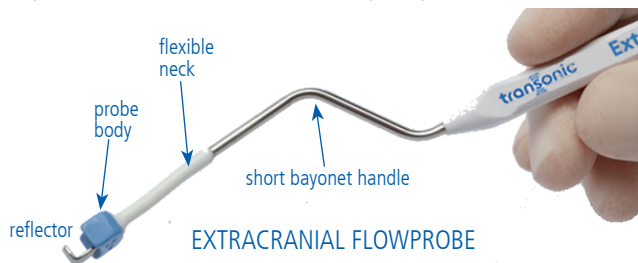
Since the proximal end of the vein graft is generally anastomosed to a carotid artery, a concern is that the graft will produce too much flow for the recipient vasculature and cause hyperemia. Therefore, free graft flow after the graft has been sewn to the carotid artery is measured in order to determine the maximum flow capacity for the graft and its hemodynamic match to the recipient artery. Baseline flows are also measured in the intracranial recipient artery before anastomosis. After the venous graft has been anastomosed intracranially to the recipient cerebral artery, post-anastomotic flows are measured in both the graft and recipient artery and are compared with baseline flows.

Flow Measurement Steps^{1,2}

Extracranial Donor Venous Graft

1. Choose the appropriate size flowprobe to measure baseline flow in the extracranial venous graft. Record flow on the EC-IC Bypass Record (Fig. 1).

PROBE SIZE (MRS/MBS)	VESSEL RANGE, OUTER DIAMETER
3 mm	2.7 - 4.0 mm
4 mm	3.0 - 5.0 mm
6 mm	4.0 - 7.3 mm



2. After the venous graft is anastomosed to the carotid artery, measure "Free Flow" in the vein graft by allowing the distal end to bleed freely for 15-20 seconds. This "Free Flow" is the amount of flow at zero resistance and indicates the "carrying" capacity or maximum flow the vein will deliver. Record flow on the EC-IC Bypass Record (Fig. 2, next page).
3. After the venous bypass has been anastomosed to the recipient cerebral artery, measure post-bypass flow in the donor graft. Record flow.

Measurement Technique²

- Select a Probe size so that the vessel will fill at least 75% of the lumen of the Probe. Use sterile saline or cerebrospinal fluid to obtain good ultrasonic contact between the Probe and vessel.
- Bend the Probe's flexible segment to best position the Flowprobe around the vessel. Listen to FlowSound® to hear volume flow.
- Wait about 30 seconds after Flowprobe application for readings to stabilize. Take a snapshot of mean flow readings or record readings displayed on the Flowmeter's LED.
- Press PRINT or take a snapshot to document flows. If a negative flow reading is displayed, press the Invert button to reverse the polarity of the flow reading from negative to positive before printing out the flow waveform.

References:

1. Cerebrovascular Surgery Handbook NS-59-hb, Rev F, 2018
2. Measuring PeriFlowprobe (CV-180-mn)RevA 2018 USltr
3. Amin-Hanjani S, "Cerebral revascularization: extracranial-intracranial bypass," J Neurosurg Sci. 2011 Jun; 55(2): 107-16. (Transonic Reference # 11097AH)
4. van der Zwan A, "How I Do It: Non-occlusive High Flow Bypass Surgery," Acta Neurochir Suppl. 2014; 119:71-6. (Transonic Reference # 10086AH)

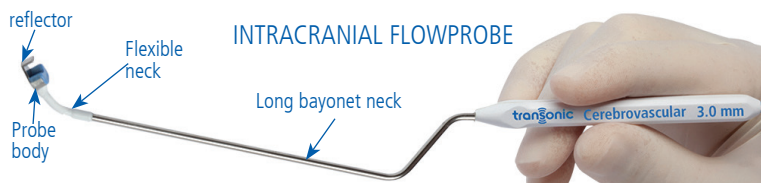
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Venous EC-IC Bypass Surgery Protocol cont.

Intracranial Recipient Artery^{1,2}

1. Choose an appropriate size flowprobe and measure and record baseline flow in the intracranial recipient artery .

PROBE SIZE(3MB/3MR)	VESSEL RANGE, OUTER DIAMETER
1.5 mm	1.1 - 1.6 mm
2 mm	1.6 - 2.4 mm
3 mm	2.6 - 3.8 mm



2. After the bypass has been constructed, measure flows in the donor vein. Record flows on the EC-IC Bypass Record.
3. Evaluate the hemodynamic match between donor venous flow and recipient arterial flows per flow chart on the right.

Date	Type of Bypass	Reason for Bypass				Surgeon
Extracranial Donor	Probe Size	BP Mean	Pre-Bypass Flow ml/min	Post-Bypass Flow1 ml/min	Post-Bypass Flow2 ml/min	
Intracranial Recipient Artery	Probe Size	BP Mean	Pre-Bypass Flow ml/min	Post-Bypass Flow1 ml/min	Post-Bypass Flow2 ml/min	
Comments/Observations/History						

Fig.1: Example of a Flow Record to record flow readings during EC-IC Bypass.

Flow Measurements during Venous EC-IC Bypass^{1,2}

Measure and record baseline flows in recipient intracranial artery proximal and distal to target anastomosis site.

Select probe size for donor extracranial vein.

Anastomose vein graft to carotid artery

Anastomose donor vein graft to intracranial recipient artery to create EC-IC bypass

Measure and record post-bypass flow in the donor vein.

Assess bypass flow hemodynamically in relation to recipient artery.

Flows did not increase

M4 flows increased

Flows increased significantly

Check anastomosis; examine bypass for kinks etc. Analyze recipient bed.

Good bypass.

Measure post-bypass flows at proximal and distal recipient artery sites to document surgical success.

Aggressive post-op management indicated to avoid complications.