

Focus on
Neuro

Transonic Flow-QC[®] Focus

A measurable improvement in Quality Care

Neurosurgery

Flow-based Strategy for EC-IC Bypass during Aneurysm Clipping Surgery

Transonic cerebral blood flow measurements:

- quick
- direct
- real time
- quantitative

An extracranial to intracranial (EC-IC) bypass is used during cerebrovascular surgery:

- 1) to **augment** flow for occlusive cerebrovascular disease (ie Moyomoya)¹
- 2) to **replace** flow during aneurysm clipping surgery when an aneurysm is trapped and a parent vessel (ie, internal carotid) has to be occluded and sacrificed.

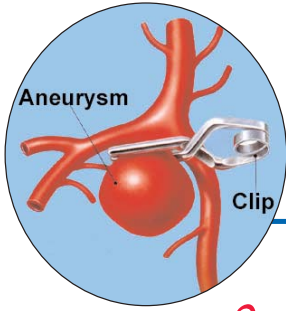
1. **Flow Augmentation for Occlusive Cerebrovascular Disease:** In 2005, Charbel and Amin-Hanjani *et al* at the University of Illinois at Chicago introduced the concept of a **Cut Flow Index** to evaluate the quality of an EC-IC bypass used to enhance flow during cerebral ischemia.¹ Briefly, the free flow of the donor extracranial artery intended for use as a bypass is measured. Once the bypass is constructed, the bypass flow of the donor artery is measured. The ratio of bypass flow to free flow is the **Cut Flow Index**. An value greater than .5 indicates a viable bypass.
2. **Flow Replacement for during Aneurysm Clipping Surgery:** At the 8th International Conference on Cerebrovascular Surgery (Taipei, 2006), Dr. Charbel's colleague, Dr. Sepideh Amin-Hanjani presented "EC-IC Bypass for Aneurysm: Decision Making Using Intraoperative Flow Measurements." She introduced a new strategy that they use to access the adequacy of a STA-or occipital artery bypass to replace flow when a aneurysm has to be trapped and a parent vessel sacrificed. Basically, flow in the artery or territory distal to the aneurysm is measured and recorded. The vessel to be sacrificed is temporarily occluded and flow is again measured in the distal artery or territory. The difference between the two flows represents the amount of flow deficit that can be expected if the parent vessel is sacrificed. This is the flow that the bypass will have to replace. The "free" or "Cut Flow" of the intended bypass is then measured. This Cut Flow value is compared to deficit flow. If the Cut Flow value equals or exceeds the potential flow deficit, the EC-IC bypass is completed and the vessel can be sacrificed with reasonable assurance that the bypass flow will compensate for the flow deficit from the sacrificed parent vessel.

Example: STA to M3 Bypass (ICA Aneurysm Clipped, Trapped and ICA Sacrificed)

- | | | |
|----|--|------------------|
| 1) | M1 baseline flow measured | 70 ml/min |
| 2) | M1 flow measured with ICA temporarily occluded | <u>50 ml/min</u> |
| 3) | Anticipated Flow Deficit Calculated
(if aneurysm trapped and parent vessel sacrificed) | 20 ml/min |
| 4) | STA Cut Flow measured
(STA bypass should be able to supply the flow deficit) | 44 ml/min |
| 5) | STA Bypass to M3 completed; aneurysm clipped and trapped | |
| 6) | STA Bypass Graft Flow measured
(bypass good - bypass flow compensates for anticipated flow deficit) | 24 ml/min |

Amin-Hanjani reported that this selective strategy allows them to:

- 1) access the adequacy of a bypass before completing its construction
- 2) select the best match for a bypass
- 3) evaluate the bypass immediately (protocol on next page)



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Flow-based Strategy for EC-IC Bypass during Aneurysm Clipping Surgery *cont.*

Protocol: Evaluating Adequacy of EC-IC Bypass for Aneurysm Clipping and Trapping Surgery

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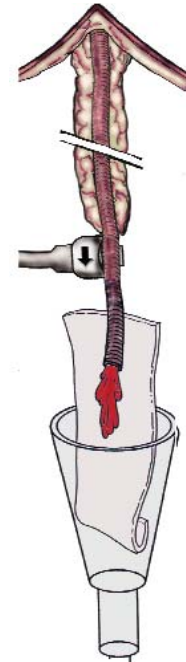
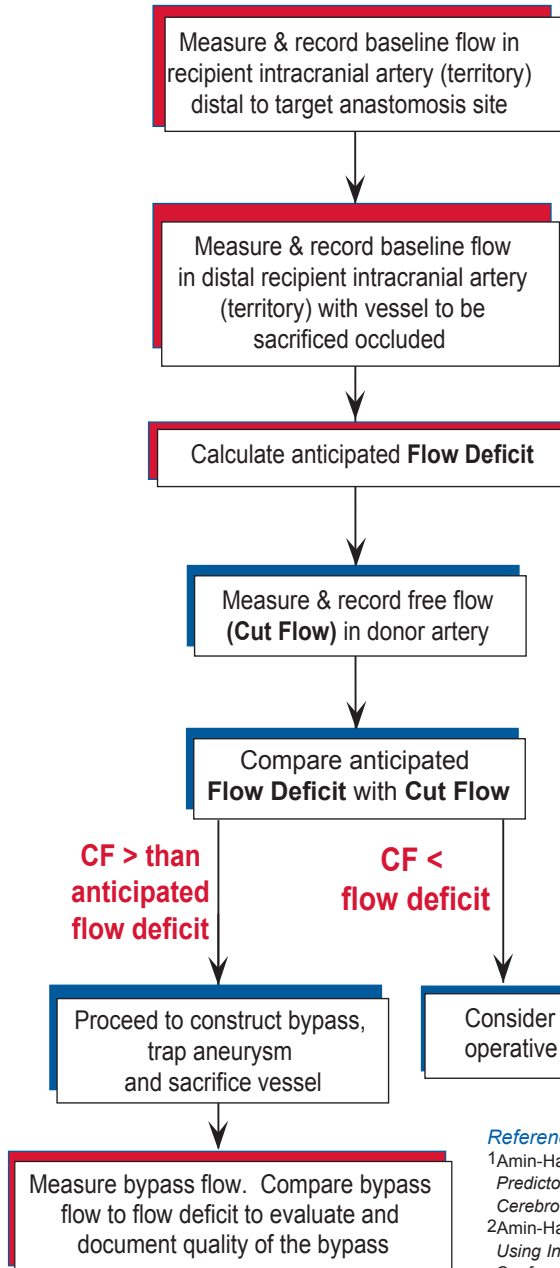


Fig. 1: Measurement of free "cut" flow of extracranial arterial bypass.

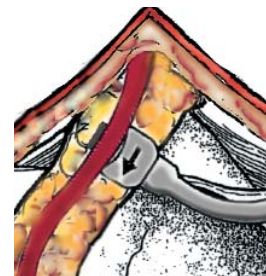


Fig. 2: Measuring bypass flow after anastomosis to recipient artery.

References:

- ¹Amin-Hanjani, et al. "The Cut Flow Index: An Intraoperative Predictor of the Success of EC-IC Bypass for Occlusive Cerebrovascular Disease," *Neurosurgery*, January 2005. (2922AH)
- ²Amin-Hanjani, S. "EC-IC Bypass for Aneurysm: Decision Making Using Intraoperative Flow Measurements," 8th International Conference on Cerebrovascular Surgery, Taipei, 2006.