Cerebral Aneurysm Surgery

Intraoperative Blood Flow Measurement

Introduction

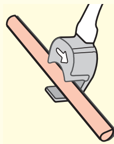
*Non-constrictive Micro-flowprobes measure blood flow in major cerebral vessels during aneurysm clipping surgery. The probes use ultrasonic transit-time principles to directly measure **volume** blood flow, not velocity. Measurements detect low flow states to help prevent intraoperative stroke.*

Measurements Steps: Aneurysm Surgery

1. Record **baseline flow measurements** of vessels at risk.
2. Record **flows after temporary clipping** and compare with baseline flows.
   a) If flows correspond, proceed with clipping.
   b) If flows are significantly lower than baseline flows, readjust clip until flows correspond.
3. Record **post-clip flows** and compare with baseline flows. If flows are significantly lower than baseline flows, readjust clip until flows correspond.

Measurement Technique

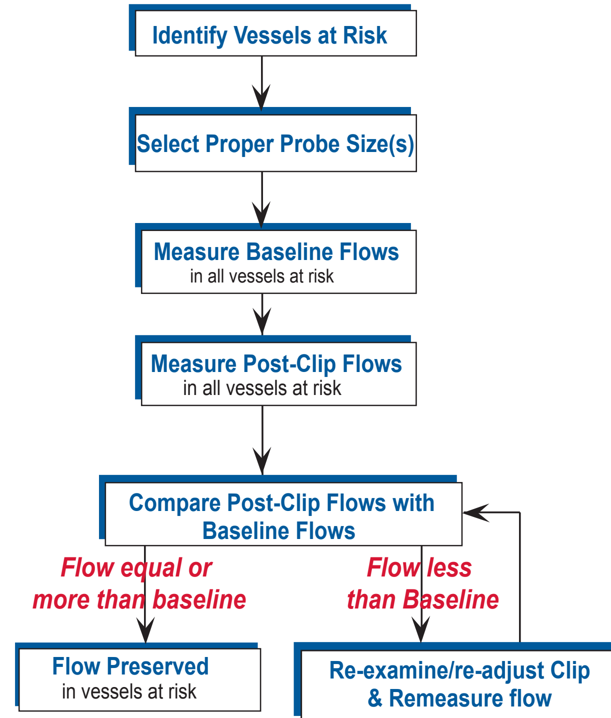
- Select a probe size so that the vessel will fill at least 75% of the lumen of the probe. Ultrasonic contact between the probe and the vessel is obtained with saline or cerebrospinal fluid.
- While listening to FlowSound™ (pitch proportional to flow), apply the flowprobe to the vessel by bending the probe's flexible segment. Transonic flowprobes also determine the net direction of flow with an arrow on the probe indicating the polarity of the probe when the Invert button is off. The probe can therefore be applied from the most convenient angle, irrespective of the probe's polarity.



- Wait about 30 seconds after application of the flowprobe for mean readings to stabilize. Then record the results displayed on the flowmeter's LED on the Aneurysm Record of Use chart.
- Press PRINT to document flows on the chart recorder. If the flow reading on the LED is negative press the Invert button to reverse the polarity low reading from negative to positive before printing out the flow waveform.

Protocol

Flow Measurement during Aneurysm Clipping



Protocol for measuring vessels at risk during aneurysm clipping surgery.

Key Points

1. Select appropriate size flowprobe and apply to the vessel as shown.
2. Add saline as needed to obtain good ultrasonic contact. Do not irrigate continuously because the flowprobe will also measure the flow of the saline.
3. When the flow reading is stable (10-15 seconds) press PRINT. Leave probe on the vessel until the printer **stops.**

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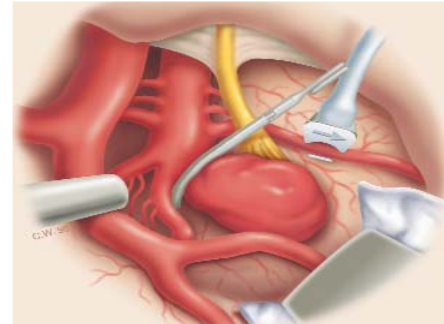
Measurement Review

- **Measure vessel and choose correct size flowprobe.**
- **Measure baseline flows before aneurysm clipping.**
  (Following burst suppression if given. Record blood pressure and end tidal CO_2 during initial measurements and keep these parameters constant during subsequent flow measurements.)
- **Measure flow after temporary aneurysm clipping to check integrity of flow.**
- **Confirm restoration of flow after permanent clipping.**



RIGHT SUPERIOR CEREBELLAR ANEURYSM
Flowprobe placed on superior cerebellar artery (SCA) to measure restoration of flow after clipping the aneurysm.

Technical Recommendations — Aneurysm Surgery

Aneurysm Site	Probe Placement	Size mm	Expected Flows ml/min	Tips
Anterior Circulation				
Carotid Ophthamic A (Opth)	M1 A1 ICA	2.0 2.0 3.0	80-110 and/or 40-60 120-170	Usually large aneurysms with no proximal control. Flow must be preserved in the the ICA and M1 and A1 outlet vessels.
Posterior Communicating A (PCom)	M1 A1 ICA	2.0 2.0 3.0	80-110 and/or 40-60 120-170	This is the one location where the probe might not be used because the surgeon may only expose the carotid and the aneurysm.
Anterior Choroidal A (ACh)	M1 A1 ICA ACh	2.0 2.0 3.0 1.5	80-110 and/or 40-60 120-170	Flow in the anterior choroidal is particularly important. The 1.5 mm probe is good for this vessel.
Carotid Bifurcation (ICA)	M1 A1	2.0 2.0	80-110 and/or 40-60	The technical challenge is to preserve flow in the M1 and A1 outlet vessels. Flow in the ICA (3 mm) can be checked also.
Anterior Communicating A (ACom)	A1 (ipsilateral) A1 (contralateral) A2 (both)	2.0 2.0 1.5	40-60 and/or 40-60 40-50	High risk. The technical challenge is to preserve flow in the A2 outlet vessels.No change in both A2s indicates flow is fully preserved. One A1 usually predominates and feeds both vessels.
Middle Cerebral A (MCA)	M2 (outlet)	2.0	50-80	This is a straightforward, relatively low stress case for the surgeon. One of the easiest places to put the probe.
Posterior Circulation				
Post. Inferior Cerebellar A (PICA)	VA (proximal or distal) PICA	3.0 2.0	100-200 and 10-15	Check flow in proximal or distal VA and PICA.
Superior Cerebellar A (SCA)	SCA (ipsilateral) PCA	1.5 2.0	18-20 and 26-30	Check flow in ipsilateral SCA and PCA (Posterior Cerebral Artery).
Basilar Tip A (BA)	P2 (ipsilateral) SCA PCom (prelude to sacrifice)	2.0 1.5	26-30 and 18-20	The perforators will still need to be inspected.