

Comparison of Modalities: Intraoperative Assessment of Cerebral Vessels

Measurement Modality	Transit Time Ultrasound	Intraoperative Angiography	Doppler Ultrasound	Fluorescence Angiography	Indocyanine Green Video Angiography
Primary Measurement Parameter	Volume flow through a vessel Functional Assessment	Cross-sectional width of a section of vessels: Anatomical Image	flow velocity	Cross-sectional width of a section of vessels: Anatomical Image	View of vessels already in the surgeon'd field of view Anatomical Image
Measurement Units	ml/min	mm	Sound pitch (KHz)	mm	mm
Accuracy	± 15%	± 0.3 mm	not quantitative	semi-quantitative	semi-quantitative
Time for Measurement	quick: 1 min/test < 5 minutes /surgery	time-consuming 20 -30 min or more	very quick, < 1 min/test < 3 minutes /surgery	15-20 minutes one time test	15-20 minutes, first time; 10 minutes between tests
Advantages	<ul style="list-style-type: none"> • quick, direct, real-time quantitative measurement of pulsatile and mean flow • non-constrictive • prompts reassessment of clipping if flow is significantly below baseline • confirms preserved flow & therefore avoids unnecessary clip positioning 	visual (anatomical) image of aneurysm clipping and/or if there is any residual aneurysm remnants	<ul style="list-style-type: none"> • quick • real-time • inexpensive 	visual (anatomical) image of aneurysm clipping and patency of cerebral vessels including perforators	visual (anatomical) image of cerebral arteries, brain perfusion during aneurysm clipping, EC-IC bypass patency
Disadvantages	<ul style="list-style-type: none"> • cannot discern residual aneurysm remnants • cannot measure flow in perforators or tiny vessels 	<ul style="list-style-type: none"> • time consuming (too slow to avert ischemic injury) • invasive: has risk involved • impractical: requires team • questionable imaging quality 	<ul style="list-style-type: none"> • qualitative, not quantitative • can't discern between mild to severe vessel occlusion 	<ul style="list-style-type: none"> • one-time procedure, can't recheck after repositioning • risk of systemic adverse reactions • questionable image quality 	<ul style="list-style-type: none"> • hidden remnants undetected • delay of 10 minutes between injections • may underestimate flow-limited vessel compromise
Effectiveness in Averting Ischemia	highly effective	low	subjective	subjective	effective
Cost: Initial: Per Measurement:	moderate low	high high	low low	high low	high low