CAROTID ARTERY CRITERIA

% ICA STEN	PEAK SYS VEL	END DIAS VEL	SYS VEL RATIO	SPECT BROAD
0 – 49%	< 125 CM/S	< 40 CM/S	<2.0	NORMAL – MILD SPEC BROAD
50 – 69%	125 – 230 CM/S	40-100 CM/S	2.0 – 4.0	MODERATE SPEC BROAD
70 – 99%	>230 CM/S	>100 CM/S	>4.0	SEVERE SPEC BROAD
99- CRIT*	ERRATIC	NA	NA	LOSS OF CARDIAC CYCLE
OCCLUDED	0	O	N/A	NO SIGNAL
ECA PSV 200 –300 CM/SEC MODERATE STENOSIS 300 CM/SEC AND ABOVE SEVERE STENOSIS				
If the vertebral waveform is retrograde or bidirectional, this is suggestive of subclavian steal syndrome. Mid systolic notching in the vertebral artery waveform suggests subclavian artery stenosis or a more proximal vertebral artery stenosis.				

Reference: "Carotid Artery Stenosis: Gray-Scale and Doppler US Diagnosis – Society of Radiologists in Ultrasound Consensus Ultrasound Conference" Radiology 2003:229:340-346.
http://radiology.rsnajnls.org/cgi/content/full/229/2/340

***Trickle flow or string sign flow of internal carotid artery (99% critical stenosis):**

Gray scale evidence of complex plaque causing a virtual total occlusion of the ICA. There is low to normal peak systolic velocities with maintained forward diastolic flow which are inconsistent with the severe degree of gray scale narrowing. Dampened or absent diastolic flow pattern is usually present in the CCA. Operability is determined by findings of a flow void with a normal sized artery, >3mm, in the distal ICA.

Reference: Color flow scan diagnosis of the carotid string sign may prevent unnecessary surgery, 1999 R. Samson,MD, D.Showalter,MD, J. Yunis,MD, K Buselli-Gil,RVT, T. Perna,RVT.
http://www.sciencedirect.com/science/article/pii/S0967210998001239

Intimal Thickening: Our protocol does not require intimal thickness measurements, however, we do comment if intimal thickness is seen. As a general guide, a normal intimal thickness is <1.0 mm.

Reference: http://www.pulsus.com/ccc2010/abs/090.htm

CAROTID STENT CRITERIA

STENOSIS RANGE	STENTED CAROTID ARTERY
<50%	PSV < 150 cm/s and ICA/CCA < 2.0
50-75%	PSV 150-300 cm/s and EDV <125 cm/s ICA/CCA >2.0
>75%	PSV >300 cm/s and EDV >125 cm/s ICA/CCA >4.0

Reference: Value of Duplex Evaluation after Carotid Stenting, Dennis F. Bandyk, MD
http://www.veithsymposium.org/veithpdf2005/57.pdf

MWHC IMAGING SERVICES
POLICY FOR DETERMINING INTERNAL CAROTID ARTERY PERCENT STENOSIS

1. All factors of the carotid duplex examination are carefully analyzed including peak systolic and end diastolic velocities, gray scale appearance of vessels in longitudinal and transverse views degree of plaque formations, technical difficulty of the exam, and the presence of a contralateral severe stenosis or occlusion.
2. All of the diagnostic parameters including, peak systolic velocity, end diastolic velocity and the IC/CC ratio are taken into consideration to determine the final impression.
3. When the various parameters used lead to different conclusions (different % stenosis), consider weighing the ratio higher.
4. In the presence of a contra lateral severe stenosis or occlusion, compensatory flow is taken into consideration when determining the degree of stenosis of the internal carotid artery.
5. Depending on the clinical situation, and the technical difficulty of the exam, the radiologist may recommend an MRA, a CTA, or contrast angiography to determine the degree of carotid stenosis

DETERMINING ECA PERCENT STENOSIS

1. Percent stenosis is based on PSV of the ECA, but note flow velocity is highly variable depending on status of both ipsilateral ICA & contralateral carotid arteries.

A. Plaque Morphology – CLASSIFICATIONS:

1. **Hypoechoic** -uniform dark gray to black echo pattern, smooth surface, "soft" echo texture a high lipid plaque generally isoechoic to the blood and less echogenic than the sternomastoid muscle
2. **Hyperechoic** – uniform medium to light gray echogenic pattern, smooth surface, a fibrous echo texture which is moderately echogenic and is more echogenic than the sternomastoid muscle and similar to the arterial adventitia.
3. **Heterogeneous** – Complex echo pattern when more than 50% of plaque is mixed with echogenic areas. Calcification can be a cause of heterogeneity.
4. **Calcified**- highly reflective, uniformly echogenic may have shadow, is brighter than arterial adventitia and can be difficult to classify plaque surface.

B. Plaque surface

1. **Smooth**- edges of the plaque are uniform.
2. **Irregular**- edges of plaque are rough, not smooth surfaces.
3. **Ulcerated**- a cavity within the plaque that has sharp margins (overhanging edges) and has blood flow within the cavity.

C. Extent:

1. Described as **focal, mild, moderate or severe**.

Note: Plaque severity may be overestimated or underestimated in the longitudinal view. Transverse views must also be obtained to determine the extent of plaque formation as well as correlating the velocities obtained with our laboratory established stenosis criteria.

[Rev 12/2013]