## MARY WASHINGTON HEALTHCARE IMAGING SERVICES

## **DIALYSIS GRAFT AND FISTULA IMAGING PROTOCOL**

- I. Primary Purpose of the Dialysis Graft Examination—Duplex ultrasound allows for identification and localization of abnormalities, which may potentially threaten access function and patency. The patency of the dialysis access, inflow and outflow vessels, and presence of venous branches, aneurysmal areas will be evaluated.
- **II. Clinical Indications**: Difficult needle placement, elevated venous pressure and recirculation times, prolonged bleeding after removing dialysis needles, loss or change in thrill, swelling, aneurysm, pseudoaneurysm, hematoma or perigraft mass, underdeveloped Cimino fistula or abnormal urea lab values.

## **III.** Patient Preparation: None

IV. Patient Position: Patient should lay supine on bed or stretcher that supports the patient's trunk and upper extremity. The arm should be rotated externally and extended from the body to about a 45 degree angle. Pillows may be utilized to aid in patient comfort. The procedure will be explained to the patient. A complete history including type and location of access as well as any revisions is taken prior to the beginning of the exam.

## V. Equipment Setup:

- A. <u>Transducer Selection and placement</u>:
  - 1. Linear transducers ranging from 8-17 MHz Frequencies are chosen as appropriate or necessary for the tissue depth and the vessels being evaluated. Use the arterial preset.
  - 2. An adjustable range-gated Doppler sample volume size with a visual and audible Doppler output is necessary.
- B. Image Optimization:
  - 1) Optimize gray scale images using the arterial and venous presets, DGC control, depth, and transmit/focal zones, I-scan, AGC and harmonics to allow for vessel wall, thrombus and plaque identification.
  - 2) Optimize color flow before acquiring images ensuring the color does not "bleed" out of the vessel walls, adjusting the color scale/gain as necessary. Typically a higher color flow scale setting should be used due to the high velocity, turbulent flow nature of the access. Use the low flow setting in the presence of possible occlusion.
  - 3) The scale and baseline controls are used to prevent aliasing of the spectral display when possible. A Doppler angle of 60 degrees or less should be used. Optimize spectral Doppler display, paying close attention to obtaining "clean" spectral window, if appropriate, to avoid measuring artifact.

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## VI. Examination Protocol

#### A. Image sequence

1. Beginning in the transverse scan plane scan in grayscale and color Doppler through the entire graft or fistula identifying the proximal artery, anastomoses and outflow vein. If configuration of graft/fistula is unknown, begin in the brachial artery & scan caudally until you see the arterial anastomosis. \*Note: Pay special attention to puncture sites.

#### For AV graft / AV fistula

Obtain longitudinal gray scale, color, Doppler waveform and velocity measurements from the following areas:

- Inflow artery proximal to graft
- Anastomotic sites (fistula has one site, graft has two sites)
- Proximal, mid and distal graft/venous fistula
- Outflow vein
- Axillary & subclavian veins
- If steal is suspected, inflow artery distal to graft
- Any area of suspected stenosis, especially puncture sites Note the prosthetic grafts taper at the anastomosis, so velocities will normally increase at these sites. However, a gradual increase in diameter and decrease in velocities will occur closer to the body of the graft.

### For Cimino-Brescia AV fistula

Begin in transverse scan from the artery above the incision scar (usually radial artery at the wrist) proceeding caudal to locate the anastomosis. The cephalic venous fistula will anastomose and lie superficial to the artery and will have turbulent flow. Obtain the longitudinal grayscale, color, and Doppler waveform

obtaining PSV & EDV measurements from the following areas:

- Inflow artery above fistula
- Fistula anastomosis
- Outflow cephalic venous fistula (3-5 sampling sites)
- If steal is suspected, inflow artery distal to fistula
- Any area of suspected stenosis, especially puncture sites

Document the presence and location of venous branches, aneurysm, hematoma and perigraft masses.

2) If the physician requests the depth of the fistula, obtain the following:

• Transverse split screen measuring the width and depth of the graft/venous fistula in 5 locations.

- 3) Long grayscale subclavian vein, supra and infraclavicular with an attempt at showing collapsibility of vein with rapid inspiration or "sniff" test. Although, the subclavian vein cannot usually be compressed due to bone structure, an attempt should be made.
  - Obtain spectral Doppler showing normal vein pulsatility and phasicity as well as augmentation with "sniff" test.
  - Transverse split screen axillary vein to evaluate the compressibility of the axillary vein
  - Long gray scale and color images of the axillary vein. Obtain Doppler signal documenting response to a distal augmentation maneuver.
  - Obtain images of the brachiocephalic (innominate), brachial, basilic, cephalic or forearm veins when applicable.

Utilize color flow analysis to assess the lumen for any filling defects. If thrombus is present, the extent and location of sites where veins fail to compress should be documented. (See Criteria for Determining Presence and Age of Venous Clot)

4) After completing the exam, the technologist should fill out the appropriate worksheet and scan it in to Primordial, scan the prescription for the exam into iSite and track the exam in the Syngo system

#### **B.** Miscellaneous

If the patient has open wounds with dressings, technologist may take off dressing if needed to complete exam with physician's approval only. (Document in patient chart and standard worksheet) NO INSTRUMENT WILL BE PLACED DIRECTLY ON OPEN WOUNDS.

If the patient has intravenous or intra-arterial line via the common femoral vein/artery, this area WILL NOT be assessed (to maintain sterility).



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# DIALYSIS GRAFT / FISTULA DUPLEX

Image Summary	
Image	<u>Measurement</u>
Long inflow artery above access grayscale	
Long inflow artery above access color Doppler	
Long inflow artery above access spectral Doppler	PSV / EDV
Long arterial anastomosis grayscale	
Long arterial anastomosis color Doppler	
Long arterial anastomosis spectral Doppler	PSV / EDV
Long prox, mid & distal graft/ venous fistula grayscale	
Long prox, mid & distal graft/ venous fistula color Doppler	
Long prox, mid & distal graft/ venous fistula spectral Doppler*	PSV / EDV
Long venous anastomosis grayscale	
Long venous anastomosis color Doppler	
Long venous anastomosis spectral Doppler	PSV / EDV
Long outflow vein grayscale	
Long outflow vein color Doppler	
Long outflow vein spectral Doppler	
Long Subclavian grayscale dual screen w & w/o sniff compression	
Long Subclavian color Doppler	
Long Subclavian phasicity with spectral Doppler	
Long Subclavian augmentation by sniff test with spectral Doppler	
Long Ax gray scale dual screen w & w/o compression	
Long Ax color Doppler	
Long Ax phasicity with spectral Doppler	
Long Ax augmentation with spectral Doppler	

## DIALYSIS CIMINO-BRESCIA FISTULA

Image Summary	
Image	Measurement
Long inflow artery above access grayscale	
Long inflow artery above access color Doppler	
Long inflow artery above access spectral Doppler	PSV / EDV
Long anastomosis gray scale	
Long anastomosis color Doppler	
Long anastomosis spectral Doppler	PSV / EDV
Long prox, mid & distal forearm cephalic venous fistula grayscale	
Long prox, mid & distal forearm cephalic venous fistula color Doppler	
Long prox, mid & distal forearm cephalic venous fistula spectral Doppler*	PSV / EDV
For all types of dialysis access, if a steal is suspected, obtain the following ir	nages:
Long inflow artery below access grayscale	
Long inflow artery below access color Doppler	
Long inflow artery below access spectral Doppler	PSV / EDV
*Obtain spectral Doppler of the graft or venous fistula in 3 to 5 different site change of velocity, document velocities pre and post of the stenosis.	es. If there is a

The ordering physician may request the depth of the fistula.

In the transverse view measure the width of the fistula as well as the depth

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from the skin in 5 places throughout the graft/fistula

#### **References:**

- 1) Duplex Ultrasound Evaluation of Hemodialysis Access: A detailed protocol; International Journal of Nephrology Volume 2012 (2012), Article ID 508956, 7 pages doi:10.1155/2012/508956. <u>www.hindawi.com/journals</u>
- 2) Utility of Duplex Ultrasound for Evaluation of Hemodialysis Access and Selection for Intervention of Non-Maturing Conduits. Dennis Bandyk, MD
- Introduction to Vascular Ultrasonography, 4<sup>th</sup> Edition; Zweibel, W.B. Saunders Co., Philadelphia
- Techniques in Non-Invasive Vascular Diagnosis, 2<sup>nd</sup> edition, Robert Daigle Jr., Summer Publishing, Colorado
- 5) Current Therapy in Vascular Surgery, 4<sup>th</sup> Edition, Ernst and Stanley "Surveillance of Angioaccess Graft Function", by Andrew Bayard Roberts and Susan Bradford
- 6) Arteriovenous (AV) Fistula the gold standard hemodialysis access; Davita, Inc.