## MARY WASHINGTON HEALTHCARE IMAGING SERVICES **PSEUDOANEURYSM / AV FISTULA PROTOCOL**

- I. **Primary Purpose of the Examination**: To determine the presence or absence of a pseudoaneurysm or AV fistula status post cardiac catheterization. Occasionally this may be done in the upper extremity. Follow the general procedures and image the appropriate vessels proximal and distal to the area of concern.
- II. Equipment: Imaging and flow analysis performed with Duplex sonography using a linear transducer with a frequency of 8 MHz or higher. Appropriate imaging and Doppler frequency and focal depths will be utilized for the vessels being evaluated with an adjustable range-gated Doppler sample volume size with a visual and audible Doppler output. A Doppler angle of 60 degrees or less is used when quantitative measurements of flow are performed.

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

- IV. Patient Positioning Groin: Patient should lie supine on bed or stretcher with head elevated 30-45 degrees. Patient will be slightly rotated on hip (of leg being evaluated) with the lower extremity externally rotated and knee slightly bent. A complete history will be taken prior to the start of exam including date of procedure. The ultrasound procedure will be explained to the patient and the patient will be instructed to remain as relaxed and still as possible.
- V. **Patient Positioning Wrist**: Patient should lie supine on a bed or stretcher that supports the patient's trunk and upper extremity, with the arm will be placed comfortably along patient's side. With the hand supine, the arm is then abducted, and the elbow slightly bent for the remainder of the examination. Pillows may be utilized to aid patient comfort.
- VI. **Imaging Technique:** Have the patient identify the area of pain or injection. There may be a palpable lump or hematoma in this area.

### A. Image Protocol GROIN:

- 1. Obtain transverse images of CFV, and prox Fem Vein w & w/o compression.
- 2. Obtain longitudinal images of the EIV, CFV and prox Fem Vein with grayscale & color as well as spectral Doppler analysis to display phasicity.
- 3. Obtain longitudinal images of the EIA, CFA, prox SFA with gray scale & color as well as spectral Doppler waveform.
- 4. If there is a pseudoaneurysm present:
  - a. Obtain a transverse and longitudinal grayscale and color picture of the pseudoaneurysm identifying which artery is involved. Obtain a Doppler waveform proximal to the pseudoaneurysm, one at the neck and one distal to the neck of the pseudoaneurysm to document to-and-fro flow.
  - b. Measure the diameter of the pseudoaneurysm. Document if thrombus is present.
- 5. If there is an AV fistula:
  - a. If an arterialized venous signal is obtained in the vein with increased velocities, there may be an AV fistula. Identify the artery and vein involved.
- 6. If a hematoma is present in the absence of a pseudoaneurysm, then measure the size of the hematoma in length, AP and width. Apply color to show absence of flow.
- 7. If the study is positive or if a wet reading is requested, present the complete exam to the Radiologist before the patient leaves the ultrasound department.

### Assess Doppler signals for the following qualities:

Spontaneity – Is the venous signal present without manipulation?

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**Phasicity** – Does the venous signal phase with respiration?

Arterial Flow – Is the arterial signal triphasic and unidirectional or is there to-and-fro flow of a pseudoaneurysm present?

#### Annotation Criteria:

Right or Left

Trans or Long

Place the letter "v" under or near the vein and "a" under or near the artery being imaged if not clearly visible. Name of vessel imaged – suggested abbreviations:

- external iliac vein=EIV
- external iliac artery=EIA
- common femoral vein = CFV
- common femoral artery = CFA
- prox Superficial Femoral Artery = Prox SFA
- prox Femoral Vein= Prox Fem V

### B. Image Protocol WRIST

- 1. Obtain transverse images of the radial artery at the injection site, without and with color Doppler.
- 2. Turn sagittal and obtain the radial artery in the sagittal plane, proximal to cath site, at the cath site and distal to cath site. Repeat images with color Doppler.
- 3. Obtain spectral Doppler of the sagittal radial artery proximal to cath site, at the cath site and distal to cath site. Ensure correct angle with the vessel.
- 4. Turn transverse and obtain transverse radial veins at the cath site. Use split screen and obtain without and with compression.
- 5. Turn sagittal and obtain sagittal radial vein 1 and 2, without and with color Doppler, at the cath site.
- 6. Obtain sagittal radial vein 1 and 2 with spectral Doppler at the cath site.
- 7. If there is a pseudoaneurysm present:
  - a. Obtain a transverse and longitudinal grayscale and color picture of the pseudoaneurysm identifying which artery is involved. Obtain a Doppler waveform proximal to the pseudoaneurysm, one at the neck and one distal to the neck of the pseudoaneurysm to document to-and-fro flow.
  - b. Measure the diameter of the pseudoaneurysm. Document if thrombus is present.
- 8. If there is an AV fistula:
  - a. If an arterialized venous signal is obtained in the vein with increased velocities, there may be an AV fistula. Identify the artery and vein involved.
- 9. If a hematoma is present in the absence of a pseudoaneurysm, then measure the size of the hematoma in length, AP and width. Apply color to show absence of flow.
- 10. If the study is positive or if a wet reading is requested, present the complete exam to the Radiologist before the patient leaves the ultrasound department.

### C. Miscellaneous

- 1. 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)
- 2. NO INSTRUMENT WILL BE PLACED DIRECTLY ON OPEN WOUNDS.
- 3. If the patient has intravenous or intra-arterial line via the common femoral vein/artery, this area WILL NOT be examined (to maintain sterility).

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# VII. Image Summary

### <u>Groin</u>

- 1. Patient Information Screen
- 2. Transverse CFV dual screen, without and with compression
- 3. Transverse femoral vein dual screen, without and with compression
- 4. Long distal external iliac vein grayscale
- 5. Long distal external iliac vein color Doppler
- 6. Long distal external iliac vein with spectral Doppler
- 7. Long common femoral vein grayscale
- 8. Long common femoral vein color Doppler
- 9. Long common femoral vein with spectral Doppler
- 10. Long femoral vein grayscale
- 11. Long femoral vein color Doppler
- 12. Long femoral vein with spectral Doppler
- 13. Long distal external iliac artery grayscale
- 14. Long distal external iliac artery color Doppler
- 15. Long distal external iliac artery with spectral Doppler (angle correct)
- 16. Long common femoral artery grayscale
- 17. Long common femoral artery color Doppler
- 18. Long common femoral artery with spectral Doppler (angle correct)
- 19. Long proximal superficial femoral artery grayscale
- 20. Long proximal superficial femoral artery color Doppler
- 21. Long proximal superficial femoral artery with spectral Doppler (angle correct)

## Wrist

- 1. Patient information screen.
- 2. Trans radial artery (at cath site)
- 3. Trans radial artery (at cath site) with color
- 4. Long radial artery (images proximal to, at, and distal to cath site)
- 5. Long radial artery (images proximal to, at, and distal to cath site) with color
- 6. Long radial artery with spectral Doppler (correct angle)
- 7. Trans radial veins (at cath site)
- 8. Trans radial veins with compression split screen (at cath site)
- 9. Long radial vein 1 (at cath site)
- 10. Long radial vein 1 (at cath site) with color
- 11. Long radial vein 1 (at cath site) with spectral Doppler
- 12. Long radial vein 2 (at cath site)
- 13. Long radial vein 2 (at cath site) with color
- 14. Long radial vein 2 (at cath site) with spectral Doppler

If a <u>pseudoaneurysm</u> is present, obtain the following images:

- 1. Transverse and long grayscale & color images of pseudoaneurysm, and document if thrombus is present.
- 2. Maximal transverse diameter of pseudoaneurysm.
- 3. Doppler waveforms proximal to the pseudoaneurysm, at the neck and distal to the neck of the pseudoaneurysm to document to-and-fro flow.

If an <u>arteriovenous fistula</u> is suspected (presence of arterialized venous signal and possibly increased velocities), identify the artery & vein involved.

- 1. Doppler waveform of vein demonstrating arterialized flow.
- 2. Doppler waveform of artery with change in.

If a hematoma is present, obtain the following images:

- 1. Transverse and long grayscale and color images with measurements of hematoma.
- 2. Repeat the above steps for contralateral as indicated.

Refer to Pseudoaneurysm AV fistula criteria for additional information and images.

### References:

- 1. Pseudoaneurysms and the Role of Minimally Invasive Techniques in Their Management Nael E. A. Saad, MB, BCh. October 2005 RadioGraphics, 25, S173-S189.
- 2. Grayscale Features of Hematomas: An Ultrasonic Spectrum; Jeffrey Wicks, Terry Silver, Robert Bree
- 3. Ultrasound Features of AV fistula; Nanda Venkatanarasimha and Simon Freeman

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