

# UT Southwestern Department of Radiology

## Ultrasound – Arterial Duplex, Upper Extremity

### **PURPOSE:**

Duplex examinations are performed to provide evaluation of the upper extremity arteries to assess for plaque morphology location and severity.

### **SCOPE:**

Applies to all ultrasound arterial Duplex studies of the upper extremity performed in:

- UT Southwestern Zale-Lipsky University Hospital, William P. Clements Jr. University Hospital, and all University Hospital-based Clinics Imaging Services (UTSW)
- Parkland Health and Hospital System Department of Radiology (PHHS)

### **INDICATIONS:**

- Evaluation or follow-up of patients with exercise induced pain, rest pain, ulceration
- Assessment of patients with documented arterial disease
- Pre-procedure assessment for planning of intervention
- Follow-up to determine technical adequacy of intervention (i.e., post angioplasty/stent)
- Follow-up of bypass grafts to detect intrinsic stenosis or progression of disease
- Evaluation of aneurysm, pseudoaneurysm and arterial-venous fistula
- Evaluation of arterial trauma

### **CONTRAINDICATIONS:**

Contraindications for upper extremity arterial duplex are few; however, some limitations exist and may include the following:

- Presence of ulcers, casts, or bandages
- Obesity
- IV or catheters that limit access to or visualization of arterial structures
- Patients' inability to cooperate with or tolerate the examination

### **EQUIPMENT:**

- Duplex ultrasound with color flow Doppler with transducer frequencies ranging from 3.5-10 MHz

### **PATIENT PREPARATION:**

- Introduce yourself to patient
- Verify patient identity according to hospital procedure
- Explain the test
- Obtain patient history including symptoms
- Place the patient in a supine position

### **GENERAL GUIDELINES:**

- A complete examination includes evaluation of the entire course of the accessible portions of each vessel
- Bilateral testing is considered an integral part of a complete examination
- Limited examinations for recurring indications may be performed as noted
- Variations in technique during the assessment of peripheral vascular interventions (i.e., stents), must be documented in tech notes

**TECHNICAL CONSIDERATIONS:**

- Equipment gain and display settings will be optimized while imaging vessels with respect to depth, dynamic range and focal zones.
- Color-flow Doppler will be added to supplement B-mode images with proper color scale to demonstrate areas of high flow and color aliasing.
- Power Doppler will be used to validate low flow states or occlusions.
- Cursor sample size will be small and positioned parallel to the vessel wall and/or direction of blood flow.
- A spectral Doppler angle of 60 degrees or less will be used to measure velocities.
- Spectral Doppler gains will be set to allow a spectral window and optimized to reduce artifact.
- Areas of suspected stenosis or obstruction will include spectral Doppler waveforms and velocity measurements recorded at and distal to the stenosis or obstruction.
- Sites of intervention (i.e., stents) will include spectral Doppler waveforms and velocity measurements from the proximal, mid and distal sites.
- Plaque should be assessed and characterized.

**DOCUMENTATION:**

- Duplex evaluation is performed bilaterally starting with the right side
- Long axis gray scale and color Doppler images must be obtained from:
  - Subclavian Artery
  - Axillary Artery
  - Brachial Artery
  - Radial Artery
  - Ulnar Artery
- Spectral Doppler waveforms and velocity measurements must be documented from:
  - Subclavian Artery (proximal and distal)
  - Axillary Artery
  - Brachial Artery (proximal, mid, distal)
  - Radial Artery (distal) – If distal waveform abnormal, include proximal and mid Doppler
  - Ulnar Artery (distal) – If distal waveform abnormal, include proximal and mid Doppler
  - Superficial palmar arch, interdigital and digital arteries as indicated
- If you identify a stenosis (obvious narrowing on gray scale, PSV > 180 cm/sec, focal spectral broadening/turbulent flow), document the following in addition:
  - At the site of stenosis
    - Grayscale diameter
    - Doppler waveform
    - Peak systolic velocity (PSV)
  - At a site 2 cm proximal to the stenosis (or relatively normal segment of proximal vessel)
    - Grayscale diameter
    - Doppler waveform
    - PSV

**PROCESSING:**

- Review examination data and process for final interpretation
- Note study limitations

**REFERENCES:**

<http://www.asecho.org/wordpress/wp-content/uploads/2013/05/Noninvasive-Vascular-Lab-Testing.pdf>

**APPENDIX:**

**Journal of Clinical Ultrasound**  
Volume 31, Issue 8, Version of Record online: 29 SEP 2003

**Table 15** Diagnostic criteria for peripheral arterial diameter reduction

	Diameter reduction	Waveform	Spectral broadening	PSV distal/PSV proximal
Normal	0	Triphasic	Absent	+++ No change
Mild	1%-19%	Triphasic	Present	< 2:1
Moderate	20%-49%	Biphasic	Present	< 2:1
Severe	50%-99%	Monophasic	Present	> 2:1*

PSV, Peak systolic velocity.

\*>4:1 Suggests >75% stenosis, >7:1 suggests > 90% stenosis.

**Table 17** Diagnostic criteria for vein graft lesions using peak systolic velocity

- Minimal stenosis <20% with PSV ratio < 1.4 and < 125 cm/s
- Moderate stenosis of 20% to 50% with PSV ratio 1.5 to 2.4 and a PSV <180 cm/s
- Severe stenosis 50% to 75% with PSV ratio 2.5 to 4 and a PSV >180 cm/s
- High-grade stenosis > 75% with PSV ratio > 4 and PSV > 300 cm/s

PSV, Peak systolic velocity.

**Table 18** Interpretation criteria for arterial stenosis after percutaneous revascularization

- PSV >180 cm/s
- PSV ratios >2 indicate significant stenosis
- Changes in waveform shape and velocity measurements on serial examinations warrant close interval follow-up

PSV, Peak systolic velocity.

**CHANGE HISTORY:**

<b>STATUS</b>	<b>NAME &amp; TITLE</b>	<b>DATE</b>	<b>BRIEF SUMMARY</b>
<b>Submission</b>	Mark Reddick, MD	<b>6/9/2016</b>	Submitted
<b>Approval</b>	David Fetzer, MD, Director	<b>6/20/2016</b>	Approved
<b>Review</b>	Eddie Hyatt	12-15-2018	Reviewed
<b>Revisions</b>	Monica Morgan, RDMS, RVT, Ultrasound Technical Supervisor	<b>6/21/2020</b>	Revised