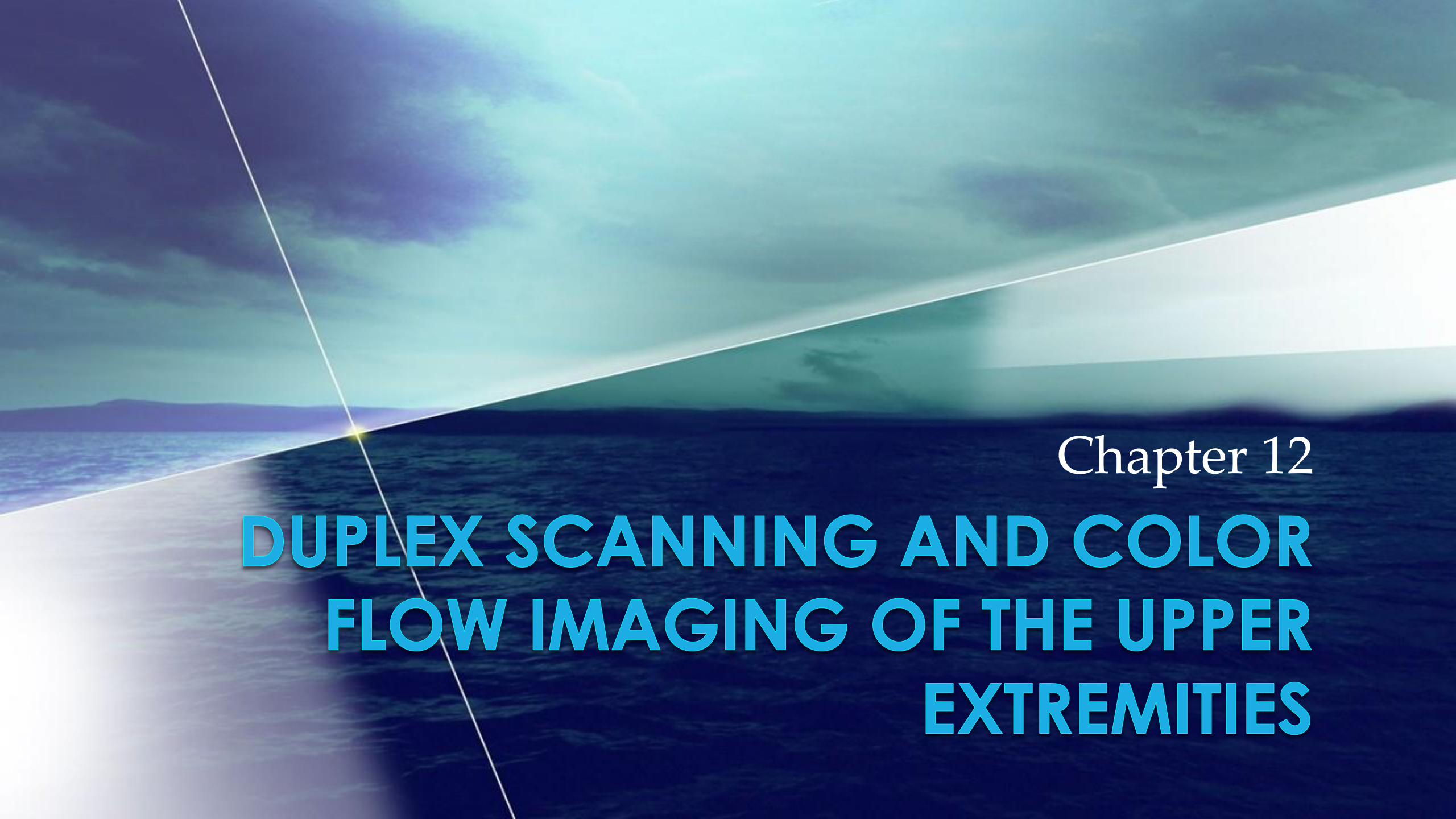


Chapter 12

DUPLEX SCANNING AND COLOR FLOW IMAGING OF THE UPPER EXTREMITIES

Symptoms

- Symptomatic vascular disease of the upper extremity is relatively uncommon
  - Etiology of upper extremity symptoms is usually neurogenic or systemic
- If atherosclerosis is present, it usually involves the Subclavian or Axillary arteries
- Patient complaints are similar to lower extremity and are related to:
  - Muscle fatigue or pain with use
  - Digit discoloration and temperature sensitivity

Capabilities

- Identify, localize, and quantify arterial occlusive lesions
- Evaluates degree of stenosis
- Determines presence/absence of aneurysm
- Evaluates hemodialysis access graft or arterial bypass graft postoperatively
- Detects arteriovenous fistulas or other unusual abnormalities
- Evaluates medical treatment or surgery on follow-up basis

Limitations

- Cannot be used in presence of dressings, sutures, skin staples or open wounds
- Difficult to image around IV sites
- Hemodialysis access grafts:
  - Difficult to visualize anastomosis due to graft angulation
  - Difficult to image outflow vein due to collateral formation
- Calcific plaque and shadowing impede visualization of lumen
- Not useful in the diagnosis of Raynaud's syndrome

Patient Positioning

- Patient should be supine with head slightly elevated
- Arm should be externally rotated with an approximate 45-degree angle from the body

Technique

- 5-7 MHz linear transducer may be used to visualize:
  - Subclavian
  - Axillary
- 7-15 MHz linear transducer may be used on:
  - Thin arms
  - Radial
  - Ulnar Palmar arch
  - Superficial Palmar arch
  - Digital arteries

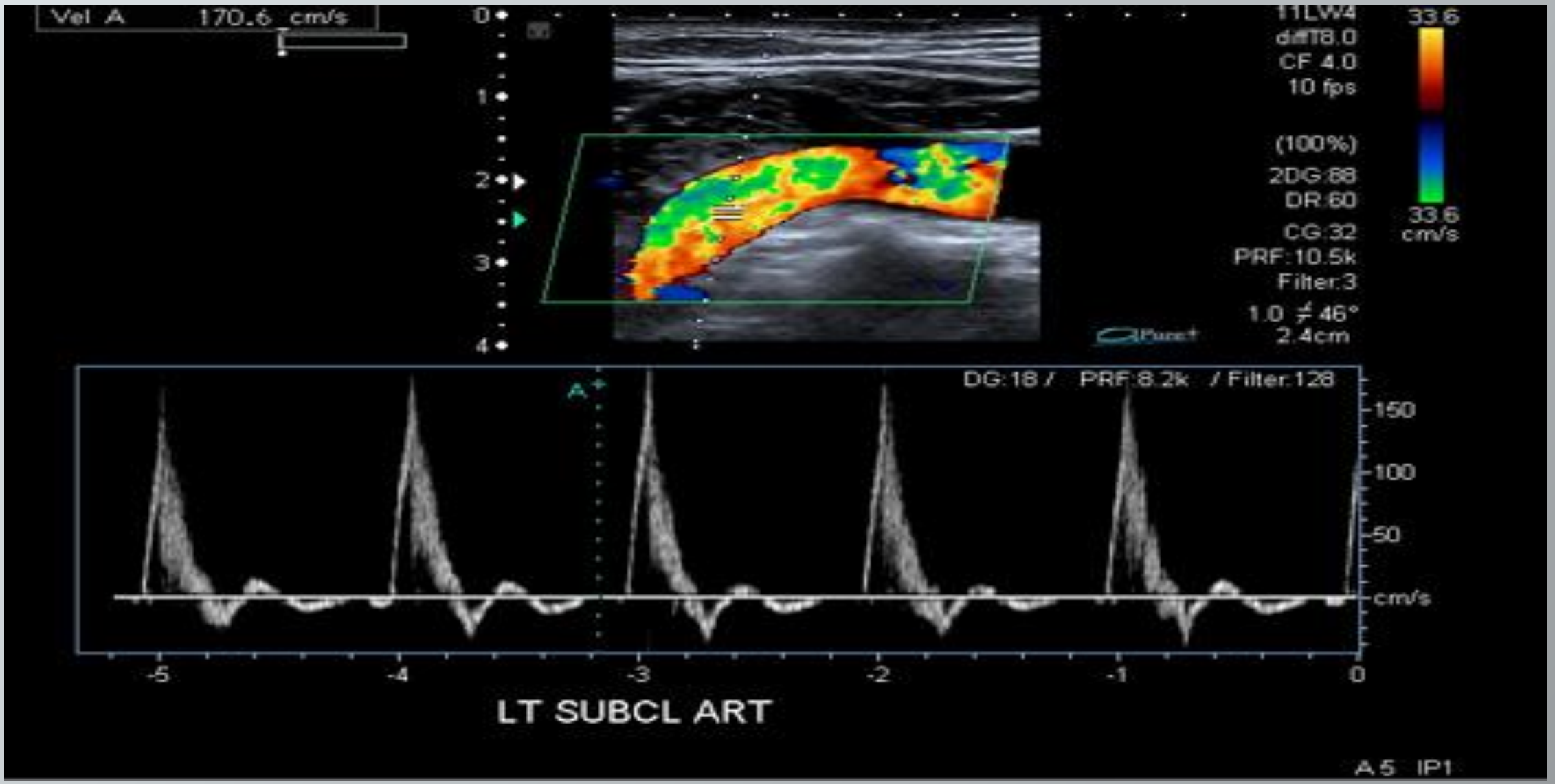
Technique

- Evaluate in transverse and longitudinal views, utilizing B-mode for the presence, size, location, and characteristics of plaque and thrombus
- Spectral analysis including waveforms and measurements of peak systolic velocities should be performed to assess blood flow
  - Maintain a 60-degree angle for measurements
- Color flow should be used to evaluate flow patterns
  - Spectral analysis and color flow should be performed in longitudinal

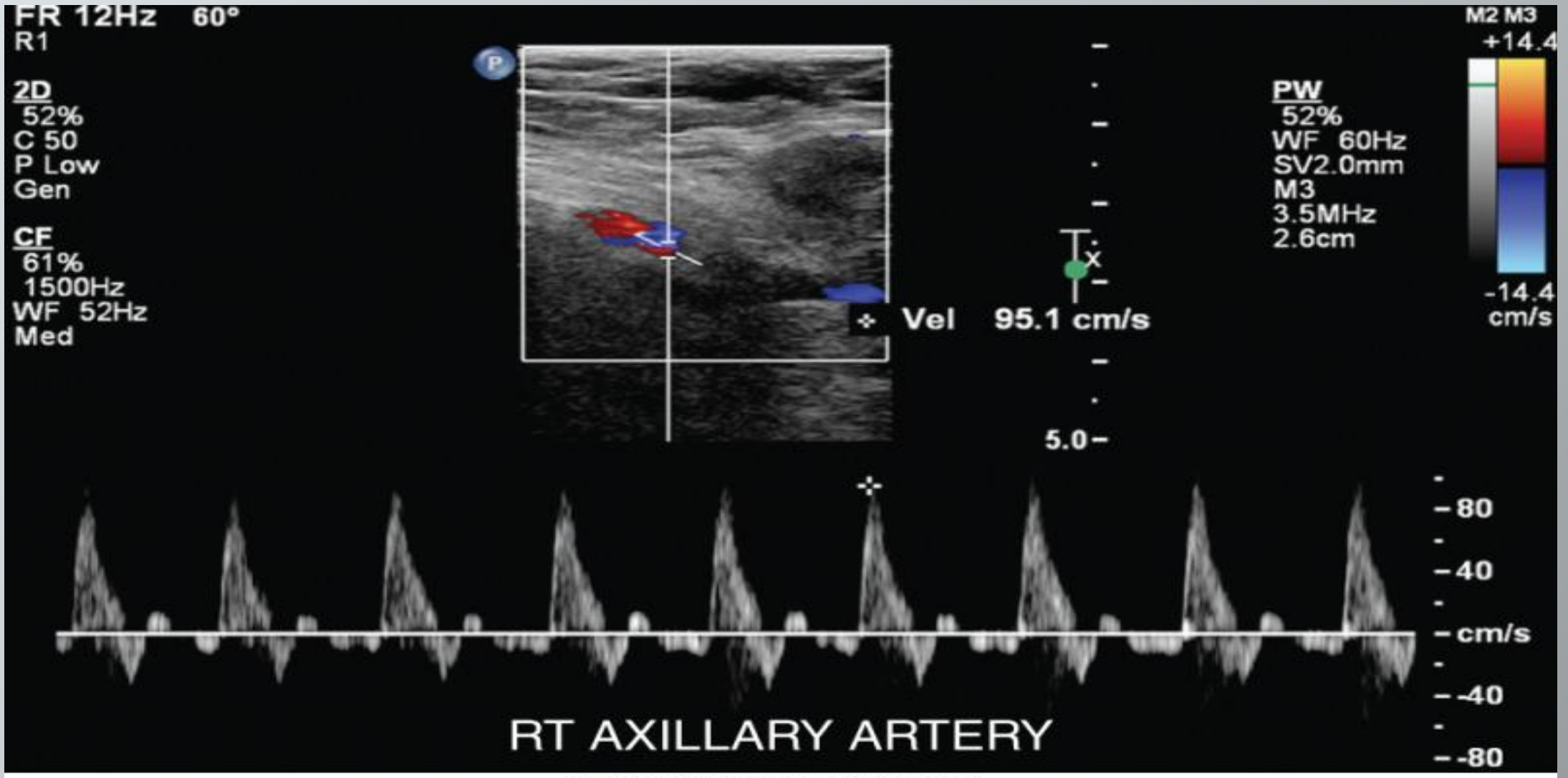
Recorded Images

- Required:
  - Subclavian
  - Axillary
  - Brachial
  - Radial
  - Ulnar
  - Palmar Arch (if necessary)
  - Superficial Palmar Arch (if necessary)
  - Digital arteries (if necessary)

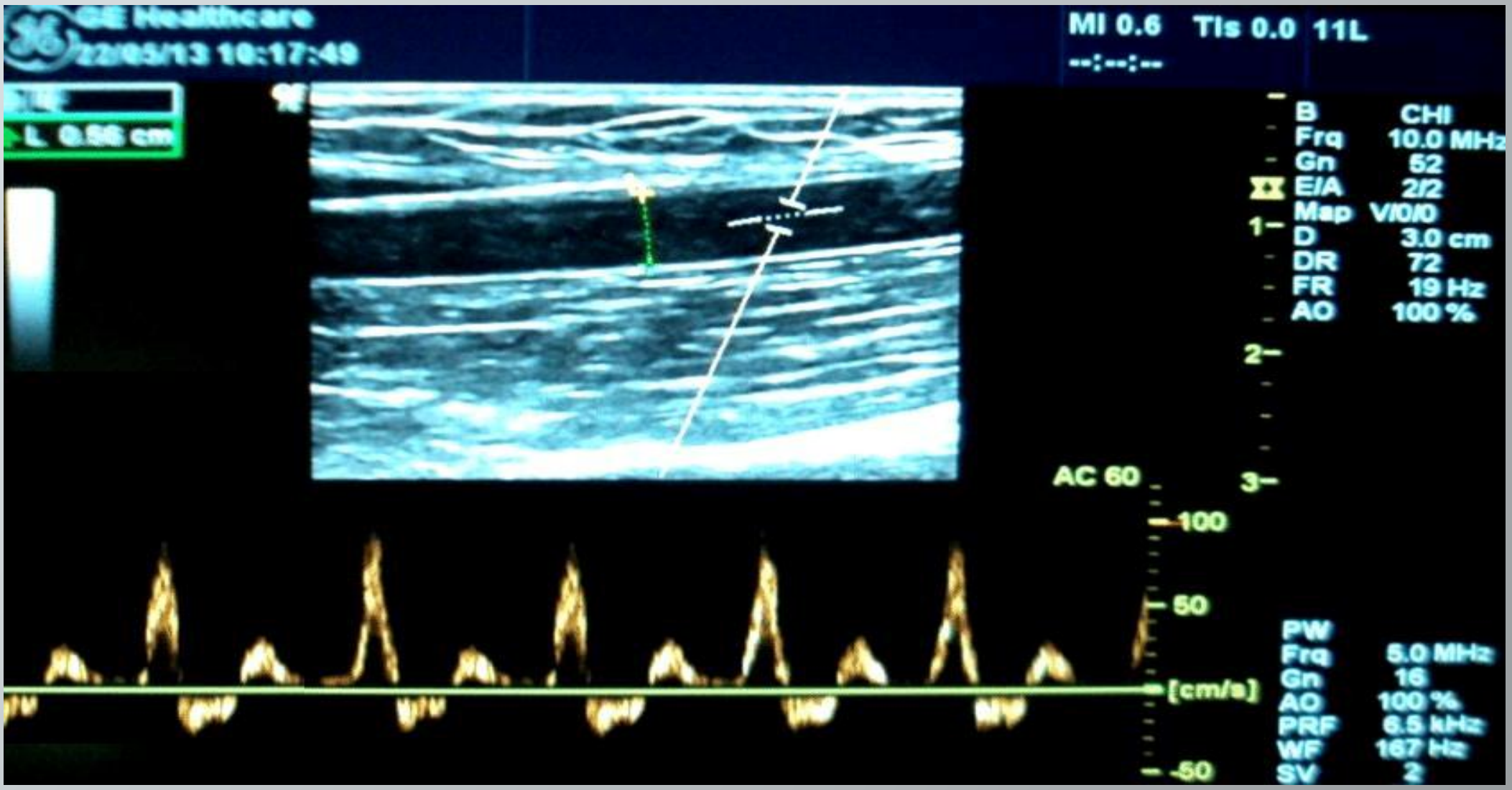
Subclavian Artery



Axillary Artery



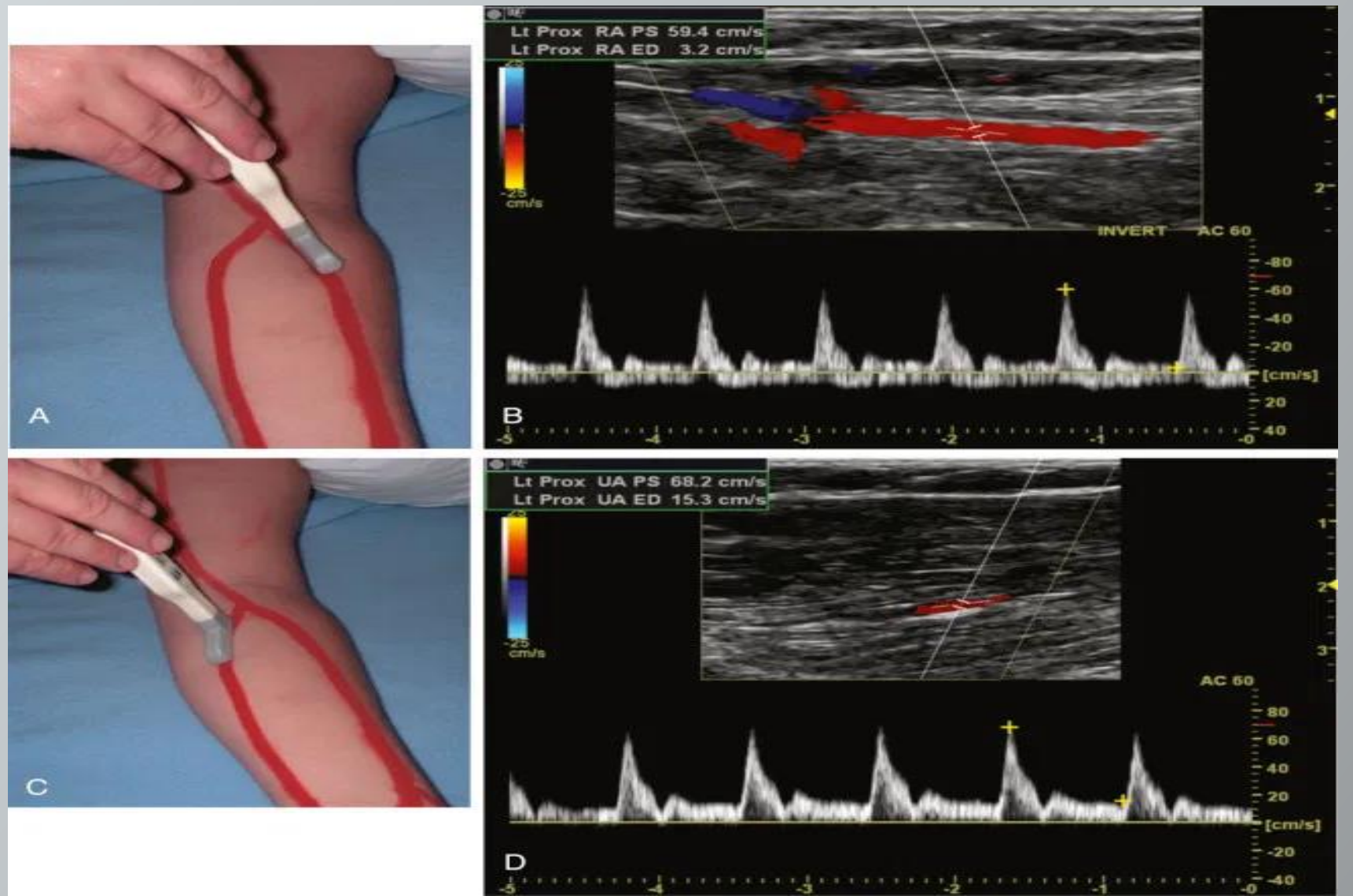
Brachial Artery



Radial and Ulnar Artery

Radial Artery

Ulnar Artery



Interpretation

- Currently there are no guidelines for classifying upper extremity disease as there are for lower extremity
- Clenching of the hand will alter Doppler signals
- Normal Doppler signal:
  - Triphasic
  - With significant arm movements or hand clenching, Doppler signals become more biphasic or even monophasic due to hyperemia

Occlusion

- Watch for absence of Doppler signals
  - Color and spectral Doppler
- "Thump" may be obtained proximal to the occlusion
  - Waveform will appear dampened and bidirectional
- Be careful to not mistake nerves, tendons, or veins for an occluded artery

Aneurysm

- Dilatation of a vessel
- Ulnar arterial aneurysms can form in response to using the palm as a hammer
  - *Hypothenar hammer syndrome*
- Subclavian aneurysms are associated with embolization to the digits

Miscellaneous Info

- It is uncommon for upper extremity arteries to become stenotic
- Main use of duplex in the UE arterial system is for the evaluation of hemodialysis access
  - Upper extremity duplex is more often used for vein mapping