86 yo female with right arm swelling, picc line.
PSA incidentally discovered
Thrombin x 3

51 yo diabetic with syncope

Dx?

Partial volume artifact
44 yo male with right monocular vision loss

Imaging Findings
Gray scale image shows extensive plaque in the ICA
Spectral tracing of the CCA has a normal waveform with a PSV of 51 cm/sec

Imaging Findings
Prox ICA normal waveform shape, velocity is 58 cm/sec
ICA/CCA ratio is 1.1
Distal ICA waveform is tardus parvus, velocity 14 cm/sec
ICA/CCA ratio (14/51) = 0.3
How do you report this?

Severe Stenosis
• Velocity increases as diameter reduction increases from 50 to 90%
• If stenosis is near complete, velocity will drop

Diagnosis: Severe Stenosis

72 year old male with abnormal mental status
Imaging Findings

Left ICA:
- Small, blunt percussive waveforms
- Low PSV
- No diastolic flow

Right ICA:
- Normal waveforms and PSV

Q: What to do next?

No Significant Stenosis: exam is complete

Severe Stenosis of the LT CCA with low velocities: do a CTA Thorax and Neck

More distal stenosis or occlusion: evaluate intracranial circulation

45 year old male with a bruit

Dx: Intracranial ICA occlusion

A ‘knocking’ waveform is characterized by diminished peak systolic velocity and absent or even reversed diastolic flow.

Knocking waveforms occur proximal to an occlusion or severe stenosis.

This patient had an occluded left internal carotid artery, resulting in an acute stroke.

Carotid dissection

This patient suffered a traumatic aortic dissection with extension into both common carotid arteries.

The waveform tends to be bizarre, highly irregular, and dampened.

Waveforms will vary according to the extent of the dissection and relative sizes of true and false lumen.
63 year old male with abnormal physical exam

Imaging Findings
Low velocity waveforms in the left and right carotid systems, involving CCA, ICA and vertebral arteries
Waveform has 2 peaks, one in systole and the second in early diastole
Diastolic flow reversal at end diastole (arrow)

Intra-aortic balloon pump
Mid systolic retraction due to pressure drop
Inflation of balloon causes 2nd peak of forward flow during early diastole
Flow reversal at end of diastole corresponds to deflation of balloon

23 year old male with chest pain and bruit

Imaging Findings
Sharp systolic upstroke and rapid deceleration
Reversed early and end-diastolic flow, indicating a widened pulse pressure
Markedly elevated peak systolic velocity

Aortic regurgitation
The ‘water hammer’ pulse may be seen with severe aortic regurgitation
This waveform is characterized by a sharp systolic upstroke with steep drop in late systolic reversal of flow in diastole marked by elevated peak systolic velocity
49 year old male undergoing heart transplant evaluation

**Imaging Findings**
Marked tardus parvus waveforms in all vessels
Low peak systolic velocity
No flow below the baseline
Findings should be reproducible in the femoral arteries

Left ventricular assist device
Blood is diverted from the left ventricular apex and propelled by a pump through a graft into the aorta
Most devices in current use provide continuous, forward flow throughout the cardiac cycle

65 yo M, Lt flank pain post trauma

Page Kidney
Chronic subcapsular fluid (blood or urine)
Extracapsular pressure, high RI’s
Subsequent hypertension

15 yo M
Proteinuria
Deborah J. Rubens, MD
TEST YOUR WAVEFORM IQ

Dx: Native RVT

- Difficult Doppler Diagnosis
- RI’s usually not affected
- 4/11 reversed diastolic flow
- Incomplete Thrombus
  Look for waveform changes, absent flow in affected veins
- Visible thrombus grayscale

Abnormality?

Left portal vein antegrade, right portal vein retrograde.

Portal Hypertension with Collateral

48 y.o. male, GI bleed

Diagnosis: Tumor Thrombus

Tumor Thrombus

- Often has visible flow within thrombus
- Don’t mistake residual flow in nonocclusive clot (portal vein wave form) with true vascularized clot (hepatic artery wave form)

CT shows occlusion of the portal vein with tumor. Histology demonstrated tumor throughout the liver and in the portal vein
CHF
Increased RA pressure reflected in TIPs, IVC, PV
PV pulsatility of greater than 50%
Severe cases have systolic flow reversal

45 yo M with weight loss and diarrhea, r/o mes. ischemia

Dx Criteria:
- PSV Celiac > 200 cm/sec
- SMA > 275 cm/sec
- IMA > 200 cm/sec
- Ratio > 2.5/3:1

ACR guidelines 2012, Pellerito JUM 2009

Diagnosis?
- Low resistance in CA
- Prominent IMA
- Color bleed over stenosis
- Dx pancreatic CA invading mesentery

Assymptomatic Patient Low RI's
Dx: HA-PV Fistula

HA-PV Fistula
Common Complication
Most Asymptomatic
Seen in up to 50% of patients within 1 week post biopsy
Less than 10% persist beyond a week
Most close spontaneously

Day 0
3:1 ratio
Dx?
Arterial compression syndrome
Following revision returns to normal

Renal Vein Thrombosis?
Renal Vein Compression

Transplant Compartment Syndrome
Related to ischemic injury and swelling from reperfusion
Doppler findings mimic RVT
Surgical pressure relief preserves fx

Transplantation: 15 January 2010 - Volume 89 - Issue 1 - pp 40-46

80 yo F; AKI, decreased renal fx s/p AAA repair

45 yo M, Rising LFT's p/BMT
**Bilateral Leg Swelling**

- Waveform extremely pulsatile
- Large extent above baseline (towards feet)

**CHF**

- Waveform extremely pulsatile
- Large extent above baseline (towards feet)

**Conclusions**

- Waveform shape and velocity both contribute to diagnoses
- Technique important to insure proper waveform
- Waveforms reflect local disease as well as proximal, distal or systemic abnormalities
- Waveform expertise makes you a Doppler star!!