Abdominal Doppler
Cases of Where, Why, and How

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Disclosures

- I have no financial disclosures to make.
Today’s Objectives

• Identify gray-scale findings of abdominal structures which may suggest the need to adapt protocol and include Doppler imaging.

• Describe clinical findings which may require triage in the department’s workflow in order to facilitate critical treatment of conditions.

• Utilize proper Doppler techniques in assessing abdominal vasculature.
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TERMINOLOGY
Spectral: Waveform Analysis

(IMPERATIVE UNDERSTANDING)

Systole

Diastole
Spectral: Waveform Analysis

(IMPERATIVE UNDERSTANDING)

Systole

Peak

Diastole

End
Resistance:
What happens when the heart is at rest?

**Low Diastolic/High Resistance**  **High Diastolic/Low Resistance**
Pulsatility

Arterial

Arterial-like (venous near heart)
Phasicity

‘Influenced’ Venous

Uninfluenced Venous
WAVEFORM ANALYSIS TECHNIQUES
Key Techniques

• Angle correction
  – If you NEED velocity, DO IT!
  – If you are only placing one caliper on waveform, DO IT!
Velocity

REQUIRES ANGLE-CORRECTION

2 Calipers

1 Caliper
Velocity

REQUIRES ANGLE-CORRECTION

2 Calipers

1 Caliper
Spectral Waveform Analysis

Resistance

Index = PSV - EDV / PSV
Always < 1.0

Ratio = PSV / EDV
Always > 1.0

NO Angle Correction Needed!
Spectral Waveform Analysis

Resistance

Index = PSV-EDV/PSV
Always < 1.0

Ratio = PSV/EDV
Always > 1.0

NO Angle Correction Needed!
Angle of Incidence

Perpendicular to flow

Parallel to flow
Color Doppler: Map Orientation

Toward/Positive?  Away/Negative?
Color Doppler: Map Orientation

Toward/Positive? YES
Away/Negative YES
Pulsed Doppler: Inversion Tool
Use with caution!
Color Doppler: Scale
Pulsed Doppler: Scale
CASES
Case #1

• R/O AAA

• 3cm distal aneurysm

• 2.8cm ectasia proximally
Case #1

- Parallel angle of incidence
  - Optimal visualization
  - Optimal angle for velocity assessment

http://basicmedicalkey.com/renal-arteries/
Case #2

History

• Renal TXP: POD #1
  – Simultaneous pancreas txp
• Marginal urine output
• Rising Potassium
• Hyperglycemic
Expiration

Inspiration

#2
Complication!!

- No REAL flow identified other than to and fro at hilum influenced by respiration
Case #2

• Gray-Scale appearance MAY be deceiving

• Careful attention to external factors (i.e., respiration)

• Color Map Orientation
Case #3

History

• 46 y/o male

• Type 2 Diabetes

• CHF

• Stage IV Renal Disease
Case #3

• Gray-Scale appearance can be deceiving

• Angle of incidence may require transducer manipulation to optimally assess

• Scale may need optimization to fully see the true finding
Case #4

History

• 54 y/o female

• Non-alcoholic Cirrhosis
Case #4

- Keep a keen eye out for gray-scale subtleties
- Velocities CAN be important to the diagnosis
- Waveforms can make or support a diagnosis
Case #5

History

• 53 y/o female

• Cirrhosis

• Liver Transplant Work-up
Cirrhosis Flow Patterns: Redistribution
Decompression through Umbilical Vein
Case #5

• Gray-scale finding can be deceiving
  – Full Doppler evaluation can provide evidence to support diagnosis

• Velocities **alone** MAY be deceiving

Case #6

History

- 31 y/o female
- Premature delivery <24 hours earlier at 28 weeks
- Fulminant hepatic failure
- Concern for Budd-Chiari
24 hours later....
Follow-Up Doppler
Follow-Up Doppler
Outcome

• Mother inpatient longer than infant
  – Six+ months of rehab and dialysis
• Nine months later
  – Infant and mother home thriving
  – Mother
    • LFT’s appear to be ‘regenerating’ liver
    • Still undergoing extensive PT
  – Infant
    • Growth at age adjusted rate
Case #6

- Gray-scale findings may suggest pending Doppler findings
Case #7

History

• 51 y/o male
• Cirrhosis
• Gallstones
Portal Hypertension

Case #7

- Always keep your ‘Peripheral Vision’ tuned up
- Use color Doppler to assess any hypo- /anechoic structures which are ‘out of place’
Case #8

History

• 45 y/o female

• Cholecystectomy (distant past)

• Hx of portal vein thrombosis (coumadin therapy)
Case #8

- Recognizing the angle of incidence is important if abnormality suspected
Case #9

History

• 53 y/o female

• S/P Liver Txp 6 days earlier

• Fever
Classical v/s piggy back technique

- Classical or cava replacement
- Piggy-back technique

https://www.slideshare.net/hr77/liver-transplantation-workshop
Case #9

- Gray-scale appearance is important!
- But so is knowledge about surgical procedures!
Case #10

History

- 20 y/o male
- Microhematuria
- Mild proteinuria
#10
Case #10

- Careful attention to the appearance of essentially normal structures!

- Assess for velocity changes in narrowed areas (remember to angle correct)
Case #10

- Careful attention to the appearance of essentially normal structures!

- Assess for velocity changes in narrowed areas (remember to angle correct)
Case #11

History

• 37 y/o female

• Referred to cardiologist for heart palpitation episodes/near syncopal

• Referred from cardiology for an ‘Abdominal Bruit’
• Video
Inspiration

Expiration

#11
Velocity: 1.68 m/s

Velocity: 4.15 m/s
Case #11

Median Arcuate Ligament Syndrome

- Compression of celiac axis during **EXPIRATION**!

- No clinical significance

- BUT....we DID answer the ‘Clinical Question’ by observing structures in gray-scale

https://openi.nlm.nih.gov/detailedresult.php?img=PMC3311854_534_2011_480_Fig8_HTML&req=4
Case #11

- What is the clinical question?

- Watch anatomy carefully in gray-scale when it moves with respiration

- Use spectral Doppler if color Doppler suggests a disruption in flow BUT...angle correct!!
Conclusion

• Use gray scale appearance to suggest Doppler!

• Develop a knowledge for critical clinical diagnoses and sonographic findings which need immediate attention

• Use Doppler techniques properly and in a manner to ease your technical struggles