Microvascular Imaging

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Faculty Disclosure

Dr. O’Hara is:
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Evolution of Vascular Imaging

High resolution    Extended Field of View
Cine loops                              3D and 4D
Color Doppler
Power Doppler
Contrast Enhanced Ultrasound

Superb Microvascular Imaging™
Color Doppler

Segmental Liver Tx

Splenic Varices

Flow plus directional info
Power Doppler

Pyelonephritis
grey scale
& Power Doppler

More sensitive flow
NO directional info
Contrast Enhanced Ultrasound
FDA Approved Agents

Definity – Lantheus Medical
Optison – GE Healthcare
Imagent – IMCOR (not being marketed)
Lumason (SonoVue) – Bracco

FDA Approved applications:
Previously only cardiac - in adults
** Now hepatic lesions in children
Contrast Enhanced Ultrasound

B-mode  Arterial phase  Portal phase

Hepatocellular Carcinoma

Microvascular Imaging – What is it?

- A new technique to optimize visibility of very small vascular structures
- Does NOT use intravenous contrast
- Preserves frame rate, less flash artifact
Microvascular Imaging

SMI – Toshiba

Angio PL.U.S.-Supersonic

The Innovative Ultrasound Company
Musculoskeletal imaging & sports medicine applications

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Impeccable image quality
Aixplorer® delivers unparalleled image quality of muscles, tendons, ligaments and joints. The software-based architecture, with specific presets optimized for musculoskeletal imaging, allows acquisition of images at speed up to 20MHz.

New! Angio PL.U.S. – PLanewave UltraSensitive™ ultrasound imaging
Angio PL.U.S. provides a new level of microvascular imaging through significantly improved color sensitivity and spatial resolution while maintaining exceptional 2D imaging.
SMI™ – How does it work?
SMI™ – How does it work?

Doppler signals

Conventional Doppler Imaging

Superb Microvascular Imaging (SMI)
Modes of SMI

- **Color Mode**
  cSMI demonstrates B-mode and color information simultaneously

- **Grayscale Mode**
  mSMI focuses only on the vasculature, improving sensitivity by subtracting the background information
Color SMI
Color SMI
Color SMI
Monochrome SMI
Monochrome SMI

17 day old infant
Monochrome SMI

8 year old liver
Doppler vs SMI™ Imaging
Doppler vs SMI™ Imaging
Doppler vs SMI™ Imaging

Monochrome SMI
Dynamic SMI
Dynamic SMI
Dynamic SMI
Dynamic SMI
Replace Cystogram??
Vesicoureteral Reflux

• Very common problem in pediatrics

• Fluoroscopic cystogram (VCUG)
  – Radiation exposure
  – Bladder catheterization

• Conventional US cannot predict VUR

• Contrast enhanced urosonography
  – Avoids radiation
  – Still requires bladder catheterization
Preliminary Study

- Compared VCUG to SMI-US
- 14 patients (28 kidney-ureter units)
- Did not require a full bladder
- Scanned bladder & kidneys with SMI
- Looked for:
  - “reversed jet” distal ureter
  - “swirl sign” in collecting system
Swirl Sign in Renal Pelvis
Preliminary Study

- 2/28 non-diagnostic
- 16/28 normal on both SMI & VCUG
- 6/28 positive on both
- 4/28 discordant (– SMI, +VCUG)
- 0/28 discordant (+ SMI, - VCUG)
- Concordant results in 85%
SMI – problem solving

Saves time

Increases confidence
15 year old testicle pain
15 year old testicle pain

Faster
More accurate
SMI – problem solving

Abscess?  
Node?  
Drainable?  

Increased confidence  

NOT liquid (yet)
SMI – problem solving

Renal Abscess?

Better visibility SMI
SMI – problem solving

5 year old post-op renal transplant

Rejection ? ATN?
SMI – problem solving

5 year old post-op renal transplant
Benefits of SMI™

- Visualization of tiny vascular anatomy, aids in diagnosis and treatment
- Rapid confirmation of blood flow or absent flow in cases of torsion/ischemia
- No intravenous contrast needed
- Fast frame rate
- Less artifact
- Well suited to pediatric patients
Conclusions

• The technology behind ultrasound and Doppler continues to improve
• SMI provides new visualization of tiny vessels “previously invisible”
• Potential to change the way we work
• SMI could replace some cystograms
• SMI may increase our specificity, decrease biopsies
Thank you!