Ultrasound for the PCP

SPEAKER
Richard Hoppmann, MD, FACP

9:45–10:45am

Learning Objectives
• Assess the main components and functions of a portable ultrasound unit
• Identify 3 clinical applications of portable ultrasound in the primary care setting

The Evolution of Ultrasound Technology
• Systems are smaller and portable
• Image quality has improved dramatically
• Images can be transmitted anywhere
• Systems are user friendly and smarter
• The cost of systems has come down

Presenter Disclosure Information
The following relationships exist related to this presentation:
► Richard Hoppmann, MD, FACP, has no financial relationships to disclose.

Off-Label/Investigational Discussion
► In accordance with pmiCME policy, faculty have been asked to disclose discussion of unlabeled or unapproved use(s) of drugs or devices during the course of their presentations.

Frequency: resolution and depth
• Diagnostic ultrasound 2-15 MHz
• Higher Frequency = Greater Resolution
• Lower Frequency = Greater Depth
Modes of Ultrasound

- B-mode: Brightness
- M-mode: Motion
- Doppler
  - Color Doppler
  - Spectral Doppler
  - Power Doppler

B-Mode: Still Image and Loop

M-Mode

Color Doppler

Spectral Doppler

Power Doppler

Echogenicity

- **Echogenicity**: the amplitude / brightness of the image
- **Hyperechoic**: more echogenic than surrounding tissue
- **Hypoechoic**: less echogenic than surrounding tissue
- **Isoechoic**: same echogenicity as surrounding tissue
- **Anechoic**: absence of echoes
**Important Imaging Principles**

- Piezoelectric effect
- Brightness of the image is a function of ultrasound waves that are reflected back to the transducer
- Waves are reflected back to the transducer from the interface of tissues with different physical properties
- Position of a structure on the screen is a function of how long it takes the wave to return to the transducer

**Abdominal Ultrasound B-Mode**

**Point-of-Care Ultrasound Examinations**

- These are short focused exams to answer a specific clinical question at the bedside: is there a gallstone, is there normal heart function, etc.
- These are exams that can complement and expand the Physical Exam (do not replace a good H&P).
- Can be used to guide procedures for improved safety, comfort, and clinical outcomes – peripheral and central line placement, joint injection, thoracentesis, etc.

**Clinical Examples**

Assess for left ventricular hypertrophy in a new hypertensive patient.

**Parasternal Long Axis View**

47-year-old male patient who just returned from a cross country visit to his parents presents Friday afternoon with a swollen right leg.
Patient with shoulder pain that is worse with abduction.
Supraspinatus impingement syndrome?

39-year-old female recently purchased a new tennis racket to improve her backhand – now has right elbow pain.

She has pain over the lateral epicondyle and pain with resisted wrist extension.

Tennis elbow?
Ultrasound with Power Doppler

Left                              Right

Assessment of reno-urinary system: post-void residual, kidney size, hydronephrosis, ureteral obstruction.

Urinary Bladder Volume

Width x Height x Depth x 0.523 = Bladder Volume (cc)

Hydronephrosis

Scan for Ureteral Jets of Urine
42-year-old computer programmer reports numbness and tingling of the right hand and nighttime awakening.

Tinel’s sign on examination is equivocal.

Carpal Tunnel Syndrome?
**Protocols for the more Complex Patient**

- **RUSH:** Rapid Ultrasound in Shock  
  - Patient is hypotensive or even unresponsive

- **CLUE:** Cardiopulmonary Limited Ultrasound Exam  
  - Patient needs rapid assessment for heart failure

- **BLUE:** Bedside Lung Ultrasound in Emergency  
  - Patient is in acute respiratory failure and may be BLUE

**Comparison of Hand-Carried Ultrasound to Bedside Cardiovascular Physical Examination.**

- Two first year medical students
- 4 hrs of lecture and 14 hrs of hands-on experience
- 61 cardiac patients evaluated by the students with ultrasound and 5 board-certified cardiologists using stethoscope and physical exam only
- Students identified 75% of the pathologies and cardiologists identified 49%


**Ultrasound Guided Procedures**

- Ultrasound can be used for real-time guidance (dynamic) or to “mark the spot” (static)
- Procedures:
  - Central and peripheral venous access
  - Thoracentesis, paracentesis
  - Joint aspiration/Injection
  - Virtually any procedure where visualization enhances success of the procedure

![Ultrasound Guided Procedures](Courtesy R Hoppmann, MD)
Lessons Learned in Primary Care Ultrasound

- Primary Care Practitioners are busy
- Applications need to be practical and quick to perform
- Ultrasound can be learned regardless of years from training
- Ultrasound can add autonomy to the practice
- Ultrasound can add to the attractiveness of a practice and enhance revenue
- Ultrasound can aid in patient education
- Ultrasound can make a difference in patient care

Training in Point-of-Care Ultrasound

- CME lectures and hands-on workshops
- Ultrasound e-textbooks and DVDs on scanning
- Web-based learning modules and videos
- Ultrasound simulation and phantoms
- Teaching centers and industry in-service training
- Image review portals for ongoing training
- Begin with ultrasound basics and develop skill with one or two applications then add others