Primary Care Ultrasound

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Why Ultrasound in Primary Care?

• Ultrasound is a safe diagnostic imaging modality
• Ultrasound can complement and improve the accuracy of the physical examination
• Point-of-care ultrasound applications have grown dramatically in recent years and cover many primary care clinical scenarios
Why now?
There has been a revolution in ultrasound and digital technology in recent years that has resulted in ultrasound machines that are:

- Smaller
- Cheaper
- Smarter

Portable Ultrasound: Laptops, Tablets, Plug-in Probes, and Pocket devices
The Two Main Components of an Ultrasound Unit

Modes of Ultrasound

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

B-Mode: Still Image and Loop
Reading Ultrasound Images

- Top of the image is where the probe contacts the body
- Brightness or echogenicity of a structure is a function of the ultrasound waves reflected back to the probe
- Strong reflectors produce bright images (bone, stones, diaphragm) and weak reflectors produce dark or even black images (muscle, blood, other fluid)
- Strong reflectors may produce dark shadows distally
- Distance from the top of the screen corresponds to the distance of the structure from the probe
**Echogenicity**

- Hyperechoic
- Isoechoic
- Hypoechoic
- Anechoic

**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, a DVT, 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

A 55-year-old male with a history of chronic poorly controlled HTN that you are seeing for the first time.

Has he developed end organ heart damage?

Parasternal Long Axis View

NORMAL

CONCENTRIC LVH

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?
College student presents with two weeks of sore throat, fever to 102°, and malaise. Monospot is positive. Splenomegaly? Return to intramural sports?

Measure and Follow Spleen Size

42 year old computer programmer reports numbness and tingling of the right hand and night-time awakening. Tinel’s sign on examination is equivocal. Carpal Tunnel Syndrome?
Ultrasound of Carpal Tunnel

Measure surface area and compare to other wrist

Assessment of reno-urinary system: post-void residual, kidney size, hydronephrosis, ureteral obstruction.
Width x Height x Depth x 0.523 = Bladder Volume (cc)

Hydronephrosis
Scan for Ureteral Jets of Urine

Expanding Applications of Point-of-Care Ultrasound

- Heart Disease
- Lung Disease
- Vascular Disease
- Thyroid Disease
- Cancers
- Trauma
- Pregnancy / complications
- Physical / Rehabilitation Medicine

- Eye Disease
- Genito-Urinary Disease
- GI Diseases
- Musculoskeletal Diseases
- Sports Medicine
- Geriatrics
- Pediatrics

Roberts G, Touma N. Urology 2011;78:565
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

Cardiopulmonary Limited Ultrasound Examination - CLUE Protocol

• Two minute assessment of global heart function

• Four views
  – Parasternal Long Axis of the Heart
    • Does Ant Mitral leaflet come within 1 cm of septal wall?
    • Is LA larger than ascending aorta throughout cardiac cycle?
  – Subcostal IVC plethora
    • parallel vessel walls, <50% collapse on inspiration
  – Two anterior apical lung views – one each side
    • ≥ 3 lung comet tails or “B” lines

• These measures give very good correlation with full ECHO studies for heart function
Heart Function

Normal

Heart Failure
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%


- Ten second year medical students used bedside ultrasound to measure liver size in six GI patients
- Four Board Certified Internists estimated liver size in the same six patients using physical examination alone
- Students’ measurements were significantly more accurate (p<0.001) than the physicians’ for every patient

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
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

That it will ever come into general use, notwithstanding its value, I am extremely doubtful; because its beneficial application requires much time, and gives a good deal of trouble both to the patient and the practitioner.

John Forbes M.D, in preface to Laennac’s first treatise on the stethoscope.