Diagnostic Bedside Ultrasound for the Hospitalist

Trevor Jensen MD MS
Assistant Professor, UCSF

Nima Afshar MD
Associate Professor, UCSF

Diagnostic Bedside Ultrasound

* AKA Point-of-Care Ultrasound (POCUS)

Less common names:
* AKA Emergency Ultrasound
* AKA Focused Diagnostic Ultrasound
* AKA Clinician-performed Ultrasound
Objectives

✈️ To understand how and why POCUS is being used in hospital medicine
✈️ To stimulate further study/training
✈️ NOT to teach you how to use US in your practice (yet)
✈️ Requires more in-depth training

Which best describes your practice environment?

1. University Hospital
2. County/General Hospital
3. Veterans Hospital
4. Large HMO (ie. Kaiser)
5. Other nonprofit hospital
6. For Profit Hospital
7. Other
What best describes your experience with POCUS?

1. Extensive experience with diagnostic POCUS
   • Significant training, regular use in clinical practice
2. Limited experience with diagnostic POCUS
   • Limited training, occasional use in clinical practice
3. Experience with procedural POCUS only
4. No experience

Overview

 Basics & History
 Diagnostic Bedside Ultrasound for the Hospitalist
 How to integrate Ultrasound into Clinical Care
   • Case 1: Leg Swelling
   • Case 2: Hypotension
   • Case 3: AKI
 Challenges & how to learn more
What POCUS is…

**Attributes**
- Bedside
- Focused
- Goal Directed
- Easy to learn
- Quick to perform
- Done by MD

**Uses**
- Organomegaly
- SOB
- Hypotension
- Flank Pain
- Leg Pain/swelling
- Chest Pain

**NOT**

What POCUS *isn’t*…

A substitute for a comprehensive formal US exam
### History of US

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1794</td>
<td>Echolocation</td>
</tr>
<tr>
<td>1877</td>
<td>Piezoelectric effect</td>
</tr>
<tr>
<td>1915</td>
<td>Sonar (WWI &amp; Titanic)</td>
</tr>
<tr>
<td>1920s</td>
<td>Soccer Physical Therapy</td>
</tr>
<tr>
<td>1940s</td>
<td>Brain and Breast Tumors</td>
</tr>
<tr>
<td>1953</td>
<td>First echocardiogram</td>
</tr>
<tr>
<td>1956</td>
<td>Doppler</td>
</tr>
<tr>
<td>1958</td>
<td>First use in OB/GYN</td>
</tr>
<tr>
<td>1960</td>
<td>Standard in radiology, OB/GYN, cardiology, GI</td>
</tr>
<tr>
<td>1990s</td>
<td>POC US</td>
</tr>
</tbody>
</table>

### History of POCUS

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1989</td>
<td>First use in ICU &amp; ED</td>
</tr>
<tr>
<td>1990s</td>
<td>US guided procedures</td>
</tr>
<tr>
<td>~1994</td>
<td>First EM US curriculum</td>
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<tr>
<td>~2005</td>
<td>First med school US curricula</td>
</tr>
<tr>
<td>2008</td>
<td>Radiology/EM statement on limited cardiac US</td>
</tr>
<tr>
<td>~2010</td>
<td>First formal IM US residency curriculum</td>
</tr>
</tbody>
</table>

EM program “near boston” circa 1995???
**Who uses POCUS ~ 2011**

<table>
<thead>
<tr>
<th>Specialty</th>
<th>Ultrasound Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anesthesiology</td>
<td>Guidance for vascular access, regional anesthesia, intraoperative monitoring of fluid status and cardiac function</td>
</tr>
<tr>
<td>Cardiology</td>
<td>Echocardiography, intracardiac assessment</td>
</tr>
<tr>
<td>Critical care medicine</td>
<td>Procedural guidance, pulmonary assessment, focused echocardiography</td>
</tr>
<tr>
<td>Dermatology</td>
<td>Assessment of skin lesions and tumors</td>
</tr>
<tr>
<td>Emergency medicine</td>
<td>FAST, focused emergency assessment, procedural guidance</td>
</tr>
<tr>
<td>Endocrinology and endocrine surgery</td>
<td>Assessment of thyroid and parathyroid, procedural guidance</td>
</tr>
<tr>
<td>General surgery</td>
<td>Ultrasonography of the breast, procedural guidance, intraoperative assessment</td>
</tr>
<tr>
<td>Gynecology</td>
<td>Assessment of cervix, uterus, and adnexa, procedural guidance</td>
</tr>
<tr>
<td>Obstetrics and maternal-fetal medicine</td>
<td>Assessment of pregnancy, detection of fetal abnormalities, procedural guidance</td>
</tr>
<tr>
<td>Neonatology</td>
<td>Cranial and pulmonary assessments</td>
</tr>
<tr>
<td>Neurology</td>
<td>Vascular access for dialysis</td>
</tr>
<tr>
<td>Neurology</td>
<td>Transcranial Doppler, peripheral nerve evaluation</td>
</tr>
<tr>
<td>Ophthalmology</td>
<td>Corneal and retinal assessment</td>
</tr>
<tr>
<td>Orthopedic surgery</td>
<td>Musculoskeletal applications</td>
</tr>
<tr>
<td>Otolaryngology</td>
<td>Assessment of thyroid, parathyroid, and neck masses, procedural guidance</td>
</tr>
<tr>
<td>Pediatric</td>
<td>Assessment of bladder, procedural guidance</td>
</tr>
<tr>
<td>Pulmonary medicine</td>
<td>Transthoracic pulmonary assessment, endobronchial assessment, procedural guidance</td>
</tr>
<tr>
<td>Radiology and interventional radiology</td>
<td>Ultrasoundography taken to the patient with interpretation at the bedside, procedural guidance</td>
</tr>
<tr>
<td>Rheumatology</td>
<td>Monitoring of synovitis, procedural guidance</td>
</tr>
<tr>
<td>Trauma surgery</td>
<td>FAST, procedural guidance</td>
</tr>
<tr>
<td>Urology</td>
<td>Renal, bladder, and prostate assessment, procedural guidance</td>
</tr>
<tr>
<td>Vascular surgery</td>
<td>Carotid, arterial, and venous assessment, procedural assessment</td>
</tr>
</tbody>
</table>

*FAST denotes focused assessment with sonography for trauma.*


**Wachter’s World**

“...The larger issue now is to decide whether we believe that building competency in ultrasound among generalist physicians – in this case hospitalists – will enhance patient safety, quality, and value. Personally, I do.”

- BW 2012
Who uses POCUS ~ 2014

A generation of physicians will need to be trained to view this technology as an extension of their senses, just as many generations have viewed the stethoscope. That development will require the medical education community to embrace and incorporate the technology throughout the curriculum.

Point-of-Care US in Medical Education. NEJM 2014

Why POCUS?

“The stethoscope of the 21st century”
Why POCUS… really?

- Allows earlier diagnosis and treatment
- Reduces iatrogenic complications (procedures)
- Reduces radiation exposure
- Reduces length of stay
- Reduces cost of stay
- Increases patient satisfaction (hands-on)

- Pleural effusion
- Pulmonary edema
- Pneumonia
- Pneumothorax
- Ascites
- Aortic aneurysm
- Hydronephrosis
- Organomegaly
- LV systolic function
- Pericardial effusion
  * Chamber size
  * Valvular disease
- Volume status
- DVT

* Advanced uses
How to use POCUS

Case 1

- 70 year old woman with immobility due to osteoarthritis, breast CA, chronic venous stasis presenting with L>R LE swelling, erythema, tenderness
- + fever, tachypnea, malaise

Ddx: cellulitis > other infection + asymmetric edema > DVT
Why use DVT POCUS?

- Many common clinical scenarios:
  - unilateral leg swelling, SOB/hypoxia
- Quick, noninvasive
- Physicians can achieve proficiency with brief, focused training
- POCUS compression DVT exam is highly accurate
  - Sensitivity of 96% and specificity of 96%

LIVE DEMO - DVT

DVT POCUS - Abnormal

[Image of ultrasound showing DVT and artery]
Case 2

- 54 year old man with COPD, CHF presenting with hypotension
- + sputum, SOB, subjective fevers, missed lasix dose x 4 days
- CXR, BNP relatively equivocal

Ddx: Sepsis from pulmonary source > CHF exacerbation

POCUS for Undifferentiated Shock

- Many Protocols
  - CLUE
  - RUSH

- Major Components
  - IVC
  - LV systolic function
  - Lung Ultrasound
Why use IVC POCUS?

- Many common clinical scenarios:
  - hypotension, hypoxia, diuresis
- Quick, noninvasive, bedside
- Physicians can achieve proficiency with brief, focused training
- Moderate utility if used independently (better if combined)
  - Diameter ROC 0.55, Collapsibility ROC = 0.84

LIVE DEMO - IVC

IVC POCUS - Abnormal

Superior

Liver

Heart

IVC

IVC Lack of Collapse

Inferior
Why use POCUS for LV function?

- Many common clinical scenarios:
  - hypotension, dyspnea
- Quick, noninvasive
- Physicians can achieve proficiency with brief, focused training
- Increases accuracy in diagnosis of CHF in the acute setting and diagnosis and treatment in undifferentiated shock

2. Kimura et al. Usefulness of a hand-held ultrasound device for the bedside examination of left ventricular function. Am J Cardiol. 2002

LV Function POCUS
LIVE DEMO – LV function

LV Function POCUS – Abnormal

Reduced LVEF video
Why use Lung POCUS?

- Many common clinical scenarios:
  - consolidation, interstitial syndrome, pleural effusion, & pneumothorax
- Quick, noninvasive
- Physicians can achieve proficiency with brief, focused training
- Diagnostic accuracy > chest xray for multiple indications
  - Consolidation: 95% vs 49%
  - Interstitial syndrome: 94% vs 58%
  - Pneumothorax: 92% vs 89%
  - Pleural Effusion: 100% vs 69%

LIVE DEMO – Lung US

Lung POCUS - Abnormal

Interstitial syndrome video
Case 3

65 year old man with BPH, kidney stones presents with AKI
+ fevers, cough, sputum, decreased UOP, not taking flomax
- dysuria, flank pain

Ddx: Prerenal > ATN >> obstruction

Why use Renal POCUS?

- Many common clinical scenarios:
  - AKI, abdominal pain

- Quick, noninvasive

- Physicians can achieve proficiency with brief, focused training

- Accurate (hydronephrosis in renal colic)
  - Sensitivity 80%
  - Specificity 77%

Renal POCUS

LIVE DEMO – Renal
Renal US - Abnormal

Hydronephrosis video

Major Challenges

- **Training:**
  - Significant time investment

- **Credentialing and Privileging:**
  - No standards for hospitalists

- **Hardware:**
  - Few institutions have appropriate POCUS capabilities

- **Research:**
  - Poorly understood diagnostic algorithms for hospital medicine patients
How to learn more…

- Attend a CME course
- Work with your EM and critical care colleagues
- Self learning via the many free or cheap online resources
- Email us for details:
  - Trevor.Jensen@ucsf.edu
  - Nima.Afshar@ucsf.edu

How likely are you to pursue further training in POCUS?

1. Very likely
2. Likely
3. Unlikely
4. Very unlikely
Questions?

Photograph citations

Slide 5:
- http://vscanultrasound.gehealthcare.com/
- http://www.adwesys.com/submit-purchase-com

Slide 7/8:
- http://www.jultrasoundmed.org/content/23/1/1/F1.expansion
- http://www.ultrasoundmed.com/history1.html
- http://www.ultrasoundmed.com/history2.html

Slide 12:

Slide 14:
- Liver: http://www.teachmebody.com/lower-body-liver.html

Slide 18/20/28/37: Soni et al. Point of Care Ultrasound. Elsevier. 2015

Slide 24:
- http://www.teachmebody.com/c/nd/9fVNd/C/ultrasound/8m8n.htm

Slide 32: