Point-of-Care Ultrasound (POCUS)
An Introduction for the General Internist

Mike Wagner, MD, FACP, RDMS
Assistant Professor of Medicine
Director of Internal Medicine Ultrasound Education
michael.wagner@uscmed.sc.edu

www.SONOInternist.com

SCHOOL OF MEDICINE
UNIVERSITY OF SOUTH CAROLINA
Background

• Disclosures: No disclosures/conflicts of Interest

• Education/Experience:
  • Internal Medicine Residency in USN (NMCP)
  • Internist and Flight Surgeon at Naval Aerospace Medical Institute
  • Primary Care Ultrasound Fellow
  • Director of IM Ultrasound Education
Defining POCUS

POCUS IS
• Performed *rapidly*
• *Limited* in scope
• Goal directed: answers very *specific* clinical questions
• An extension and augmentation of physical exam

POCUS IS NOT
• NOT a comprehensive survey or “gold standard” test
• Replacement for a “formal” study

“Is a pericardial effusion present”

“Is this AS severe enough to warrant a valve replacement”
Who uses POCUS?

American College of Emergency Physicians

POLICY STATEMENT

Emergency Ultrasound Guidelines

Approved October 2008

Society of Critical Care Medicine

Guidelines for the Appropriate Use of Bedside General and Cardiac Ultrasonography in the Evaluation of Critically Ill Patients—Part I: General Ultrasonography

Heidi L. Frankel, MD, FACS, FCCM, FCCP, Andrew H. Kirkpatrick, MD, MHSc, FRSC, FACS

EXPERT CONSENSUS STATEMENT

Focused Cardiac Ultrasound: Recommendations from the American Society of Echocardiography

Kirk T. Spencer, MD, FASE, Bruce J. Kimura, MD, Claudia E. Koczwara, DVM, RDMS, FASE, Patricia A. Pollock, MD, FASE, Peter S. Bahlke, MD, FASE, and Robert J. Siegel, MD, FASE, Chicago, Illinois; San Diego and Los Angeles, California; Madison, Wisconsin; Rochester, Minnesota

The New England Journal of Medicine

Table 1. Selected Applications of Point-of-Care Ultrasonography, According to Medical Specialty.*

<table>
<thead>
<tr>
<th>Specialty</th>
<th>Ultrasound Applications</th>
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</thead>
<tbody>
<tr>
<td>Anesthesia</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>
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<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 adnex; 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>
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<tr>
<td>Nephrology</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>Pediatrics</td>
<td>Assessment of bladder, procedural guidance</td>
</tr>
<tr>
<td>Pulmonary medicine</td>
<td>Tracheostomy pulmonary assessment, endobronchial assessment, procedural guidance</td>
</tr>
<tr>
<td>Radiology and interventional radiology</td>
<td>Ultrasonography 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.
Who CAN use POCUS?

H-230.960 Privileging for Ultrasound Imaging

(1) AMA affirms that ultrasound imaging is within the scope of practice of appropriately trained physicians;

(2) AMA policy on ultrasound acknowledges that broad and diverse use and application of ultrasound imaging technologies exist in medical practice;

(3) AMA policy on ultrasound imaging affirms that privileging of the physician to perform ultrasound imaging procedures in a hospital setting should be a function of hospital medical staffs and should be specifically delineated on the Department’s Delineation of Privileges form; and

(4) AMA policy on ultrasound imaging states that each hospital medical staff should review and approve criteria for granting ultrasound privileges based upon background and training for the use of ultrasound technology and strongly recommends that these criteria are in accordance with recommended training and education standards developed by each physician’s respective specialty. (Res. 802, I-99; Reaffirmed: Sub. Res. 108, A-00)
Some Applications: Head to Toe

- Ocular - retinal detachment, intracranial pressure
- ENT - Sinusitis, Peritonsilar abscess
- Carotid - plaque/stenosis, dissection, volume responsiveness?
- Thyroid - Nodules, Graves
- Trachea/Eosophagus - Endotracheal tube placement
- Heart/IVC - pericardial effusion, EF, valves, chamber size, CVP
- Lung - Pneumothorax, Pleural Effusion, Pulm Edema, Pneumonia
- Spleen - Splenomegaly
- Liver/Gallbladder - hepatomegaly, gallstones, cholecystitis
- Kidneys/ureters/bladder - hydronephrosis, urinary retention
- Intestines - small bowel obstruction, appendicitis
- Peritoneum - Hemoperitoneum/ascites, paracentesis
- Genitals/Pelvic - mass, torsion, pregnancy
- Vascular - DVT, central and peripheral line placement
- Musculoskeletal - fractures, tendon injury, joint injections
- Skin/Soft tissues - cellulitis, abscess
How Should Internists Use Ultrasound?

- At a MINIMUM: US-GUIDED PROCEDURES!!!!!
  - CVL Placement
  - Thoracentesis
  - Paracentesis

- Aid in Dx and Tx
  - DVT
  - Pleural Effusions
  - Ascites

- Start small and build gradually
Why Should Internists Use Ultrasound?

- **Safe**
- Repeatable
- Sharable
- “Real-time”
- Cost-Effective
WHY IM POCUS NOW?
Ultrasound Basics and

Important POCUS “Home Screens”
Important BASIC Ultrasound Tips

- Think of ultrasound probe like a FLASHLIGHT shining into body
  - Beam slices 3D anatomy into 2D images based on plane of cut

- Shape+depth of beam depends on probe
Important BASIC Ultrasound Tips

- **Anechoic**: FLUID IS BLACK
- **Hypoechoic**: TISSUE IS GREY
- **Isoechoic**: AIR/BONE IS WHITE
- **Hyperechoic**:...
- **Reflective**:
IJV
ICV

• Applications
  • Intravascular Volume Assessment
  • Central Venous Pressure Assessment
Probe Placement and Plane of Cut

Transverse Plane

Longitudinal Plane
IVC Homescreen (Transverse)
IVC Homescreen (Longitudinal)

- Cranial
- Liver
- HVs
- Vertebral Bodies
- Caudal
- RA
- IVC

Deep/Posterior
Hypervolemia/Elevated CVP

Normal

Abnormal
Hypovolemia/Low CVP

Normal

Abnormal
ABDOMEN (RUQ)

• Applications
  • Pleural Effusion
  • Ascites
  • Renal size, appearance, and hydroureter and hydronephrosis
  • Gallstones
  • Alternate IVC and aorta windows
Trouble with RUQ Orientation?
Try This Laminated Sheet Example
RUQ
Ascites

Back to Front

Liver
Kidney
Caudal
Cranial
Deep/Medial

Ascites
RUQ
Pleural Effusion
Pleural Effusions

Normal (- effusion)

Abnormal (+ effusion)

Curtain Sign (- effusion)

Mirror image artifact and NO spine sign (- effusion)

Spine sign (+ effusion)
Ascites

Normal

Abnormal
HEART

• Applications
  • Cardiac Activity vs Standstill vs Fine Vfib (Codes)
  • Proportions (right ventricular, aortic root, and left atrial enlargement)
  • Pericardial Effusion
  • Left Ventricular Function
Parasternal Long Axis View (PLAX)

- LV (Left Ventricle)
- LA (Left Atrium)
- IVS (Interventricular Septum)
- RV (Right Ventricle)
- Aorta
- MV (Mitral Valve)

Images depict various cardiac structures and views, including an ultrasound image and an anatomical illustration of the human heart.
Understanding the PLAX

Plane of cut

Looking from the left TO the right

Images adapted from:
https://www.youtube.com/watch?v=42vaOjNdErQ

Images adapted from:
http://www.barnardhealth.us/echocardiography/info-bvs.html
Pericardial Effusion

Normal

Abnormal
Left Ventricular Function

Normal

Abnormal

LV
LA
IVS
RV
Aorta
MV
LA
>1 CM
LUNG

• Applications
  • Pneumothorax
  • Pulmonary Edema (Interstitial Syndrome)
  • Pleural Effusion
  • Pneumonia
  • Pulmonary Fibrosis
  • Pulmonary Embolism
  • Pleuritic Chest Pain
Lung Ultrasound Just Looks Different...
Making Sense of Artifacts

Goal is to distinguish Abnormal artifacts from the normal ones...
The Pleural Surface as a REFLECTOR
Normal Lung “Homescreen”
A-Lines vs B-Lines

- No Fluid (normal)
- Fluid (abnormal)

Horizontal artifact pattern

Vertical artifact pattern
Pulmonary Edema

Normal (Aerated Lung)

Abnormal (Wet Lung)
Pneumothorax

Normal (No PTX)

Abnormal (PTX)
Lung Point ≈100% Specific for PTX

Exhale (no lung sliding)  
Inhale (lung sliding)
Unfortunately, no one can be *told* what POCUS is...

...you have to see it for yourself!
Next Steps

• Get connected, get involved!
  • www.susme.org
  • www.sonointernist.com
  • www.twitter.com - #pocus, #IMPOCUS, #FOAMus

• Get more training, bring a colleague!
  • http://ultrasoundinstitute.med.sc.edu/
  • http://im2016.acponline.org/educational-program/pre-session-courses
  • http://www.hospitalmedicine2016.org/program/pre-courses/#three
  • http://www.sccm.org/Education-Center/Ultrasound/Pages/Fundamentals.aspx
  • https://www.emergencyultrasound.com/

• REGIONAL ACP MEETINGS???
Get Involved!

LOCATE OTHER SONO-ENTHUSIASTS!

Find out what physicians near you are using bedside ultrasound as part of their daily clinical practice.

Email us (at the bottom of the page) if you want to be pinned to this map!

Never doubt that a small group of thoughtful, committed citizens can change the world. Indeed, it is the only thing that ever has.

- MARGARET MEAD

www.sonointernist.com
Final Questions/Feedback?

Michael.wagner@uscmed.sc.edu  sonointernist@gmail.com