Point of Care Ultrasound in Homeless Medicine: A Practice Changing, Patient Centered Tool

Joseph Mega, MD, MPH
Medical Director
Contra Costa County Health Care for the Homeless

Jason Reinking, MD
Roots Community Health Center
Alameda County Health Care for the Homeless
Disclosure

Neither presenter has any actual or potential conflict of interest in relation to this presentation
Health Care for the Homeless
Contra Costa County, CA

OAKLAND
Health Care for the Homeless Mobile Outreach
Oakland Street Team Outreach Medical Program (STOMP)
Outline

• Historical Perspectives
• What is Point of Care Ultrasound (POCUS)?
• Why should I care about POCUS?
• Supporting data
• Cases
• Practicalities
"That it will ever come into general use, notwithstanding its value, is extremely doubtful; because its beneficial application requires much time..."
### Stanford Medicine 25 → UCI 30

<table>
<thead>
<tr>
<th>1. Fundoscopic exam</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visualize cond of retinal blood vessels—indicative of cond of vessels throughout body</td>
</tr>
<tr>
<td>Potential diagnosis of neurologic problems</td>
</tr>
<tr>
<td>Clues to systemic diseases</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2. Pupillary responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Examine pupillary constriction and dilation in response to light</td>
</tr>
<tr>
<td>Can reveal eye trauma, neurological disease, other conditions</td>
</tr>
<tr>
<td>Imaging of pupil constriction under a closed eyelid</td>
</tr>
<tr>
<td>Assess for relative afferent pupillary defect</td>
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<thead>
<tr>
<th>3. Thyroid exam</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feel thyroid gland by palpating neck</td>
</tr>
<tr>
<td>Helps diagnose thyroid disease</td>
</tr>
<tr>
<td>Directly visualize thyroid lobes</td>
</tr>
<tr>
<td>Detect much smaller tumor</td>
</tr>
<tr>
<td>Differentiate between solid tumors and cysts with high sensitivity and specificity</td>
</tr>
<tr>
<td>For patients with hyperparathyroidism:</td>
</tr>
<tr>
<td>As sensitive and specific as MIBI in localizing parathyroid adenomas</td>
</tr>
<tr>
<td>Noninvasive, cost-effective screening modality</td>
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</tbody>
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<thead>
<tr>
<th>4. Neck veins</th>
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</thead>
<tbody>
<tr>
<td>Visualize jugular venous pulse</td>
</tr>
<tr>
<td>Can aid in diagnosis of cardiac conditions</td>
</tr>
<tr>
<td>Noninvasive measurement of central venous pressure</td>
</tr>
<tr>
<td>Visualization of waveforms consistent with cardiac conditions</td>
</tr>
</tbody>
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<thead>
<tr>
<th>5. Pulmonary exam</th>
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</thead>
<tbody>
<tr>
<td>Determine lung's boundaries by tapping the chest</td>
</tr>
<tr>
<td>Detection of fluid or pneumonia</td>
</tr>
<tr>
<td>Auscultation to detect pleural effusion, alveolar consolidation, and alveolar-interstitial syndrome</td>
</tr>
<tr>
<td>Detection of various lung pathologies considerably better than auscultation or even chest x-ray</td>
</tr>
<tr>
<td>Safe, rapid, cost-effective alternative to thoracic computed tomography</td>
</tr>
</tbody>
</table>

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<thead>
<tr>
<th>6. Point of maximal impulse and parasternal heave</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feel the beating heart and impulses originating in heart or large vessels</td>
</tr>
<tr>
<td>Detection of heart and lung problems</td>
</tr>
<tr>
<td>Precisely locate point of maximal impulse</td>
</tr>
<tr>
<td>Increased diagnostic capabilities</td>
</tr>
<tr>
<td>Differentiate various forms of cardiomyopathy and assess dyskinesia through visualization of atrial and ventricular walls</td>
</tr>
</tbody>
</table>

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<thead>
<tr>
<th>7. Examination of liver</th>
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</thead>
<tbody>
<tr>
<td>Percussion to approximate liver size</td>
</tr>
<tr>
<td>Feel liver edge, gallbladder tenderness, and gallbladder inflammation</td>
</tr>
<tr>
<td>Trace edges of liver</td>
</tr>
<tr>
<td>Screen liver for small masses, nodularity, hepatitis, inflammation</td>
</tr>
<tr>
<td>Measure liver volume, and detect and measure hepatic masses</td>
</tr>
<tr>
<td>Measure thickness of gallbladder wall and assess for inflammation, obstruction</td>
</tr>
<tr>
<td>Measure bile flow and can estimate cholelithiasis</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>8. Examination of the spleen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Palpate spleen to detect various illnesses: infection, tumor, leukemias, liver disease</td>
</tr>
<tr>
<td>Visualize spleen in enirety and accurately measure</td>
</tr>
<tr>
<td>Visualize splenic masses and characterize as cystic or solid</td>
</tr>
</tbody>
</table>

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<thead>
<tr>
<th>9. Musculoskeletal system: common gait abnormalities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observe person's walk to detect nervous system and musculoskeletal problems and conditions</td>
</tr>
<tr>
<td>Visualize musculoskeletal system: joints, tendons, and muscles</td>
</tr>
<tr>
<td>Differentiate between hip fluid collection and proximal femoral fracture</td>
</tr>
<tr>
<td>Accurately guide needle into joint space for fluid aspiration</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>10. Deep tendon (ankle jerk) reflex</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hammer used to strike Achilles tendon above the heel to detect ankle jerk reflex</td>
</tr>
<tr>
<td>Diagnosis of partial and complete tears of Achilles tendon</td>
</tr>
<tr>
<td>Hyperreflexia in brainstem injury</td>
</tr>
<tr>
<td>Hyporeflexia in lower motor neuron disorders</td>
</tr>
</tbody>
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![Image](https://via.placeholder.com/150)

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![Image](https://via.placeholder.com/150)
Interested? A Case...

HPI: At the weekly needle exchange night clinic a gentleman presents with stated fall from bike 4 days ago with persistent hand pain, difficulty grasping objects
-Social Hx: homeless, living in a tent. Recycles daily for living expenses
PE: ttp over 3\textsuperscript{rd} and 4\textsuperscript{th} metacarpal heads

What do you do next?
Changing management

- Direct urgent referral to orthopedics (Cast placed days later)
- Splint placed following POCUS on mobile clinic
- Pain management informed
- 10 day medical respite arranged
- Connected to services in medical respite
What is Point of Care Ultrasound?

• AKA - “Limited,” “Focused,” “Clinician performed”
• Use of portable ultrasound at the point of patient encounter for diagnostic or therapeutic purposes
• Real time application of imaging modality
• Extension of the physical exam adding anatomic, functional, and physiologic information
• NOT COMPREHENSIVE STUDY
What Point of Care Ultrasound is NOT?

• Comprehensive
  – Provider orders
  – Tech acquires images
  – Radiologist reads
  – Provider incorporates results into patient care

• Point of Care
  – You are the provider
  – You are the technologist
  – You are the radiologist
  – Real time application
Comparisons

• Comprehensive
  – Time-consuming
  – Information loss
  – Extraneous information

• Point Of Care
  – Immediate
  – Clinical correlation
  – Focused information can be used in algorithms
  – Yes/No dichotomous questions
Yes/No questions

- Are there gallstones in the gallbladder?
- Is the ejection fraction normal?
- Is there a fracture?
- Is there free fluid in the abdomen?
- Is there fluid in the lungs?
- Are the kidneys obstructed?
- Is there an abscess?
- Is there a blood clot?
- Is there an abdominal aortic aneurysm?
Why should I use POCUS?

• Patient Centered
  – Improved patient satisfaction
  – Improved diagnostic accuracy
  – Safer, more accurate procedures
• Decreased time to decision making
• Reduces Cost
• Safe
• Portable
• Diverse applications
POCUS applications

• Echocardiography
  – Pericardial effusion
  – Ejection fraction
  – Chamber assessment
  – Valvular disease
• Obstetrics
  – IUP
  – Intrauterine masses
  – IUD placement
• AAA screening
• Liver/Biliary
  – Cholelithiasis/choledocholithiasis
  – Cholecystitis
  – Hepatic masses
  – ascites
• Spleen
• Urinary Tract
  – hydronephrosis
  – PVR
• Procedural guidance
  – Joint injections
  – Foreign body removal
  – Abscess incision and drainage
• DVT
• Soft-Tissue
  – Cellulitis vs abscess
• Musculoskeletal
  – Ligament/tendon pathology
  – Fractures
  – Dislocations
• Thoracic
  – Consolidation (PNA)
  – Pulmonary edema
  – Pleural effusion
• Ocular
  – Retinal detachment
  – Lens dislocation
• Testicular
  – Testicular mass
  – Hydrocele
  – epididymitis
• Thyroid
• Breast
• FASH exam
  – Extrapulmonary tuberculosis
Why POCUS in Homeless health care?

- Patient centered
  - Performed by trusted care team
  - Deepen relationship with patient
  - Improves patient satisfaction
  - Diagnostic and therapeutic accuracy
- Portable into the field or in a clinic
- High image quality
- Easily Reproducible
- Safe
- Low cost
- Diverse applications
Barriers to diagnostic imaging in the homeless

- Basic needs prioritization, aka “the hustle”
- Lack of transportation
- Lack of identification
- Lack of insurance and associated cost
- Lack of trust
- Schedule adherence
- Anxiety regarding reading or writing forms
- Self-consciousness (appearance and hygiene)
Truthfully....

How many of your patients complete imaging referrals?
April 2018 Data

- 164 patients
- 18 scans
- 11% rate
2 choices
Relationships build trust
But I thought only Radiologists could use ultrasound

• AMA Resolution 802 (2010)
  – All medical specialties have the right to use ultrasound according to specialty specific standards

• ACEP US guidelines

• AAFP POCUS Curriculum Guidelines (2017)
I don’t have time for a fellowship

• Becoming part of residency training
• Basic Skills take little time to learn
• Can be learned at any stage of training
My Physical Exam is Accurate Enough
We send so many patients to the hospital because, “what if that venous stasis is a DVT?”
## TABLE 2
Point-of-care ultrasound: How accurate? How much training?

<table>
<thead>
<tr>
<th>Protocol</th>
<th>Sensitivity</th>
<th>Specificity</th>
<th>Training requirement</th>
<th>Time required to perform protocol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evaluation for left ventricular systolic function (compared with expert sonography)</td>
<td>69%-94%</td>
<td>91%-94%</td>
<td>8 hours of training or 20 practice exams</td>
<td>*</td>
</tr>
<tr>
<td>Evaluation of IVC to determine volume status and predict readmission for CH</td>
<td>81%</td>
<td>72%</td>
<td>4 hours of training and 20 practice exams</td>
<td>*</td>
</tr>
<tr>
<td>Evaluation for pleural effusion (compared with CT or expert sonography)</td>
<td>94%</td>
<td>98%</td>
<td>3 hours of training</td>
<td>*</td>
</tr>
<tr>
<td>Evaluation for pneumonia (compared with x-ray or CT)</td>
<td>90%-96%</td>
<td>88%-93%</td>
<td>3 hours of training</td>
<td>*</td>
</tr>
<tr>
<td>Evaluation for pulmonary edema (compared with final diagnosis by blinded chart review)</td>
<td>85%-100%</td>
<td>92%-98%</td>
<td>5 practice exams</td>
<td>*</td>
</tr>
<tr>
<td>Screening exam for AAA (compared with expert sonography)</td>
<td>100%</td>
<td>100%</td>
<td>50 practice exams</td>
<td>&lt;4 minutes</td>
</tr>
<tr>
<td>Evaluation for proximal leg DVT (compared with expert sonography)</td>
<td>95%</td>
<td>96%</td>
<td>10 minutes to 5 hours of training</td>
<td>&lt;4 minutes</td>
</tr>
</tbody>
</table>

AAA, abdominal aortic aneurysm; CHF, congestive heart failure; CT, computed tomography; DVT, deep vein thrombosis; IVC, inferior vena cava.

*Time required to perform was not evaluated for these protocols in the literature that was reviewed.
B-LINES

NORMAL LUNG
Case

52 yo M seen at street outreach
Noted that he has had SOB with minimal activity and difficult to sleep at night.
IV heroin and methamphetamine use
BP 180/110 HR 81 T97.9F SaO2 98%
Patient’s POC Echo

Normal POC Echo
Did Ultrasound Change Management?

- New diagnosis of Systolic CHF confirmed
- Prescribed lasix, lisinopril and metoprolol
- Likely avoided ER visit
- Followed up with patient in 1 week, feeling better
- Started on buprenorphine
- Working on meth cessation
Case

• 53 yo F presented to our HCH clinic c/o lump in right breast for several months. Patient living on the street. Daily methamphetamine use.
• Nervous to come to clinic, rarely accesses medical care.
Patient’s Breast US

Normal Breast US
Did Ultrasound Change Management?

• Patient referred for same day mammogram and formal US showing mass concerning for neoplasm
• AWOL for several days from shelter
• Returned 4 days later to HCH shelter clinic, US-guided core needle bx done in clinic by our NP
• Pt seen by oncology 1 week later and began treatment
• Obtained medical respite bed
CASES

• 52 yo M h/o CHF, active daily meth use seen in field with SOB, LE edema for several months, worse past week. Off meds.
• Started back on lasix, referred to clinic for follow up check in 1 week.
• Pt reports increased urination, no improvement in respiratory symptoms.
Did Ultrasound Change Management?

- Pt sent directly to ED for CXR, admission, thoracentesis
- Expedited diagnosis of large pleural effusion
- Able to engage patient in treatment plan and give real-time information
- Patient subsequently transferred to medical respite, about to be housed.
Case
Did ultrasound alter management?

- Abscess identified
- No Color flow seen
- I&D done safely based on US images
- ER visit saved
- Patient buy-in to provider-patient treatment plan
Case

• 44 yo F with no pmhx presents to health van from her encampment.

• Two days nausea, severe epigastric/RUQ pain after eating a burrito. Reports this happens every couple months.

• Vitals: HR 80, BP 138/79, T98.2F, SaO2 99%

• Very TTP in RUQ on exam
Patient’s RUQ US

Normal RUQ US
Did ultrasound change management?

- Outpatient labs done same day, all normal
- Pain managed, diet triggers reviewed
- Patient referred to gen surg as outpatient, had elective cholecystectomy
- Avoided ER visit, immediate diagnosis of cholelithiasis
Case

- 35 y F h/o cocaine dependence and schizophrenia living in encampment.
- Presents to outreach c/o suprapubic pain, ongoing nausea for two months.
  - Urine dip negative for UTI
  - Urine preg positive
Did ultrasound change management?

- On-site dating and confirmation of IUP with +FHT
- Likely avoided ER visit
- Accurate date-based options counseling provided on site
- Patient buy-in to provider-patient treatment plan
Practicalities

- Cost
- Billing
- Archiving
- Training
- Credentialing
Cost

• Price point has dropped in last decade with increasing POCUS
  – High end portable ultrasound $20,000+
  – Quality budget units $7000+
  – Monthly plans: $200/month
Archiving

• Developing field – general recommendations
• All images should be archived
  – Medical record
  – External archive
• Electronic or printed
• Medical record – written report
  – Limited vs complete
Billing

• Yes, it is possible
• Limited vs complete ultrasound coding
• cannot bill for both limited and complete pertaining to single work-up
• Check with each individual insurer for regulations
  – Medicare requires documented training or CME, competency
Trainings

• Focused
  – Weekend courses – CME certified
    • General POCUS
    • Musculoskeletal
  – Didactic Material
    • Podcasts
    • Books

• Longitudinal
  – 1 year academies - online
  – Residency curriculums
  – Medical school curriculums
# 2 day course schedule

## DAY 1

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
</tr>
</thead>
<tbody>
<tr>
<td>800am</td>
<td>Introduction (Neil Jayasekera)</td>
</tr>
<tr>
<td>815am</td>
<td>&quot;The Basics&quot; - US terminology, Physics &amp; Knowledge (Jason Reinking)</td>
</tr>
<tr>
<td>845am</td>
<td>Trauma: FAST and eFAST (Neil Jayasekera)</td>
</tr>
<tr>
<td>905am</td>
<td>FAST and E-FAST Lab</td>
</tr>
<tr>
<td>1015am</td>
<td>Abdominal US -- Gallbladder and Aorta (Jason Reinking)</td>
</tr>
<tr>
<td>1035am</td>
<td>Abdominal US Lab</td>
</tr>
<tr>
<td>1145am</td>
<td>Pass the Pointer (Jason Reinking) Review of Basics, FAST, and Abdominal US</td>
</tr>
<tr>
<td>1200-100pm</td>
<td>LUNCH</td>
</tr>
<tr>
<td>100pm</td>
<td>Basic Cardiac Echo (Jason Reinking)</td>
</tr>
<tr>
<td>120pm</td>
<td>Basic Cardiac US Lab</td>
</tr>
<tr>
<td>240pm</td>
<td>Abdominal US - Kidney &amp; Bladder (Jon Powell)</td>
</tr>
<tr>
<td>500pm</td>
<td>Abdominal US Lab</td>
</tr>
<tr>
<td>540pm</td>
<td>DVT US (Jon Powell)</td>
</tr>
<tr>
<td>400pm</td>
<td>DVT US lab and/or Open Lab</td>
</tr>
<tr>
<td>500pm</td>
<td>Adjourn</td>
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</tbody>
</table>

## DAY 2

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
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</thead>
<tbody>
<tr>
<td>830am</td>
<td>Brief review/Pass the pointer (Kendra Johnson)</td>
</tr>
<tr>
<td>850am</td>
<td>OB 1st trimester, rule out ectopic (Kendra Johnson)</td>
</tr>
<tr>
<td>910am</td>
<td>OB 1st trimester lab</td>
</tr>
<tr>
<td>1000am</td>
<td>Soft Tissue US &amp; Nerve Block (Neil Jayasekera)</td>
</tr>
<tr>
<td></td>
<td>Abscess, Foreign Body evaluation, Nerve Block</td>
</tr>
<tr>
<td>1020am</td>
<td>Procedural US (Neil Jayasekera)</td>
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<tr>
<td></td>
<td>Arterial line, Venous access, Thoracentesis, Paracentesis</td>
</tr>
<tr>
<td>1040am</td>
<td>Soft Tissue, Nerve Block, Procedural US lab</td>
</tr>
<tr>
<td>1200-100pm</td>
<td>LUNCH</td>
</tr>
<tr>
<td>100pm</td>
<td>Pulmonary US (Jason Reinking)</td>
</tr>
<tr>
<td>120pm</td>
<td>Pulmonary US Lab</td>
</tr>
<tr>
<td>180pm</td>
<td>Musculoskeletal (Jason Reinking)</td>
</tr>
<tr>
<td>210pm</td>
<td>Musculoskeletal lab</td>
</tr>
<tr>
<td>510pm</td>
<td>RUSH - Rapid Ultrasound for Shock &amp; Hypotension (Neil Jayasekera)</td>
</tr>
<tr>
<td>530pm</td>
<td>RUSH lab</td>
</tr>
<tr>
<td>450pm</td>
<td>Overview of advanced applications (Neil Jayasekera)</td>
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<tr>
<td>500pm</td>
<td>Adjourn</td>
</tr>
</tbody>
</table>
Competency

• Accuracy highly dependent on skill of practitioner
• Training, assessment, quality assurance
• Each system develops its own guidelines
• In general...
  – 150-300 total scans
  – 25-50 scans for specific exam
  – 5-10 scans for ultrasound guide procedures
Be an ultrasound champion

- Repurposing...
- Build a program
Questions

Jason Reinking, MD
jreinking@ccfamilymed.com

Joe Mega, MD
jmega@ccfamilymed.com
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