Echo in the Emergency Room: Who Does It and To Whom?

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Introduction

• Over the past 2 decades, US equipment has become more compact, higher quality and less expensive
• Wider availability and feasibility of echo equipment has broadened its use to non-traditional users
• Rapid diagnostic capability ideal for the critically ill in the ER.
Echo in the ER

- Full echo performed by cardiology-run echo lab for complex studies
- Focused echo performed by ER personnel
  - First guidelines published by ACEP in 2001
  - Guidelines revised by ACEP in 2008
- ER US not confined to the heart
- US training now incorporated into ER residency and fellowship training programs.
Scope of Practice

- Goal-directed, focused US exam that answers brief and important clinical questions
- Evaluation of emergency medical conditions, resuscitation of acutely ill or injured pts
- Applied to any emergency medical condition in any setting with limitations of time, personnel or patient condition
- US performed, interpreted, and integrated in an immediate and rapid manner
Functional Clinical Categories

• Resuscitative
• Diagnostic
• Symptom or sign based
• Procedure guidance
• Therapeutic and monitoring
Figure 1. ACEP 2008 emergency ultrasound guidelines scope of practice.

- Resuscitative
- Diagnostic
- Procedural Guidance
- Symptom or Sign-Based
- Therapeutic

Core Applications 2008
- Trauma
- Intrauterine Pregnancy
- AAA
- Cardiac
- Biliary
- Urinary Tract
- DVT
- Soft-tissue/musculoskeletal
- Thoracic
- Ocular
- Procedural Guidance
Training Pathways

Figure 2. Pathways for emergency ultrasound training, credentialing, and incorporation of new applications.

Residency Training

Didactics
Attends residency curriculum covering emergency ultrasound curriculum or
Attends introductory emergency ultrasound course

Experiential
Training in residency per Emergency Medicine Residency Ultrasound Guidelines

Proficiency
Residency Director and/or Ultrasound Coordinator certifies ultrasound training categorized by the ACEP emergency ultrasound proficiency guidelines and ACEP/ABEM “The Model of the Clinical Practice of Emergency Medicine”

Credentialing
Acquired at local hospital setting within departmental privileges

Continuing Medical Proficiency and Education
Quality review of ultrasound performed continuously. CME attended in accordance with specialty guidelines

New Applications
New applications adopted after CME, research, or other training.

Practicing Physician

Didactics
Attends introductory emergency ultrasound course or courses that cover core emergency US applications

Experiential
Performs ultrasounds under supervision over-reads, gold standards confirmatory testing or patient outcome review within departmental ultrasound plan

Proficiency
Ultrasounds are obtained with documentation and review to meet ACEP emergency ultrasound proficiency guidelines. Ultrasound available for departmental and hospital examination

25-50 cases in each core application

# Echo Training for Cardiology Fellows

<table>
<thead>
<tr>
<th>Level</th>
<th>Cumulative Months of training</th>
<th>Minimum TTEs performed</th>
<th>Minimum TTEs interpreted</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>3</td>
<td>75</td>
<td>150</td>
</tr>
<tr>
<td>II</td>
<td>6</td>
<td>150</td>
<td>300</td>
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</tbody>
</table>

Level III: Additional 12 months of training

Cocats 4 Task Force 5: Training in Echocardiography 2014
Maintenance of Certification for ER Physician Performing Focused Echo

- 5-10 hrs CME every 2 yrs
- Maintenance of credentialing at discretion of institution
- QA determined by institution
IAC Standards for Echo Lab Accreditation

• 15 Echo CME hrs over 3 yrs
• Specific QA program outlined in IAC standards document
Goals of Focused Cardiac US in the ER

- Assessment for presence of pericardial effusion
- Assessment of global cardiac function
- Identification of RV and LV enlargement
- Intravascular volume assessment
- Guidance or pericardiocentesis
- Confirmation of pacing wire placement

J Am Soc Echocardiogr 2010
• 61 year old female with 2 weeks flu-like illness presents with SOB/DOE and positional chest pain.

• Suspected pericarditis.
• 44 year old female NSCLC, pulmonary blastomycosis presents with weakness and poor po intake.
• Vomiting, dyspneic and somnolent in ED.
• Intubated and resuscitated, abx for sepsis. Poor BP response despite IVF.
• 68 yr old male with h/o pacemaker – s/p recent revision
• C/o dyspnea over last 2 weeks
• 40 yr old female with scleroderma complicated by interstitial lung disease.
• C/o worsening dyspnea and tachycardia
• Echo lab sonographer called to do echo
Focused US of Heart, Lungs, Deep Veins in Pts with Acute Respiratory Symptoms

- 134 pts underwent focused US exam
- 19 patients (14%) diagnosed with acute life-threatening condition missed at primary assessment.

Accuracy of focused sonography for the diagnosis of an acute life-threatening condition:
  - sensitivity, 100% (95% CI, 85.2%-100%)
  - specificity, 93.3% (95% CI, 86.7%-97.3%);
Focused Lung and Cardiac US for Diagnosis of Acute Decompensated HF

- Sens = 83%
- Spec = 83%

ACADEMIC EMERGENCY MEDICINE 2015;22:182–191
• 72 year old male history of sarcoidosis
• C/o leg edema, SOB
• Recently traveled from Europe
Accuracy of RV Strain Detection in the ER

- 411 pts identified with limited ER echo and consultative echo with 72 hrs
- Echo performed for c/o chest pain, dyspnea, hypotension
- Retrospective analysis of accuracy of reported RV dilatation
- Focused echo performed by 69 ER providers (all training levels) over 12 months

## Results

### Limited ER Echo RV Dilatation

<table>
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<tr>
<th></th>
<th>No</th>
<th>Yes</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>328</td>
<td>6</td>
<td>378</td>
</tr>
<tr>
<td>Yes</td>
<td>54</td>
<td>19</td>
<td>29</td>
</tr>
<tr>
<td>Total</td>
<td>382</td>
<td>25</td>
<td>407</td>
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</table>

<table>
<thead>
<tr>
<th></th>
<th>Sensitivity</th>
<th>Specificity</th>
<th>LR+</th>
<th>LR-</th>
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<tbody>
<tr>
<td></td>
<td>26% (16-37%)</td>
<td>98% (96-99%)</td>
<td>14 (6-35)</td>
<td>0.75 (0.65-0.86)</td>
</tr>
</tbody>
</table>
Prognostic Value of RV Strain Identified in the ER in Pts with PE

<table>
<thead>
<tr>
<th>Variable</th>
<th>Odds Ratio</th>
<th>(95% CI)</th>
<th>p Value</th>
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</thead>
<tbody>
<tr>
<td>Daniels score &gt; 8</td>
<td>1.9</td>
<td>(0.32–9.4)</td>
<td>0.47</td>
</tr>
<tr>
<td>Geneva score (high risk)</td>
<td>1.83</td>
<td>(0.47–7.05)</td>
<td>0.37</td>
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<tr>
<td>Hypotension (SBP &lt; 90 mm Hg)</td>
<td>1.74</td>
<td>(0.45–7.11)</td>
<td>0.42</td>
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<tr>
<td>RV strain</td>
<td>9.2</td>
<td>(3.2–29)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Thromboembolic disease</td>
<td>1.2</td>
<td>(0.32–5.37)</td>
<td>0.78</td>
</tr>
<tr>
<td>Cardiopulmonary disease</td>
<td>3.4</td>
<td>(1.2–11)</td>
<td>0.02</td>
</tr>
<tr>
<td>HR &gt; 110 beats/min</td>
<td>1.1</td>
<td>(0.35–3.1)</td>
<td>0.91</td>
</tr>
<tr>
<td>AMS</td>
<td>3.1</td>
<td>(0.59–16)</td>
<td>0.18</td>
</tr>
<tr>
<td>Hypoxia (O₂ &lt; 90)</td>
<td>1.1</td>
<td>(0.34–3.14)</td>
<td>0.91</td>
</tr>
</tbody>
</table>

Cl = confidence interval; SBP = systolic blood pressure; RV = right ventricle; HR = heart rate; AMS = altered mental state; O₂ = oxygen saturation.

J Emer Med; 2013: 45(3): 392–399
Assessment of RA Pressure

- Comparison of RA pressure assessment using JVP vs IVC on hand carried US (HCU)
- 40 pts who underwent RHC evaluated by 4 IM residents using HCU
- Sensitivity for detecting RAP>10 mmHg
  - HCU: 82%
  - JVP: 14%

Am J Cardiol 2007;99(11):1614-1616
• 65 yr old female who presented with RUQ and right lower chest pain associated with belching
• Normal ECG, labs, troponins
• Admitted to the medicine service
• Echo ordered
• 65 yr old male with history of HTN, CKD, prior Afib ablation and recent DVT
• C/o acute onset facial pain, nausea, vomiting and blurred vision
• Admitted to medicine unit
• Echo ordered from the echo lab
Chest CT
Conclusions

• Focused echo has become an integral in the care of acutely ill patients in the ER

• Focused echo answers a specific clinical question and is not a comprehensive exam

• Most common cardiac indications:
  – Pericardial effusion
  – RV and LV enlargement
  – Intravascular volume assessment
  – Guidance of pericardiocentesis
  – Confirmation of transvenous pacer wire

• Appropriate training and maintenance of certification is critical to maintain quality of care
Thank You