Faculty Feedback Using Remote Images to Assess Point-of-Care Ultrasound Skills in Trainees

Kate Steinberg MD
Pierre Kory MD
University of Wisconsin-Madison
Department of Medicine
Background

• Increasing use of point-of-care ultrasound
• Skill sets for competence defined by consensus and evidence-based guidelines\textsuperscript{1,2}
• Growth has been limited by number of expert faculty available within programs\textsuperscript{3,4}
• Remote supervision with feedback as one solution\textsuperscript{5}

Aims

• To assess feasibility of using remote supervision and feedback to teach ultrasound skills in our ICU

• To describe the quality of images obtained, accuracy of image interpretation, and clinical application of ultrasound findings
Basic Critical Care Echocardiography (BCCE)
## Basic Critical Care Echocardiography (BCCE)

<table>
<thead>
<tr>
<th>Shock State</th>
<th>Ultrasound Findings</th>
<th>Treatment</th>
</tr>
</thead>
</table>
| Acute Cor Pulmonale          | • Dilated RV  
     • Impaired RV Function  
     • Dilated IVC             | • Anti-coagulation  
     • Lytics  
     • Thrombectomy           |
| Left Ventricular Failure      | • Dilated LV  
     • Impaired LV Function  
     • Dilated IVC             | • Inotropes  
     • Afterload Reduction    |
| Tamponade                    | • Pericardial Effusion  
     • Atrial/RV Collapse  
     • Dilated IVC             | • Pericardiocentesis         |
| Distributive                 | • Essentially Normal Echo  
     • Hyperdynamic Heart  
     • Variable IVC Size      | • Fluids  
     • Vasopressors           |
| Hypovolemic                  | • Essentially Normal Echo  
     • Hyperdynamic Heart  
     • Small IVC              | • Fluids  
     • Blood Products  
     • Hemostasis            |
Methods

• Focused two-day training course teaching:
  – Four domains of critical care ultrasonography (lung/heart/abdomen/lower extremity DVT exam)
  – Defined image sets to be achieved for each domain

• Exams performed in the ICU, images saved and uploaded to feedback software

• Trainee filled out findings/interpretation/clinical application form

• Software sent form and all images to faculty expert

• Written feedback given based on quality of images, interpretation, and clinical application
Basic Critical Care Echo Views

• Five Views
  – Parasternal Long Axis
  – Parasternal Short Axis
  – Apical 4-Chamber
  – Subcostal
  – IVC Assessment
Basic Critical Care Echo Assessments

- LV and RV size and function
- Regional wall motion abnormalities
- Major valvular abnormalities
- Presence/absence of pericardial effusion
- IVC Size and Variation
Methods

TLC Image Acquisition Quality

GOOD (16-20)

COMMENT ON IMAGE QUALITY

excellent A4C, IVC - too MUCH depth on SCLA (would have been a 5!). PSLA AND PSSA were ...2’s - I really could barely make an assessment except for maybe that the RV was not dilated (in some cases this alone is a lot of information to glean, like in this case - however, these poor quality views were not your fault, you were on axis - nice job!
Results

• 123 basic critical care echos performed by 9 ICU trainees over 9 months (Sept 2015-June 2016)
• 81 studies submitted for review and feedback
• Number of studies submitted by each trainee ranged from 3 to 23
Quality of Images (N=79)

Grading Scale
• Each view graded 1-5
• 5 views added to get total score
• 0-10: Poor
• 11-15: Fair
• 16-20: Good
• 21-25: Excellent

Poor 1.2% (2 studies)
Fair 25.3% (20 studies)
Good 39.2% (31 studies)
Excellent 32.9% (26 studies)

2 studies were not evaluated for image quality and are not included in this chart.
Accuracy of Interpretation

<table>
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<tbody>
<tr>
<td>Trainee reported positive finding</td>
<td>27</td>
</tr>
<tr>
<td>Training reported negative finding</td>
<td>7</td>
</tr>
</tbody>
</table>

- Positive predictive value = 79%
- Negative predictive value = 74%
- Overall diagnostic accuracy of 77%  
  - Based on all cardiac findings

4 studies were not evaluated for accuracy and are not included in this table.
Clinical Application of Findings

Accurate Interpretation of Images

- 96% appropriate clinical application
- 4% inappropriate clinical application

Inaccurate Interpretation of Images

- 75% appropriate clinical application
- 25% inappropriate clinical application

Inappropriate clinical applications included incorrect fluid management and use of inotropes.
Conclusions and Next Steps

• Conclusions
  – Use of a remote feedback software system is feasible and enables a single faculty expert to give feedback to multiple trainees
  – Trainees were able to capture high quality images and had high diagnostic accuracy with appropriate clinical applications

• Address Limitations
  – Many ultrasounds that were performed were not saved or not submitted for review
  – Feedback was limited by information available to faculty (especially in assessment of clinical application)
  – Requires a large time commitment from faculty giving feedback

• Database involved review and feedback on other types of ultrasound exams (lung, abdominal, DVT)


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