Effectiveness of a Novel Perioperative Transthoracic Ultrasound Training Program for Students and Residents

Juliet Ray, MD; Jonathan Mezioso, MD; Valerie Hart, DO; Davis Horkan, MD; Vicente Behrens, MD; Kittu Rao, MD; Charles Karcutskie, MD; Joshua Lenchus, DO; Carl Schulman, MD & Roman Dudaryk, MD

1DeWitt Daughtry Family Department of Surgery, University of Miami Miller School of Medicine; 2Department of Anesthesiology, Perioperative Medicine and Pain Management, University of Miami, Miami, FL; 3Department of Internal Medicine, University of Miami, Miami, FL; 4Department of Anesthesiology, Florida International University, Miami, FL.

Introduction

Focus ultrasound is a rapid point of care assessment used by trauma surgeons to identify anatomy and hemodynamics at the bedside in acute settings.

Currently, there is a lack of standardized or required training among medical students and residents. Courses do exist, but they require access to simulation, hands on teaching, or extensive time commitment.

In 2015, we developed a novel 30-minute goal-directed, web-based introductory course in transonic ultrasound consisting of 3 components: didactics, virtual practical, and clinical correlation without live skills training.

This course was piloted by 22 surgical interns in August 2015 to determine efficacy in conveying knowledge and image acquisition skills.

Objective: to compare learning across three levels of training and clinical specialties using this modality.

Methods

A prospective observational study of 3rd-year surgery clerkship medical students, interns from the Internal Medicine and Surgery programs, and anesthesiology residents.

Statistical Analysis:
- Analyzed pre and post-tests assessing 3 competencies: anatomy identification, ultrasound knowledge/window recognition, and clinical application.
- Mean score improvement (post minus pre-test scores) was compared by paired-sample T-test.
- Mean score improvement between cohorts was compared by ANOVA with significant p<0.05.

Survey results were analyzed for those who agreed strongly or agreed with survey compared to those who did not before and after the intervention using an exact McNemar test.

Results

Table 1: Mean Score Improvements (MSI) by Cohort

<table>
<thead>
<tr>
<th>Competency</th>
<th>MEDICAL STUDENTS (n = 78)</th>
<th>INTERNS (n = 27)</th>
<th>RESIDENTS (n = 40)</th>
<th>Between-group p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSI</td>
<td>White-group p-value</td>
<td>MSI</td>
<td>White-group p-value</td>
<td>MSI</td>
</tr>
<tr>
<td>TOTAL (%)</td>
<td>7.80±3.43^a</td>
<td>&lt;0.001</td>
<td>6.11±2.78</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Anatomy (%)</td>
<td>1.95±1.23</td>
<td>&lt;0.001</td>
<td>1.56±1.40</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Knobology &amp; Anatomy Recognition (%)</td>
<td>2.36±1.30^c</td>
<td>&lt;0.001</td>
<td>1.91±1.12^d</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Clinical Application (%)</td>
<td>3.49±2.35</td>
<td>&lt;0.001</td>
<td>2.67±2.02</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Note: Individual MSI was compared with paired-sample t-test and significance is represented by within-group p-values. MSI between cohorts was compared with ANOVA and significance is represented by between-group p-values. P values: a*c d 0.001; b*c d 0.005.

There was a significant improvement in mean score noted in each of the three competencies in all 3 cohorts (Table 1).

Mean score improvement was significantly higher in medical students compared to residents in total score and ultrasound knowledge/window recognition (Table 1).

All cohorts reported improved comfort in using transthoracic ultrasound technique and improved ability to recognize indications for use (Table 2).

Table 2: Results of Participants Reporting Strong Agreement or Agreement in “Comfort with Use” and “Recognition of Indications for Use” on Pre- vs Post-Course Surveys.

<table>
<thead>
<tr>
<th>MEDICAL STUDENTS (n = 78)</th>
<th>INTERNS (n = 27)</th>
<th>RESIDENTS (n = 40)</th>
<th>Between-group p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>N (%)</td>
<td>N (%)</td>
<td>N (%)</td>
<td></td>
</tr>
<tr>
<td>Pre-course Comfort using T/U/S</td>
<td>0 %</td>
<td>6 %</td>
<td>5 %</td>
</tr>
<tr>
<td>Post-course Comfort using T/U/S</td>
<td>18 %</td>
<td>16 %</td>
<td>24 %</td>
</tr>
<tr>
<td>Pre-course ability to recognize indications for T/U/S use</td>
<td>16 %</td>
<td>14 %</td>
<td>22 %</td>
</tr>
<tr>
<td>Post-course ability to recognize indications for T/U/S use</td>
<td>66 %</td>
<td>24 %</td>
<td>39 %</td>
</tr>
</tbody>
</table>

Note: * Unable to calculate p by McNemar's test. P = 0.001; ^a = 0.005; ^b = 0.006; ^c = 0.01; ^d = 0.001. T/U/S: transthoracic ultrasound

Conclusions

Learners across levels of medical training and specialties can benefit from brief, goal-directed, web-based training.

This modality should be incorporated early into longitudinal curriculum for maximal benefit as overall improvement in performance was inversely proportional to level of training.

The competency of anatomical recognition showed the most improvement.

These results can be used to guide future US curriculum development for various levels of trainees.

References