RAD-SCORE:
A TOOL FOR ASSESSMENT OF PROCEDURAL COMPETENCE

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APRIL 15, 2016
There are no financial disclosures to report for the presenter or any of the co-authors.
OBJECTIVES

► Introduction
  • Role of procedures in radiology
  • Current means of assessment
  • Purpose of RAD-Score

► Methods
  • Creation of RAD-Score template
  • Testing of RAD-Score
  • Gathering qualitative/quantitative feedback

► Results

► Discussion
INTRODUCTION

► In residency programs across many specialties, training moving away from apprenticeship/time-based model to a competency-based model

► Competence in diagnostic radiology tested through final residency certification exams and other in-training exams
  • These mainly pertain to ‘diagnostic’ side of radiology

► Very little formal evaluation of procedural skills
  • Often use of in-training evaluation-reports (ITERs)

► However, procedural work makes up substantial part of residency training, with procedures integrated in most rotations

► Presently, no tool exists for assessment of procedural competence specific to diagnostic radiology - providing such a tool would eliminate some limitations of ITERs
  • Similar tools for evaluation of clinical encounters, like mini-CEX or IPPI, have demonstrated good construct validity
PURPOSE

► To develop a tool with valid scores that is able to assess procedural competence of radiology trainees in any procedure that is typically performed by a radiologist

► **Procedure** in radiology defined as “diagnostic or therapeutic interaction with a patient which requires use of image guidance and routine presence of radiologist in the room with the patient”

► **Procedural competency** is defined as readiness to perform a procedure independently

► Aim to develop tool for both **clinical and simulation setting**
METHODS

Phase 1 – Tool development
► Needs assessment was performed to identify any existing tools for evaluation of procedural competence – no tool found
► Group of staff radiologists with expertise in procedural work and education considered key features of radiology procedures to determine most relevant areas of assessment; they used the Gofton ‘Ö-Score’ as a basis for RAD-Score – pilot tool for assessment of procedural competence

Phase 2 – Testing
► Pilot RAD-Score version was tested between Oct 2014 and June 2015
  • Resident and faculty participants were recruited and trained
  • Participating faculty – all radiologists at TOH, used RAD-Score to evaluate procedural competence among residents at University of Ottawa Diagnostic Radiology Program
  • Data collected in both clinical setting during residents’ various clinical rotations, and at university simulation centre
  • Goal was to obtain a minimum of 100 completed RAD-Score forms with minimum of 20 per PGY level
METHODS

- Aim to gather sources of validity evidence from 5 different sources to support construct validity of RAD-Score tool:
  - Content, Response process, Internal structure, Relations to other variables, Consequences

**Phase 3 – Quantitative and Qualitative Analysis**

- Following data collection, psychometric analysis of tool performed
  - Evaluation of internal structure
  - Generalizability analysis to determine reliability
  - Comparison across post-graduate years of training to determine if scores differed as function of level of training

- Both faculty and trainees had opportunity to provide written feedback in web-based form
- In-person focus groups held for both trainees and faculty
- Feedback was analyzed and used to create final version of RAD-Score
RESULTS

► 25 residents and 7 faculty members participated in study
► Total of 105 RAD-Score forms completed during assessment period

<table>
<thead>
<tr>
<th>GY Level (number of trainees)</th>
<th>Forms collected in the simulation setting</th>
<th>Forms collected in the clinical setting</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>GY2 (5)</td>
<td>5</td>
<td>12</td>
<td>17</td>
</tr>
<tr>
<td>GY3 (7)</td>
<td>17</td>
<td>14</td>
<td>31</td>
</tr>
<tr>
<td>GY4 (7)</td>
<td>16</td>
<td>17</td>
<td>33</td>
</tr>
<tr>
<td>GY5 (6)</td>
<td>15</td>
<td>9</td>
<td>24</td>
</tr>
<tr>
<td>TOTAL (25)</td>
<td>53</td>
<td>52</td>
<td>105</td>
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</tbody>
</table>

► Variety of radiological procedures were used for assessment:
  • 8 vascular, 42 abdominal, 12 MSK, 23 chest, 20 breast
► Median of 5 forms completed per resident
RESULTS

► Range of scores given for each item in RAD-Score (Items 1-7; final item 8)
  • Greatest range (scores 1-5) seen in the technical items which have the greatest learning trajectory; most narrow range in items like professionalism in which residents demonstrate early mastery

► Average scores for items 1-7 were analyzed with PGY level as between subject factor
  • Difference in PGY level ($F(3,96) = 19.91, p<.001$, partial $\eta^2 = .38$)
  • Post-hoc analysis showed that scores for PGY2s much lower than others, PGY3 were lower than PGY4, while PGY4 and 5 showed no significant difference

► Positive correlation between PGY level and readiness for independent practice ($\chi^2(3) = 33.23, p < .001$).
RESULTS

- Setting: No statistically significant difference between mean scores on items 1-7 in the clinical vs. simulation groups (p = 0.67)

- In the analysis of the scale total for questions 1-7 as a function of the response to question 8, there was a significantly different mean score in the two categories of trainees
  
  - Those rated as ready for independent procedure work had an overall mean item score 1 point higher than those deemed not ready to work independently (4.7, SD = 0.38 vs. 3.7 SD = 0.46; p<0.001).

- Item analysis: item-total correlations ranging from 0.47-0.72; no redundancy of items (>0.85)
  
  - No highly related items

- No significant difference as function of body system involved in procedure or complexity of procedure
RESULTS

- G-theory analysis for variance components nested with trainees and crossed with questions 1-7 identified multiple contributors to variance, which were used to determine reliability
  - With 5 encounters per person, reliability was 0.76 (0.8 considered optimal)

Participant feedback

- Overall consensus that RAD-Score tool provided useful structured template to give objective feedback
- Faculty felt that their RAD-Score evaluation accurately reflected resident’s ability to independently perform procedures
  - Consensus was that items 1-7 are meant to guide overall assessment
- Residents appreciated receiving specific feedback, did not feel deterred by negative rating
### Results

#### Summary of feedback comments:

<table>
<thead>
<tr>
<th>Level of recurrence</th>
<th>Positive</th>
<th>Negative</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Faculty</td>
<td>Trainees</td>
</tr>
<tr>
<td>High</td>
<td>Useful structured template to assess all parts of procedure</td>
<td>Use of score allowed for more detailed specific feedback</td>
</tr>
<tr>
<td></td>
<td>Comprehensive assessment tool</td>
<td>Comfortable asking staff to fill out form</td>
</tr>
<tr>
<td>Moderate</td>
<td>Not deterred by negative score</td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>Time-consuming</td>
<td>Missing “other” section for additional comments/tracking other parameters of procedure</td>
</tr>
</tbody>
</table>
## FINAL VERSION OF RAD-SCORE

**Radiology Resident Procedural Evaluation Form: RAD-SCORE**

<table>
<thead>
<tr>
<th>Resident name:</th>
<th>PGY: 1 2 3 4 5</th>
<th>Staff name:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Procedure:</td>
<td>Simulation/Clinical setting</td>
<td>Date:</td>
</tr>
</tbody>
</table>

**Relative complexity of procedure compared to average similar procedure:** Low Medium High

**Preamble:**
- This tool’s purpose is to evaluate a trainee’s ability to perform this procedure safely and independently regardless of their level of training – it should assess readiness for independent practice.
- Final evaluation of independent competence should be a holistic overall assessment of resident performance guided by the below items rather than quantitative score. If you did not observe enough of the procedure to make this determination please use the ‘incomplete assessment’ box.

### Pre-procedure

- Determines whether the procedure is indicated & assesses for contraindications (e.g., allergies)
- Ensures appropriate modality and technique (e.g., core vs. FNA)
- Anticipates appropriate measures (e.g., anticoagulant medication, antibiotics, sedation)

<table>
<thead>
<tr>
<th>N/A</th>
<th>1</th>
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<th>5</th>
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### Consent and procedural pause

- Obtains appropriate consent including conveying the nature of procedure, anticipated outcome, risks and alternatives
- Leads or ensures a pre-procedural pause is performed (if considered standard of care at institution)

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<tr>
<th>N/A</th>
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### Preparation for procedure

- Washes hands, good sterile/aseptic technique
- Establishes a plan/approach/route and ensures appropriate equipment available
- Ensures a comfortable/safe/ergonomic position for both self and patient

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<tr>
<th>N/A</th>
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</thead>
</table>

### Procedure/technical performance

- Understands steps of procedure, potential risks, and means to avoid/overcome them
- Sound technical performance with efficiency of steps and obvious planned course
- Sound visual-spatial/hand-eye coordination with ability to self-correct when needed
- Appropriate use of image guidance to ensure device (e.g., needle tip) is in desired location

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<thead>
<tr>
<th>N/A</th>
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<th>5</th>
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</thead>
</table>
# FINAL VERSION OF RAD-SCORE

<table>
<thead>
<tr>
<th>Post-Procedure</th>
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<th>2</th>
<th>3</th>
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</thead>
<tbody>
<tr>
<td>Disposes of sharps</td>
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<tr>
<td>Assesses for any immediate complication</td>
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<tr>
<td>Appropriate post-procedure plan (note, orders, requisitions, appropriate observation period)</td>
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</table>

<table>
<thead>
<tr>
<th>Communication</th>
<th>N/A</th>
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<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
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<tbody>
<tr>
<td>Establishes effective rapport with the patient and allied health care team and utilizes team appropriately</td>
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<tr>
<td>Procedural report is clear, concise and accurate</td>
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<td>Instills a sense of trust and confidence</td>
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<tr>
<td>Communicates post-procedural expectations, pertinent instructions to patient and/or team</td>
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**Professionalism**

- The procedure was conducted in a manner conforming to the highest professional standards

**This trainee is able to perform this procedure safely and independently**

- **YES**
- **NO** (If NO, please provide additional comments below)

- **Incomplete Assessment**

**Resident’s signature (to confirm receiving feedback):**

**Give 1 specific aspect of procedure done well**

**Give 1 specific suggestion for improvement**

**Additional comments** (time taken to perform procedure, fluoroscopy time, etc.)

**SCALE**

- **5** – “I did not need to be there”. Safely performs procedure independently. Ready for practice.
- **4** – “I needed to be in the room just in case”. Independence but unaware of some risks and still requires supervision for safe practice.
- **3** – “I had to prompt them from time to time”. Demonstrates some independence but requires intermittent direction.
- **2** – “I had to talk them through it”. Able to perform tasks or parts of procedure but requires constant direction.
- **1** – “I had to do it for them”. Requires complete hands on guidance or did not do.

*Feb. 24, 2016*
DISCUSSION

Throughout this prospective study, evidence collected for 5 categories to prove construct validity:

**Content**

- No similar tool was identified
- Experts in radiology procedures created pilot version of tool which was later refined following feedback

**Internal structure**

- No redundancy of items or bad items
- Statistically significant differences in competence between PGY levels, greatest differences seen between PGY 2-4

**Relations to other variables**

- No significant differences in scores as function of setting or difficulty of procedure
DISCUSSION

Response Process

- Based on feedback, faculty and trainee participants felt that RAD-Score was a helpful tool in providing feedback, with minimal changes suggested for further ease of use.

- Correlation of scores on items 1-7 with final item 8 showed appropriate use of individual items to create summary of trainee’s performance.

Consequences

- Residents found the detailed feedback based on RAD-Score valuable, with specific areas identified for improvement.

- Trainees and faculty both support incorporation of tool into regular practice in our department.
DISCUSSION

**Strengths of study**

- Variety of trainees at different levels
- Use in both clinical and simulation settings – more broad applicability
- Faculty members with range of expertise used form with success, evaluating broad variety of different procedures

**Limitations**

- Varied number of forms collected per PGY level and per resident – may form incomplete picture of results
- Mildly underpowered study – reliability of 0.76 which could have been 0.8
- Generalizability to more complex procedures such as interventional oncology or interventional neuroradiology procedures not performed
- Limitations of generalizability to centres which may incorporate different resident teaching structure
CONCLUSION

► RAD-Score is a newly developed tool for assessment of procedural competence which shows high construct validity

► Positive feedback from both trainee and faculty participants who used the tool

► This tool could be integrated into radiology residency curriculum for procedural work, and can play an instrumental role in the transition to competency-based radiology training.

Questions?