Construct Validity of a Neck Palpation Simulation Model in Medical Education

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ABSTRACT

Objective
We designed a high-fidelity neck model to improve the acquisition of technical skills related to the assessment of lymphadenopathy. This prospective randomised study evaluates the construct validity of this model.

Methods
Six first-year medical students with prior training (novice learners), and six otolaryngology residents of various stages of training, performed the head and neck lymph node examination on the neck simulator. Two otolaryngologists blinded to training type, evaluated the videotaped performances using two validated assessment tools specifically designed for the head and neck lymph node examination: a global rating scale (GRS), and task-based checklist (TBC). Through a Bonferroni correction, significance was set as p<0.025.

Results
The surgical residents scored significantly higher than the medical students on the GRS (p=0.008). There was also a trend towards better scores for the residents on the TBC (p=0.085).

Discussion
The neck model demonstrated construct validity, by easily distinguishing between experts and novices on the basis of procedural competence. Using the global rating scale and task-based checklist, this model can be used to provide formative feedback, and to assess technical skills acquisition in trainees.

Take-home messages
This is the first reported study of a high-fidelity lymphadenopathy simulator evaluated with task-specific assessment tools. This neck model can now be advanced into its next stage of investigation, towards its integration in medical education curricula - a comparison between traditional and simulation-based medical education.

BACKGROUND

Training simulators provide a high-fidelity environment for developing new skills, while avoiding patient safety concerns. Simulation based training is superior to traditional clinical medical education in certain fields, for achieving specific clinical skill acquisition and in improving actual patient outcomes (Draycott et al., 2008; Javia & Deutsch, 2012).

There have been no studies on the inclusion or validity of neck simulators with pathological lymph nodes in medical education.

METHODS

A neck model was developed to teach basic neck palpation and lymph node assessment skills (Xu et al., 2012). Certain components (e.g. airway cartilage, spinal cord) were fabricated using 3D printing.

The neck model contains simulated pathology, such as enlarged lymph nodes (Xu et al., 2012).

METHODS CONT.

There are no validated assessment tools in the literature for evaluating a head and neck lymph node examination. Therefore, two assessment tools were created, based on the widely used:
1) Global rating scale (GRS)
2) Task-based checklist (TBC)

<table>
<thead>
<tr>
<th>Palpate lymph nodes</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Use pads of index and middle fingers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. Note size</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. Note shape</td>
<td></td>
<td></td>
</tr>
<tr>
<td>d. Note delineation (discrete vs matted)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>e. Note mobility</td>
<td></td>
<td></td>
</tr>
<tr>
<td>f. Note consistency</td>
<td></td>
<td></td>
</tr>
<tr>
<td>g. Note tenderness</td>
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Study design
Construct validity is an objective measure of the simulator’s ability to differentiate between levels of expertise.

RECRUITING
1) Medical students (n=6);
2) Otolaryngology residents (n=6)
3) Two blinded raters (otolaryngologists)

The goal is to compare and elucidate a difference between medical students’ and residents’ performances using the neck construct. Significance is p<0.025.

RESULTS

A total of 24 evaluations were completed for both the novices and the experts [PGY-1 (n=1); PGY-3 (n=1); PGY-4 (n=3); PGY-5 (n=1)].

There was a significant difference in mean GRS scores between medical students and residents (p=0.008). The experts outperformed the novices on all categories of the GRS.

There was also a trend towards better mean TBC scores for the residents (p=0.085).

DISCUSSION

Results:
1) The residents had significantly better overall performance scores than the medical students.
2) There was a trend towards better TBC scores for residents, indicating improved abilities in palpating and accurately detecting lymphadenopathy.

This study confirms the construct validity of the neck model, while objectively comparing the competencies between novices and more experienced medical residents.

We were underpowered to see a difference between groups with the TBC. A sample size of 24 (12 in each group) would have been required to see a meaningful difference, based on a power value of 0.80, and α-value of 0.025.

In otolaryngology, there is a distinct lack of unified validation concepts and a very limited number of studies that address simulator validity. In a systematic review of simulators in otolaryngology by Javia & Deutsch (2012), only half of all simulators have been validated, most of these investigating only face or content validity (subjective measures). Construct validity objectively detects differences between levels of expertise.

Establishing construct validity is crucial before its integration as an effective training and assessment tool into undergraduate education.

This is the first reported study of a high-fidelity lymphadenopathy simulator, capable of being used in undergraduate medical curricula. It is also the first to bridge simulator research with undergraduate medical education.

FUTURE DIRECTIONS

As a follow-up study, it will be pertinent to increase the sample size to demonstrate significant results for both assessment tools.

In future studies, it may also be possible to distinguish participants with intermediate skill levels (i.e. clerks).

REFERENCES


Hassan CM, Peppas NA. Structure and applications of poly (vinyl alcohol) hydrogels produced by conventional crosslinking or by freezing/thawing methods. Advances in Polymer Science. 2000; 153: 37-65

