

Validation of Performance Measures of Laparoscopic Salpingostomy using Novel Low-Cost Ectopic Pregnancy Simulator

C. Yoonhee Ryder, BS, University of Michigan Medical School; Nicole M. Mott, BS, University of Michigan Medical School; Deborah M. Rooney, PhD, University of Michigan Dept. of Learning Sciences; Mark J. Snell, MD, Mbingo Baptist Hospital Dept. of Surgery; Blessing N. Ngam, MD, Mbingo Baptist Hospital Dept. of Surgery; Melanie L. Barnard, MD, Southern Illinois University Dept. of Surgery; David R. Jeffcoach, MD, Soddo Christian Hospital; Grace J. Kim, MD, University of Michigan Dept. of Surgery

Abstract:

Laparoscopic skills have been shown to improve with simulation-based training. We developed a low-cost simulator to teach technical skills required to perform laparoscopic salpingostomy. Learners viewed an annotated video of an expert performing the procedure in the simulator and then uploaded a video of their own performance. To validate technical skills performance assessment, participants reviewed and rated one another's deidentified videos using a novel checklist of key technical components created by ALL-SAFE (African Laparoscopic Learners for Safe Advancement for Ectopic Pregnancy).

Participants' (11 novices and 7 experts) performances were digitally recorded and uploaded. A total of 10 de-identified videos (5 novices and 5 experts from each site) were randomly selected. Participants (n=12) independently rated these videos using the ALL-SAFE dichotomous checklist of 8 key tasks (2=Done, 0=Not done) and 3 critical errors (3=Error avoided, 0=Error), a 5-item modified OSATS scored on 5-point scales, and a 3-point overall "Final Rating". Using current Standards we evaluated a) the tools' summed scores' utility at discriminating between novice and expert performances (Kruskal-Wallis), b) inter-rater agreement of novice (n=7) versus expert (n=5) ratings (ICC), and c) the correlation between the checklist and m-OSATS summed scores (Pearson r).

The ALL-SAFE checklist discriminated novice (Mn=21.8, SD=2.8) from expert (Me=23.5, SD=1.9), regardless of judge expertise, $P=0.001$, as did the m-OSATS (Mn=36.8, SD=6.7; Me=42.1, SD=5.4), $P=.01$. Inter-rater agreement across novice and expert judges was estimated (ICC =.88, .95, CI=.79, .97). Findings indicated a strong positive correlation between summed ALL-SAFE checklist and m-OSATS scores, $r(114)=.534$, $P=.0001$, and with Final Rating, $r(114)=.76$, $P=.0001$.

Preliminary evidence supports use of the ALL-SAFE checklist and m-OSATS tool for laparoscopic salpingostomy skills training and performance assessment. The tool can reliably distinguish novice from expert surgeons. Additionally, inter-rater agreement was demonstrated across novice and expert judges, alleviating the need for expert review and scalability concerns.

Because this research demonstrates that novices are as reliable as experts in rating ectopic salpingostomy simulation surgeries in the ALL-SAFE box trainer, we plan to use learners as peer graders in an ectopic pregnancy educational platform. This platform is open-access to all but specifically geared for surgical learners in low-income countries. Each learner will upload a video of themselves performing the procedure in the ALL-SAFE box trainer, and another learner/peer will rate their performance. This creates a sustainable way for surgical learners across the globe to receive free, timely, and accurate feedback that they can translate clinically. This concept of peer-to-peer rating is being studied by our team with other simulation procedures.

Table 1. Validity evidence relevant to internal structure. Comparison of novice v. expert performance ratings

Tool	Novice Mean (<i>SD</i>) Combined All Raters	Experts Mean (<i>SD</i>) All Raters	P- value	Novice Mean (<i>SD</i>) Combined Expert Raters Only	Experts Mean (<i>SD</i>) All Raters Expert Raters Only	P- value
Checklist Summed	21.79 (2.81)	23.50 (1.88)	.001	21.65 (2.84)	24.04 (1.33)	.002
m-OSATS Total	14.75 (4.83)	18.79 (4.51)	.01	14.57 (5.27)	18.96 (4.16)	.006
Checklist + m-OSATS Total	36.79 (6.67)	42.13 (5.37)	.01	36.22 (7.47)	43.00 (4.46)	.001
Final Rating	2.30 (.78)	2.75 (.51)	.01	2.22 (.85)	2.83 (.49)	.006

Table 2. Validity evidence relevant to internal structure. Rater agreement across novice and expert judges

Item	Tool	ICC	95% Confidence
Interval			
Checklist			
–	Checklist Summed	.96	.85 - .95
Global (m-OSATS)			
1	Respect for Tissue	.90	.70 - .90
2	Economy of Time and Motion	.90	.83 - .95
3	Instrument Handling	.90	.82 - .94
4	Flow of Operation	.89	.80 - .94
5	Overall Performance	.77	.58 - .87
–	m-OSATS Summed	.93	.88 - .96
–	Checklist + m-OSATS Summed	.95	.91 - .97
–	Final Rating	.88	.79 - .94