Validity and Reliability of Global Operative Assessment of Laparoscopic Skills (GOALS) in Novice Trainees Performing a Laparoscopic Cholecystectomy

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PURPOSE: Global Operative Assessment of Laparoscopic Skills (GOALS) assessment has been designed to evaluate skills in laparoscopic surgery. A longitudinal blinded study of randomized video fragments was conducted to estimate the validity and reliability of GOALS in novice trainees.

METHODS: In total, 10 trainees each performed 6 consecutive laparoscopic cholecystectomies. Sixty procedures were recorded on video. Video fragments of (1) opening of the peritoneum; (2) dissection of Calot's triangle and achievement of critical view of safety; and (3) dissection of the gallbladder from the liver bed were blinded, randomized, and rated by 2 consultant surgeons using GOALS. Also, a grade was given for overall competence. The correlation of GOALS with live observation Objective Structured Assessment of Technical Skills (OSATS) scores was calculated. Construct validity was estimated using the Friedman 2-way analysis of variance by ranks and the Wilcoxon signed-rank test. The interrater reliability was calculated using the absolute and consistency agreement 2-way random-effects model intraclass correlation coefficient.

RESULTS: A high correlation was found between mean GOALS score ($r = 0.879$, $p = 0.021$) and mean OSATS score. The GOALS score increased significantly across the 6 procedures ($p = 0.002$). The trainees performed significantly better on their sixth when compared with their first cholecystectomy ($p = 0.004$). The consistency agreement interrater reliability was 0.37 for the mean GOALS score ($p = 0.002$) and 0.55 for overall competence ($p < 0.001$) of the 3 video fragments.

CONCLUSION: The validity observed in this randomized blinded longitudinal study supports the existing evidence that GOALS is a valid tool for assessment of novice trainees. A relatively low reliability was found in this study. (J Surg 72:351-358. © 2014 Association of Program Directors in Surgery. Published by Elsevier Inc. All rights reserved.)

KEY WORDS: laparoscopy, trainee, assessment, videotape recording, laparoscopic cholecystectomy

COMPETENCIES: Practice-Based Learning and Improvement, Interpersonal and Communication Skills, Systems-Based Practice

INTRODUCTION

Objective assessment of technical skills of surgical trainees is an important topic in the field of surgical education. To provide a valid and reliable tool in the assessment of surgical skills, Martin et al.[1] developed a global rating scale in the late 1990s, currently known as the Objective Structured Assessment of Technical Skills (OSATS). OSATS has been implemented in many academic centers to measure operative performance in the operating theater and provide feedback to trainees. Although the OSATS is considered to be a validated tool for global assessment of operative competence,[2,3] there was no equivalent for

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laparoscopic surgery. As laparoscopic surgery is the standard for an increasing list of procedures, there was a need for a valid and reliable assessment tool that addresses the specific requirements of laparoscopic surgery. Laparoscopic surgery involves a man-machine environment that requires the ability to work with a 2-dimensional view, decreased degrees of freedom, and reduced tactile feedback. Furthermore, the surgeon is challenged by the fulcrum effect, and inversion and scaling of movements of the parts of the instruments inside the abdomen. To evaluate these skills, Vassiliou et al.[4] developed Global Operative Assessment of Laparoscopic Skills (GOALS), a non–procedure-specific assessment tool that can be applied to any procedure in MIS (minimally invasive surgery).

Rasmussens' model of human behavior can be used to describe different levels that have to be achieved in laparoscopic skill training to obtain competency in MIS.[5] In the first level, the trainee acquires skill-based behavior by learning automated sensory-motor patterns. It has been shown that these skills can be improved on a virtual-reality simulator.[6] In the early post-simulator development phase, learned sensory-motor patterns are calibrated to the MIS environment, whereas rule- and knowledge-based behaviors are acquired. Moore and Bennett[7] demonstrated that the risk of complications is approximately 1.7% in the first laparoscopic cholecystectomy and decreases to 0.7% after 5 cases. Although much has changed in the education of trainees, this novice development stage can still be considered as one of the most important learning phases in guiding surgical trainees to competency in performing a laparoscopic cholecystectomy. This study was conducted to explore the validity and reliability of using GOALS for video assessment of laparoscopic cholecystectomy in this critical learning phase.

METHOD

Participants and Patient Selection

In total, 10 surgical residents in their first ($n = 4$) and second ($n = 6$) year of training were recruited for a training curriculum in laparoscopic cholecystectomy. Only trainees who had attended less than 5 laparoscopic procedures and had no experience with performing a laparoscopic cholecystectomy were included. A minimum of 6 months' experience with open surgery was a prerequisite to participate in the study. After a basic laparoscopic skills training, the trainees performed 6 laparoscopic cholecystectomies in the operating room under the supervision of 1 of the 3 participating experienced laparoscopic surgeons.

All the patients included in the study had uncomplicated symptomatic gallstone disease. All the patients gave informed consent before undergoing surgery.

Basic Laparoscopic Skills Training

Basic laparoscopic skills were acquired on the SIMENDO laparoscopy trainer (SIMENDO, Rotterdam, The Netherlands). The intention of the SIMENDO simulator training is to teach trainees a specified level of basic automated sensory-motor patterns required for safe participation in laparoscopic procedures in humans.

Direct Observation: OSATS Assessment

The OSATS was developed by Martin et al.[1] in 1997 and is currently the standard method for the assessment of surgical skills. The OSATS consists of 7 items: (1) respect for tissue, (2) time and motion, (3) instrument handling, (4) knowledge of instruments, (5) use of assistants, (6) flow of operation, and (7) knowledge of the procedure. Each item was scored as generally used in the Dutch surgical training program on a 10-point scale.

The 3 supervising surgeons that randomly supervised the operations used the OSATS to assess the laparoscopic performance of the trainees. Because OSATS assessment is an integral part of the surgical curriculum in the Netherlands, the surgeons had used the OSATS frequently in the past to assess trainees. Although no formal OSATS instruction course was taken, the principles were discussed in teach-the-teacher trainings. The surgeons were uninformed about the number of procedures the trainee performed previously, but not blinded to the identity of the trainee.

To determine whether the increase in OSATS is mainly caused by non–sensory-motor skill acquisition, the OSATS-sensory motor (OSATS-sm) was calculated by summing the items 1, 2, 3, and 6 of the OSATS form.

Video Assessment: GOALS and Overall Competence

The GOALS assessment form contains 6 items. Four items represent domains of technical competence in laparoscopic surgery: (1) depth perception, (2) bimanual dexterity, (3) efficiency, and (4) tissue handling. The fifth item is used to rate the autonomy of the subject. Only parts of the video in which the trainee performed as operating surgeon were edited so the item autonomy was therefore left out of the GOALS form. The sixth item, level of difficulty, was added by Chang et al.[8] to also take into account any difference in difficulty of the procedure.

To be able to compare GOALS with the modified 10-point version of the OSATS global rating scale that is used in our institution, the items on the GOALS form were converted to a 10-point scale. Complementary to the GOALS items, a grade for overall competence was rated on a 10-point scale for each video fragment. It has been shown that transformation of a 5-point scale to a 10-point scale does not significantly influence the data characteristics