Effect of Rehearsal Modality on Knowledge Retention in Surgical Trainees: A Pilot Study

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OBJECTIVE: The operating room is an exciting learning environment. With growing curriculum limitations and increasing complexity of care, existing education opportunities need to be optimized. Rehearsal has benefits for surgeon performance in the operating room, but its role for enhancing operative learning remains unclear. This pilot study aimed to differentiate the effects of physical rehearsal (PR) and cognitive rehearsal (CR) modalities on surgical trainee technical knowledge retention.

DESIGN: Participants took part in a 2-day (sequential Fridays), instructed operative workshop performing midline laparotomy, splenectomy, left nephrectomy, and hand-sewn, side-to-side small bowel anastomosis (SBA). Participants were randomized to 10 minutes of either a (PR; $n = 5$) or (CR; $n = 5$) activity each day before operating. PR consisted of practicing SBA on a felt bowel model. CR entailed viewing narrated operative footage detailing the steps of SBA. Participants' technical knowledge of all procedures was assessed at 1 and 12 weeks postworkshop using a 31-question test.

SETTING: Animal operative suites at an academic medical center.

PARTICIPANTS: A total of 10 general surgery postgraduate year 1 interns participated in the workshop; all completed the study. Participants had similar levels of operative exposure at the time of study participation.

RESULTS: At 1-week postworkshop, mean assessment scores for CR were higher than PR (Mean ± Standard Deviation) (CR = 24.7 ± 1.6 vs. PR = 21.8 ± 1.7, p = 0.02). After 12 weeks, there was no difference in mean scores (CR = 23.3 ± 2 vs. PR = 21.7 ± 1.8, p = 0.22). Knowledge decay for the 12-week period was similar between groups (CR = −1.4 ± 1.6 vs. PR = −0.1 ± 2.4, p = 0.36). Study participants performed better on SBA-related questions than unrelated questions (laparotomy, splenectomy, and nephrectomy) at 1-week (related = 81.5% ± 11.3 vs. unrelated = 71.9% ± 6.6, p = 0.03) and 12 weeks (related = 81% ± 13.1 vs. unrelated = 68.6% ± 8.8, p = 0.02).

CONCLUSION: This pilot data suggests the modality of the rehearsal activity may not significantly effect surgical learners' technical knowledge retention. Participants did score higher on questions related to the rehearsal topic, indicating a potential supplementary role for rehearsal activities. (J Surg Ed 73:831-835. © 2016 Association of Program Directors in Surgery. Published by Elsevier Inc. All rights reserved.)

KEY WORDS: warm-up, rehearsal, surgery, learning, knowledge, retention

COMPETENCY: Practice-Based Learning and Improvement

INTRODUCTION

Increasing complexity of patient care, budgetary constraints, and duty hour restrictions are factors motivating surgical educators to pursue more efficient and effective methods for training surgical learners. Rehearsal activities that prepare trainees for educational opportunities may be tools for curriculum optimization and enhancement of learners' long-term knowledge retention.

Rehearsal uses preemptive and deliberate practice of technical and nontechnical skills related to a target task to generate a physical or cognitive stimulation in a performer.[1] Rehearsal should be differentiated from warm-up, which relies on general activities that are unrelated to the target task to produce the stimulus. Preemptive rehearsal may employ aspects of both physical and cognitive practice modalities. Physical modalities stimulate somatic (physiological) arousal whereas cognitive practice promotes cognitive arousal.[2]

The physical and cognitive benefits of rehearsal are well known to athletes, artists, and musicians.[3] Surgery, with its

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emphasis on skill, experience, and high-stakes performances, shares commonalities with these professions. Surgeons preparing for the operating room may also benefit from rehearsal activities; previous studies have confirmed such benefits.[4,5] These efforts have also shown that rehearsal provides a greater enhancement to surgeon performance in the operating room than general warm-up exercises.[6,7]

Despite application for experienced surgeons, rehearsal activities have not been well studied in surgical education. Little information regarding the optimal format, timing, and application of these activities is available. Comparison between physical and cognitive warm-up activities with nonsurgeon laypersons learning laparoscopic skills has demonstrated no relevant correlation between the modality of activity and the targeted technical outcomes.[8] However, studies examining the effects of rehearsal modality in surgical trainees learning technical skills and knowledge are nonexistent.

We aimed to differentiate the effects of physical rehearsal (PR) and cognitive rehearsals (CR) on surgical trainee retention of technical knowledge.

MATERIAL AND METHODS

Institutional Review Board

This study was reviewed and approved by our Institutional Review Board and Institutional Animal Care and Use Committee. Informed consent to educational research was obtained from all subjects before study participation.

Participants

The study population consisted of general surgery postgraduate year 1 interns ($n = 10$) who volunteered to participate in an operative workshop. Participants had similar clinical and operative experience at the time of participation.

Study Design

This pilot study was a double-blind, parallel-group, and randomized trial. Study participants were assigned randomly into 2 groups: PR with a model (Group PR) or CR with a video (Group CR). Participants learned of their activity on arrival to the workshop for their first session. Each group performed their respective rehearsal activity immediately before beginning both sessions of the operative workshop. Workshop instructors were blinded to the modality of rehearsal each trainee received.

Rehearsal Tasks

Group PR participants ($n = 5$) were given 10 minutes to practice a hand-sewn, side-to-side, small bowel anastomosis (SBA) on a low-fidelity, felt model (Fig. 1).[9] Before beginning their activity, trainees received a standardized prompt to first place multiple seromuscular, interrupted, posterior outer wall sutures, then a continuous, running full-thickness stitch along the posterior and anterior portions of the inner wall, and finally another layer of seromuscular, interrupted sutures along the anterior, outer wall. No additional instruction or assistance was offered for this activity.

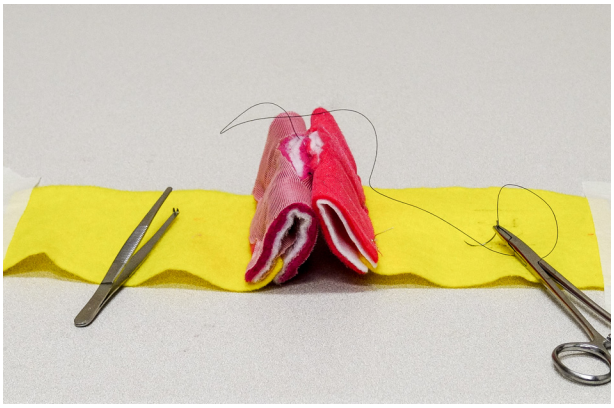

FIGURE 1. Constructed, felt small bowel model used for practice of hand-sewn, small bowel anastomosis.

Group CR participants ($n = 5$) watched 10 minutes of a narrated video consisting of operative footage demonstrating the same steps of a SBA described earlier.

Operative Workshop

The operative workshop consisted of a midline laparotomy, open splenectomy, left nephrectomy, and small-bowel resection with SBA on an anesthetized pig. The activity was supervised by a postgraduate year 3 general surgery resident who provided instruction based on a set of standardized learning objectives. Participants attended the workshop for 2 consecutive Friday mornings. During the first session, trainees played the role of a surgical assistant, aiding a junior surgeon and learning the procedures. In the second session, participants served as the junior surgeon, performing the operations and teaching the procedures to their assistant.

Assessment

Participants were assessed using a 31-question technical knowledge assessment (1 point per question) that was based on the workshop objectives and procedurally relevant knowledge (Appendix A). Assessments were given at 1 and 12 weeks postworkshop. Trainees were also asked to rate the amount of preparation they had undertaken before the workshop and their overall satisfaction with their workshop learning experience using a 5-point Likert scale.