ORIGINAL REPORT

Halsted's "See One, Do One, and Teach One" versus Peyton's Four-Step Approach: A Randomized Trial for Training of Laparoscopic Suturing and Knot Tying

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BACKGROUND: This study aimed to compare the effectiveness of Halsted's method "see one, do one, and teach one" with Peyton's Four-Step Approach for teaching intracorporal suturing and knot tying (ICKT).

METHODS: Laparoscopically naïve medical students ($n = 60$) were randomized to teaching of ICKT with either Halsted's ($n = 30$) or Peyton's method ($n = 30$) for 60 minutes. Each student's first 3 and final sutures were evaluated using Objective Structured Assessment of Technical Skills (OSATS), procedural implementation, knot quality, total time, and suture placement accuracy.

RESULTS: Performance score and OSATS-PSC always differed significantly in favor of Peyton's group ($p = 0.001$). OSATS-GRS ($p = 0.01$) and task time ($p = 0.03$) differed only in the summary of the first 3 sutures in favor of Peyton's group. There were no significant intergroup differences in knot quality and accuracy.

CONCLUSIONS: Peyton's Four-Step Approach is the preferable method for learning complex laparoscopic skills like ICKT. (J Surg Ed ▮:▮▮▮-▮▮▮. © 2017 Association of Program Directors in Surgery. Published by Elsevier Inc. All rights reserved.)

KEY WORDS: laparoscopy, education, Peyton, Halsted, minimally invasive surgery, knot tying

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

INTRODUCTION

Almost every medical institution currently uses skill laboratories for their various training programs. Minimally invasive surgery (MIS) skill laboratories offer new surgeons a safe, tolerant training environment outside the operating room to practice techniques without compromising patient safety.[1-3] Although many MIS skill laboratories incorporate training modalities like virtual reality (VR) simulators, box trainers, and live animal training, the issue of how to teach and train laparoscopy is not yet resolved.[4,5] To convey certain technical skills to learners, the literature mentions a variety of existing instructional approaches.[6,7] However, it remains unclear which instructional method of intracorporal suturing and knot tying (ICKT) maximizes student proficiency and performance. American surgeon William Stewart Halsted's phrase, "See one, do one, and teach one," formerly characterized traditional surgical instruction. Under Halsted's dogma, medical trainees were expected to competently perform a certain procedure after observing a single performance.[8] Many recent critics argue that students are unable to safely perform a medical procedure after only seeing it once and believe that Halsted's method is outdated.[8] Owing to the complex technical nature of procedural skills such as ICKT, "Peyton's Four-Step Approach" is becoming more prevalent in medical

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education.[7,9,10] Peyton's Four-Step Approach consists of the following 4 clearly defined instructional steps:

(1) The teacher demonstrates the skill at his normal pace without any comments ("Demonstration").
(2) The teacher repeats the procedure, this time describing all necessary substeps ("Deconstruction").
(3) The student has to explain each sub-step while the teacher follows the student's instructions ("Comprehension").
(4) The student performs the complete skill on his own ("Performance").[7]

The aim of this study was to compare the effectiveness of Halsted and Peyton's methods in teaching ICKT to medical students.

METHODS

Materials

A box trainer (KARL STORZ GmbH, Tuttlingen, Germany) was used for laparoscopic ICKT with predefined openings. Two working ports were placed through these openings at 30° angles on both sides of a 10-mm-diameter laparoscope with 30° optics (KARL STORZ GmbH, Tuttlingen, Germany) positioned at the midline. Two lockable laparoscopic needle holders (KARL STORZ GmbH, Tuttlingen, Germany) were inserted into the lateral ports. The laparoscope was fixed with a clamp at a set angle and focal length that allowed the participant to work independently. The laparoscope was connected to a camera box (Telecam Pal; KARL STORZ, GmbH & Co. KG, Tuttlingen, Germany) and a Xenon 300 light source (KARL STORZ GmbH, Tuttlingen, Germany). The image was visualized on a 14 in monitor (Sony Trinitron, Tokyo, Japan) placed at a defined height directly in front of the trainee. A 12 cm Polysorb 3-0 braided absorbable suture with a CV-23 taper ½ circle, 17-mm needle (Covidien, Minneapolis, MN) was placed in central view. We used a standardized silicon suture pad with a defined wound dehiscence of 2 mm (Big Bite Medical GmbH, Heidelberg) and marked needle entrance and exit targets next to the incision.[11]

Participants

The study included medical students ($n = 60$) between their third and sixth year of education with no prior experience in laparoscopic surgery. The medical students were divided into 2 groups. The first group ($n = 30$) was taught ICKT with Halsted's method and the second group ($n = 30$) was taught with Peyton's method.

Study Design and Setting

This was a monocentric, prospective, 2-armed, randomized controlled trial in the MIS training center of the Department of General, Visceral, and Transplantation Surgery at Heidelberg University. Participants were randomly allocated to either the Peyton group or Halsted group in a 1:1 ratio. We used random permuted blocks with constant sizes of 4 students to ensure that the groups were balanced at the end of every block. The randomization of subjects based on a computer-generated randomization list was performed by an employee otherwise not involved in the study using sealed envelopes. To compare both ICKT teaching methods, students learned how to make a standardized surgeon's square knot, tied with an initial double-wrap throw followed by 2 single throws in alternate directions. Medical students first received a hands-on tutorial in a laparoscopic box trainer based on either Halsted or Peyton's instructional method. Each participant then tied as many intracorporeal square knots as possible within the standardized training time of 60 minutes. A student-teacher ratio of 1:1 was applied to both groups. The classic Halsted method was modified with the exclusion of the third step of "teaching one." In the Halsted group, the teacher demonstrated once how to carry out an intracorporeal square knot. Afterwards each student in the group performed ICKT on his own but had access to assistance by instructors on demand. Peyton's Four-Step Approach consisted of the following instructional steps previously mentioned: (1) The teacher demonstrated the intracorporeal square knot at his normal pace without any comments. (2) The teacher repeated the procedure, this time describing all necessary substeps. (3) The student had to explain each sub-step while the teacher followed the student's instructions. (4) The student performed the complete knot tying himself on his own. The students in the Peyton group were then able to repeat the procedure for the rest of the available training time.

Outcome Parameters

Objective Structured Assessment of Technical Skills (OSATS), procedural implementation, knot quality, total time, and suture placement accuracy were the parameters for assessment in this study. The OSATS was developed by Martin et al.[12] and Reznick et al.[13] as a means of providing objective assessments of trainee surgical task performance. This validated assessment includes a checklist of objective skills, and is divided into a procedure-specific checklist (PSC) and a global rating scale (GRS).[14] In the PSC, procedural steps are broken down into tasks that are assessed with "yes" or "no" answers based on whether or not the task was fully executed. The GRS is a validated skill assessment[15] used to evaluate general technical skills rather than procedure-specific ones.[14] The GRS is divided into the following 4 categories: depth perception, bimanual dexterity, tissue handling, and autonomy. Examinees are scored on a Likert scale and given a total score based on performance. We used a de novo OSATS tool designed by Chang et al.[14] to assess