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Can medical students achieve skills proficiency through simulation training?

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Abstract

BACKGROUND: The purpose of this study was to determine whether third-year medical students can become proficient in open technical skills through simulation laboratory training.

METHODS: A total of 204 students participated in a structured curriculum including bladder catheterization, breast examination, and knot-tying. Proficiency was documented using global rating scales and validated, objective, model-based metrics.

RESULTS: For catheterization and breast examination, all trainees showed proficiency, and self-rated comfort increased in more than 90%. For knot-tying, 83% completed the curriculum; 57% and 44% of trainees showed proficiency for 2- and 1-handed tasks, respectively. Objective performance scores improved significantly for 2- and 1-handed knot-tying (62.9–94.4 and 49.2–89.6, respectively; $P < .001$) and comfort rating also increased (28%–91% and 19%–80%, respectively; $P < .001$).

CONCLUSIONS: Objective scores and trainee self-ratings suggest that this structured curriculum using simulator training allows junior medical students to achieve proficiency in basic surgical skills.

Learning objectives for the third-year surgery clerkship in most medical schools encompass cognitive, psychomotor, and affective or behavioral skills. In the past, students have learned the basic technical or psychomotor skills as apprentices on the surgical wards and in the operating rooms. However, stresses in the teaching environment have made this traditional approach inadequate. Specifically, increased clinical demands on faculty mean that students receive variable teaching and little opportunity for direct feedback. There is no universal standard for proficiency and educational goals are unclear. As has been shown plainly in resident education, shifting basic skills training to simulation laboratories has great potential benefit for patient safety and cost, especially in the context of restricted duty hours.

To standardize teaching and assess proficiency in basic skills, a proficiency-based skills curriculum was designed and implemented in the third-year surgery clerkship at our institution. The purpose of this study was to evaluate the feasibility and benefit of this curriculum. We hypothesized that medical students could achieve proficiency in basic skills through simulation training.

Methods

A basic skills curriculum using simulation training in the third-year surgery clerkship at University of Texas Southwestern Medical Center was initiated in the 2006–2007

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academic year. This Institutional Review Board–approved study was designed to evaluate the effectiveness of this curriculum.

Study participants

All third-year students (n = 206) in the year-long study period were offered enrollment into the study. Of these, 204 (87 women and 117 men) agreed to participate and were enrolled prospectively. Data were collected regarding sex and any prior training or experience. In addition, surveys were administered at the beginning and at the end of the 8-week clerkship to determine the individual's comfort level and self-rating of performance of each skill before and after the course. Participants rated their own ability to perform open surgical skills tasks using a Likert scale in which 1 indicated very poor, 2 indicated poor, 3 indicated moderate, 4 indicated good, and 5 indicated excellent. End-course surveys also asked the participants to estimate practice time and operating room experience gained during the training period.

Skills curriculum

The following skills were taught: male and female bladder catheterization, female breast examination, and the open surgical skills of 2-handed and 1-handed knot tying. The decision to include these skills was based on a needs assessment that elicited feedback from faculty, students, and the Student Education Committee in the department.

Two surgery faculty members participated in the planning and oversight of the skills curriculum, investing approximately 30 hours. Other requirements for one academic year included skills laboratory staff to administer the course (30 hours), nurse educators teaching bladder catheterization (48 hours), breast fellows teaching breast examination (48 hours), skills laboratory staff performing pretests and posttests (96 hours), and residents testing and proctoring (100 hours).

Bladder catheterization. Bladder catheterization was taught using male and female models (Life/Form model numbers LF00855U and LF00856U, respectively; Life/Form Replicas, Saugerties, NY) in proctored group sessions. A curriculum was developed that included the following procedural steps: opening the tray, donning gloves, and preparing the tray (swabs, lubricant, Foley balloon tested). The participant was expected to explain the procedure as he would to an actual patient and the model was draped and prepared. After lubricating the catheter, it was inserted into the bladder and the balloon was inflated after urine was obtained. Sequential steps in the catheterization procedure were taught and then students performed the task on both male and female models. Proficiency was defined as performance of each step in the correct order without error. Global rating was performed by an expert examiner using a check list (Table 1). Participants who did not achieve proficiency were immediately remediated and testing was repeated until proficiency was achieved.

Table 1 Evaluation of performance of bladder catheterization

Steps in procedure	Correct	Error
Aseptic technique		
Putting on gloves		
Handling tray and instruments		
Preparation of patient		
Male catheterization		
Order of steps		
All steps completed		
Depth of insertion		
Correct inflation of balloon		
Female catheterization		
Order of steps		
All steps completed		
Depth of insertion		
Correct inflation of balloon		

Breast examination. All participants were trained to perform a breast examination on models that included a strap-on breast and the Examination and Diagnostic Breast Trainer (model 40100 and model 40044, respectively, by Limbs and Things, Savannah, GA). At the end of the proctored session, students were evaluated for proficiency in performing the breast examination and their ability to identify any lesions present. Breast examination skills included obtaining the clinical history (simulated), performing the examination on a model including inspection and palpation, and identifying lesions. The following were required for proficiency: a complete examination, all existing lesions identified, and the location and character of each lesion described without error. Proficiency was determined using a global rating scale by an expert examiner and was based on a check list. Participants who did not achieve proficiency were immediately remediated and testing was repeated until proficiency was achieved.

Open knot tying. Participants were instructed in both 2-handed and 1-handed knot tying using a previously validated proficiency-based curriculum.[1,2] Orientation included a video tutorial showing appropriate technique and common errors. Students could review the video either online or in the skills laboratory at any time throughout the ensuing 8 weeks. After orientation, a proctored pretest was administered that included a repetition of each task. Performance was scored on the basis of time and errors based on a previously published formula.[1,2] Teaching and testing were performed on knot-tying boards (Covidien, Mansfield, MA). During the 8-week rotation, participants were expected to self-practice until student-level proficiency criteria were achieved on at least 1 repetition. Additional supervision and feedback was provided by surgical residents. A final posttest (1 repetition of each task) was administered at the end of the training period.

As previously described, participants were trained to tie a 2-0 silk suture around a 5-mm colored segment on a thick