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Learning to Teach: A Review of Peri-Procedural Teaching and Assessment in General Surgery

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Abstract

Purpose of Review With the continued growth of the field of surgery, procedural education must be prioritized. The aim of this article is to review methods for procedural teaching as well as tools for operative performance assessment.

Recent Findings There are many techniques for approaching peri-procedural education, all of which have their advantages and disadvantages. Currently, data suggest that trainees and educators do not regularly engage in peri-procedural educational discussion. Regarding assessment, immediate post-procedural feedback is recommended. This should be for single, directly observed encounters, and ideally should be combined with dialogue or written (or dictated) commentary from the educator.

Summary With technological innovation, patient and case complexity, and time constraints for both educators and trainees, the need for formalized educational strategies has never been stronger. A number of techniques that can be used for peri-procedural teaching and assessment have been reviewed in this chapter and can be implemented based on institutional, educator, and learner preferences.

Keywords Procedural teaching · Surgical education · Feedback · Assessment · Operative performance · Faculty development

Introduction

Since the era of William Stewart Halsted, the field of surgery has changed immensely. Yet the phrase "see one, do one, teach one" remains familiar to nearly any individual training in a general surgery residency program. Arguably Halsted's greatest contribution to surgery was his development of the residency training program [1]. Since that time, several factors have led to decreased operative autonomy for the surgical resident. Advancements in surgical technology, increased patient and operative complexity, an emphasis on patient safety and quality improvement, and resident duty hours are among these factors. In light of these vast changes, peri-procedural education must also evolve.

The need for formalized educational strategies has never been stronger. Current residents are performing more operations during their training, demonstrated by a continued rise in the number of cases required for graduation [2]. However, the number of high-frequency cases remains relatively stable and the operations are increasingly more complex [2, •3]. Given this information, the expectation that surgical trainees are going to be deemed competent in the independent practice of a vast number of operations may seem unreasonable [•3]. Some have suggested that perhaps trainees should be expected to demonstrate competency in general surgical principles and the ability to independently perform a smaller number of high-frequency operations safely [•3].

In order to achieve this goal and effectively teach procedural skills, educators require some formal instruction. This is a change for those educators who were in fact "taught by doing." Many strategies have been proposed to guide surgeons with procedural instruction. In this article, we will review some of these methods as well as tools for operative performance assessment. We will also describe future directions for procedural teaching.

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Pre-patient Procedural Teaching Strategies: Simulation

One important way in which procedural skills can be taught is through simulation-based training. Particularly useful for novice learners (i.e., medical students and junior residents), simulation allows for skill acquisition without any patient risk. Many surgical programs currently institute simulation for the purpose of "boot camps" for incoming interns, procedures such as central line placement, or basic skills such as knot-tying or suturing. There are also simulation curricula related to team training and non-technical skills. Simulation can be beneficial for learning new techniques, such as robotic, laparoscopic, or endoscopic skills. As part of the American Board of Surgery (ABS) graduation requirements for general surgery residency, trainees must successfully complete both laparoscopic and endoscopic curricula, which in part requires the demonstration of appropriate skill acquisition via simulation. Research related to simulation-based training is promising regarding its utility in improving basic surgical skills and procedural performance [4, 5]. However, the routine adoption of simulation-based training into residency programs is somewhat limited by issues such as inadequacy of resources and high costs, logistical barriers, lack of robust data related to skill acquisition, and the time constraints of balancing additional educational requirements within the already congested residency training paradigm and 80-hour work week [4].

Pre- and Post-procedural Briefing and Debriefing

In combination with intraoperative instruction and postoperative feedback, preoperative preparation plays a significant role in procedural learning. Both adult learning theory and literature in health professions education suggest that pure discovery learning is inferior to guided, goal-directed learning. "Deliberate practice," a term defined by Swedish psychologist K. Anders Ericsson, consists of focusing on improvement in a particular aspect of performance, receiving immediate and focused feedback, followed by repeat exposure [6]. It is this goal-directed approach to learning that leads to expert performance of a task, rather than innate ability or case repetition alone. In this section, we will review two techniques used for peri-procedural teaching that emphasize this philosophy.

Briefing, Intraoperative Teaching, Debriefing (BID) Model

The "Briefing, Intraoperative Teaching, and Debriefing" (BID) approach to perioperative learning was described by Roberts et al. in response to the concern that learners taking a "discovery learning" approach are unlikely to experience permanent change from a procedural experience [•7]. The BID model has three parts: briefing, intraoperative teaching, and debriefing. The briefing component consists of a short interaction between the educator and learner focused on establishing learning objectives for the procedure. The process involves a review of past exposures and potential weaknesses, which is ideally initiated by the learner but should be guided and even prompted by the educator. These objectives are then incorporated into the next component of the BID model: intraoperative teaching. During this phase, the usual forms of intraoperative communication will occur, but a point should be made to focus on the learning objective(s) pre-determined by the pair prior to the start of the procedure. Finally, debriefing takes place after the operation is finished. Per the authors, debriefing should include reflection, rules, reinforcement, and correction. It should be engaging, requiring the learner to think about what was covered during the encounter. Table 1, adapted from from Roberts et al., provides an example of the BID Model in use [•7].

Advantages of the BID model include that it is straightforward, brief, and focused. It can be easily incorporated into the normal flow of an operative experience and does not necessarily change any already-established teaching strategies an educator prefers. Disadvantages of this approach are few and are mostly related to the fact that this is an extra task to perform in a busy operative day. A recent study assessing the use of educational preoperative briefings at a national level found that less than half of attending surgeons and trainees reported engaging in them and only 19% of participants reported discussing specific learning objectives frequently [8]. Participants were slightly more likely to report receiving or providing postoperative feedback (44% reported it occurred more than half of the time); however, this was not necessarily structured or actionable feedback. In this study, participants indicated that the greatest barriers to performing preoperative educational briefings were time constraints, external pressures (administrative, financial, etc.), and lack of other-party engagement. Importantly, in a study by Anderson et al., the authors assessed a 3-phase process to implement changes in teaching patterns via the BID approach and found that using continuous process improvement efforts, the preoperative briefing rate increased from 34 to 96% [9]. Thus, with a dedicated effort toward faculty development and an emphasis on a culture of education, change can be effectively made.

Educational Time-Out

Similar to the BID model, there is an approach referred to as the educational time-out (ETO). Developed based on an institutional needs assessment pertaining to perioperative education and assessment, the ETO also emphasizes guided learning and the establishment of operative learning

Table 1 Briefing, intraoperative teaching, debriefing model adapted from Roberts et al. with permission [•7]

Step and timing	Subcomponents	Example: inguinal hernia repair
Briefing: 2 min	Identifying objectives for the operation: "What would you like to focus on today" or "I would like you to focus on …"	Attending to resident: "What would you like to focus on today?" Resident: "I would like to focus on improving my identification and dissection of the indirect sac."
Intraoperative teaching; brief, focused interactions during the operation (1–5 min each)	Teaching focused on identifying learning objectives, augmented with teaching scripts	Attending: "Where do you begin to look for an indirect sac?" Resident: "I usually begin somewhere in the middle between the deep and superficial inguinal ring." Attending: "It's important to begin exploration near the deep inguinal ring to avoid missing a very small indirect sac."
Debriefing: 1–3 min	Stimulate reflection on part of the learner Teach general rules Reinforce what was right Correct mistakes	Attending: "How do you think you did?" Resident: "I felt better about the dissection of the sac. Using a more organized approach resulted in less bleeding by avoiding blunt dissection." Attending: "I agree. The dissection was careful and precise and you were able to reduce the sac without opening the sac." Attending: "What will you take away from this case in regard to sac dissection?" Resident: "I need to remember to begin dissection more proximally to avoid missing a small sac." Attending: "Your careful technique for dissection of the sac will avoid the complication of scrotal hematoma." Attending: "I would recommend moving the ileoinguinal nerve out of the dissection field early on to avoid possible injury during sac dissection."

goals [10]. As suggested by its name, the ETO is intended to be performed in conjunction with the mandated surgical pre-incision time-out as a reminder to set the stage for education as well as safety. The intervention has three parts, which include discussing a step of focus for the operation, the current autonomy level at which the trainee is currently performing that step, and tactics that can be used to reach their desired level of autonomy (Fig. 1) [10, 11]. The use of the ETO has been studied at a single institution in both the organ transplantation and endocrine surgery settings, and was shown to improve the frequency of goal setting and strengthen the participants' educational experiences [10, 11]. Not included as part of the ETO, but performed in conjunction with it in both studies, was step-specific feedback provided using the system for improving and measuring procedural learning (SIMPL) application. Participants used this validated tool to assess levels of supervision and performance for the step chosen for a particular operation [12].

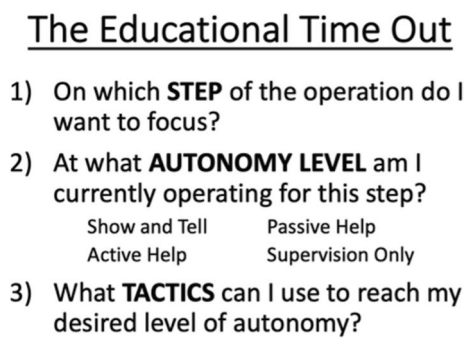

Fig. 1 The Educational Time-Out from Lillemoe et al. [11]

The educational time-out has similar pros and cons to the BID model. Based on the studies employing the ETO, it improved goal-setting and perioperative discussion, including receipt/provision of feedback [10, 11]. Attending surgeons found the discussion of the trainee's current level of autonomy particularly useful [11]. A major difference from the BID model is the pre-determined steps of the procedure that were used for the purposes of the ETO. The authors created stepwise breakdowns of the operations included in each study, making the "goal setting" aspect of the intervention inherent. Feedback was, thus, required to be specific to this step as well. While it is less clear if performing interventions such as the ETO or BID model improve performance, evidence suggests they could be useful as surgical training moves toward a competency-based learning paradigm.

Operative Performance Assessment

Procedural education cannot be discussed without mentioning tools that are used for assessment. There are two major procedural requirements by the American Board of Surgery (ABS) for general surgery certification, the first of which includes the submission of both clinical and operative performance assessments. The second is a procedural case log, which will be discussed later in this section. A major critique of the current system is that performance assessments vary by program, as does quality and timing of the assessment [13]. In 2016, Williams et al. provided practice guidelines for operative performance assessments [••14]. While it is outside the scope of this chapter to review all 10 guidelines for assessing a single operative performance, the authors strongly suggest that surgical educators familiarize themselves with these items. Some important take-aways are that operative performance evaluations should be for single encounters that are directly observed and should occur immediately after the encounter. Thus, generalized post-rotation commentary related to operative performance is often less reflective of actual performance as retention related to performance is short. Evaluations should also include the amount of supervision provided by the educator, comment on the degree of case complexity, and avoid rater biases as much as possible. Dialogue between the two parties is strongly encouraged as are written comments, and assessment tools should avoid long, detailed requirements that are outside of the normal language of the educator.

There are many specific tools that exist for operative performance assessment. The Ottowa Surgical Competency Operating Room Evaluation (O-SCORE), described by Gofton et al., is an 11-item form that covers important aspects of peri-procedural preparation, communication, and performance [15]. It was the first assessment tool to emphasize the degree of supervision (i.e., autonomy) within the operative rating. The Operative Performance Rating System (OPRS), developed within the Department of Surgery at Southern Illinois University, includes a series of operative performance rating instruments for various general surgery procedures [16]. These forms assess procedure-specific skills, general procedural competencies, and overall performance. The tools have been adapted to also include case complexity, degree of supervision, and the elapsed time between the operation and the assessment [13]. Lastly, the Zwisch scale of operative autonomy and its use within the SIMPL application is an assessment tool more recently adopted by many surgical programs. SIMPL evaluations, available via smartphone app, assess autonomy, performance, and case complexity [12]. The evaluations incorporate the previously validated Zwisch scale [17], a 4-level scale related to the degree of supervision provided for a procedural interaction, with a 5-level performance scale (ranging from "unprepared" to "exceptional performance") as shown in Fig. 2. A pilot study among 15 general surgery programs showed it to be an easily adoptable platform for operative performance assessments [12]. Importantly, SIMPL evaluations allow for dictated feedback to be provided to the trainee.

The second procedural requirement for certification in general surgery is an operative case log achieving a set minimum number of procedures as defined by the Accreditation Council for Graduate Medical Education (ACGME) and ABS. Currently, there is little evidence that procedural numbers can be used as a surrogate for determining operative competence. In a study by Stride et al. evaluating over 10,000 operative assessments for the most common general surgery procedures, the authors were able to identify transition points at which most residents cross over to meaningful operative autonomy for the core procedures [18]. However, these targets were difficult to define even in the setting of a high number of evaluations, given most residents may not actually perform enough of even the most common types of procedures to reach them. A distinct strategy, recently proposed by Williams et al., suggests that high-frequency procedures be assessed differently from low-frequency procedures [3]. For high-frequency procedures, expectations should be that residents can perform them "safely, effectively, and independently by the conclusion of the training program"; thus, assessments should be competency based, rather than time or numbers based [3]. The authors include examples of evaluations for such cases and how competency could be assessed, emphasizing the need for many operative experiences with numerous raters. For low-frequency procedures, the operative goals should be tempered to practicing transferable operative skills without the implication that operative independence is the goal. Clearly, this proposal implies a need for a new framework for reporting and certifying surgical trainees, which has been and will be debated by the involved parties. It does provide food for thought related to the current assessment paradigm and how we determine if trainees are "ready" for independent practice.

Conclusions

The field of general surgery has come a long way since Halsted created the first general surgery residency training program. With technological innovation, patient and case complexity, and time constraints for both the educators and trainees, procedural education must be prioritized. A number of techniques that can be used for peri-procedural teaching and assessment have been reviewed in this chapter and can be implemented based on institutional, educator, and

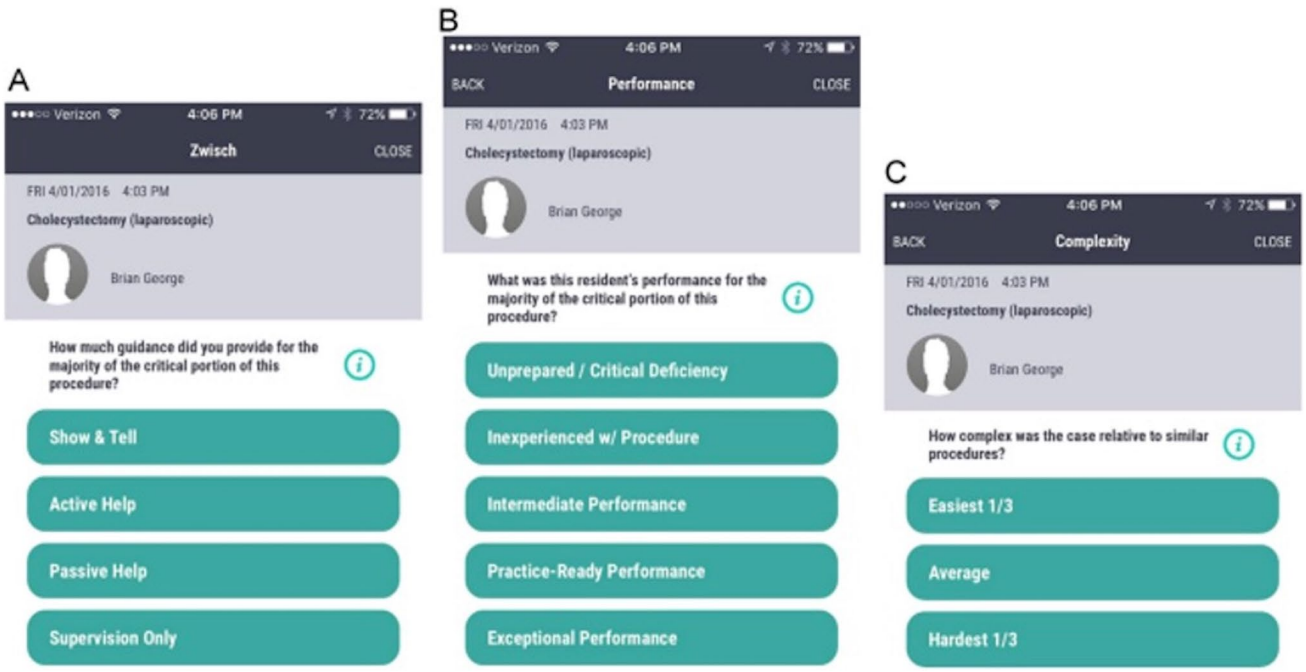

Fig. 2 SIMPL application from Bohnen et al. [12]

learner preferences. Questions remain related to how we can shift toward more effectively evaluating competency with the previously mentioned limitations at hand. What is clear, however, is that the old surgical adage of "see one, do one, teach one" will no longer suffice.

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Declarations

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