

Surgical Education

Development of a knowledge, skills, and attitudes framework for training in laparoscopic cholecystectomy



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Abstract

BACKGROUND: The implementation of duty-hour restrictions and a heightened awareness of patient safety has changed resident education and training. A new focus has been placed on high-yield training programs and simulation training has naturally grown to fill this need.

METHODS: This article discusses the development of a training framework, knowledge, skills, and attitudes, and the design of a surgical simulation curriculum. Five residents were recruited for a pilot study of the curriculum.

RESULTS: A successful framework for curriculum development was implemented using laparoscopic cholecystectomy as the example. The curriculum consisted of classroom and virtual reality simulation training and was completed in 3.1 to 4.8 hours.

CONCLUSIONS: The current curricula that have been developed for surgical education cover the breadth of a surgical residency well. This curriculum went beyond these curricula and developed a structured framework for surgical training, a method that can be applied to any procedure.

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Educational strategies are continuously evolving, especially in surgical education. With the implementation of duty-hour restrictions, a push for more cost-effective medicine, and a heightened awareness of medical errors and patient safety, training has shifted from the operating room and wards to other learning environments. The optimal training environment and learning strategy have been the focus of much discussion and debate.^{1,2} Simulation has been one solution, providing the opportunity for a safe learning environment that is both immersive and experiential. Multiple studies have assessed the efficacy of simulation training and have shown that surgeons who are trained using simulation show improved technical skills in the operating room.^{3–5}

So far, there has been an intense focus on technical skills training; however, focus has recently shifted to include training in nontechnical and teamwork skills.⁶ Nontechnical skills are the interpersonal and cognitive skills that complement technical skills and are essential to safety in the operating room. Examples include situational awareness, communication, decision-making, and teamwork.⁷

Although simulation offers a very promising training modality for novice surgeons, simulators and simulation laboratories alone are not enough to institute a training program. Fully developed curricula, ideally based on evidence, are required. To this end, there have been multiple solutions suggested for training surgical residents, including the Surgical Council on Resident Education, the Surgical Education and Self-Assessment Program, and Fundamentals of Laparoscopic Surgery (FLS) curricula, as well as the American College of Surgeons (ACS)/Association of Program Directors in Surgery (APDS) skills curriculum. The Surgical Council on Resident Education is a comprehensive list of the topics to be covered in surgical resident education focusing on knowledge and procedures. This standardizes the training goals and ensures that each resident has been exposed to a set of tasks and has a certain set of competencies when graduating. The ACS produced the Surgical Education and Self-Assessment Program that also focuses on clinical knowledge and test preparation with a collection of problem-based multiple-choice questions. Many simulation curricula in residency programs in the United States consist in part of the FLS certification. It is a standardized training and testing system that consists of web-based learning modules as well as training and assessment in a laparoscopic box trainer.⁸ The ACS and APDS developed a standardized 3-phase surgical skills curriculum that advances from basic surgical skills to advanced procedures and then team-based skills.⁹ The training is done using the FLS modules, video trainers, and finally a virtual operating room with team-based exercises. The ACS/APDS skills curriculum is unique in that it incorporates nontechnical skills training. This component is often overlooked in simulation curricula because of the difficulty in including it, but just like technical skills, can be improved with training.¹⁰

An important part to these curricula (and any other successful curriculum) is the ability to assess residents' progress and develop benchmarks and passing points for training. Both the FLS and ACS/APDS skills curriculum incorporate assessment into the training. In this article, we present a modular approach to the design of a surgical simulation curriculum, including a framework for the assessment of residents' competence. We present the development of the curriculum and assessment framework in detail and we report data on the feasibility of the delivery, including resources required (time, manpower, and equipment) and time taken to complete the curriculum. We use laparoscopic cholecystectomy as an example of a procedure-specific curriculum because it is one of the first procedures that surgical residents perform—the curriculum and framework, however, can be applied to any procedure.

Methods

The goal of this framework was to approach surgical education in a way that is similar to real life, through gaining knowledge, skills, attitudes, and behaviors. A surgeon first develops the knowledge base for the disease and treatment, and then continues to build on the knowledge base as he/she practices the technical intricacies of the procedure. Throughout this time, nontechnical and team skills also develop. Typically, nontechnical skills are not formally taught, rather surgeons are trained in an informal and unstructured manner, with trainees observing the practices of experienced and respected colleagues for guidance on how to behave and interact with other members of the operating team. In the development of this framework, we draw upon the wide literature that incorporates not only technical skills but also knowledge, attitudes, and teamwork.^{11,12} These elements are also the 3 core components that are evaluated by Kirkpatrick in his seminal work of evaluating training.¹³

An example of using this framework to develop a laparoscopic cholecystectomy curriculum is discussed here. It is based on previously validated components as well as new interactive media components. The intended audience was surgical residents early in their career, before they had completed 25 laparoscopic surgeries. Because laparoscopic cholecystectomies are frequently seen in surgical practice and are one of the first procedures done by trainees, the surgical curriculum focused on laparoscopic cholecystectomies. Five surgical trainees were recruited to pilot the training curriculum. Informed consent was obtained from the residents and approval was obtained from the Ethics Review Board at Imperial College London.

The 3 core elements of the curriculum and framework were designed as follows:

Knowledge

This portion was based on the Laparoscopic Cholecystectomy Course Handbook and video from the Royal College of Surgeons (UK)¹⁴ introducing the trainee to the equipment and theory of laparoscopic surgery. The video discusses the basics of laparoscopy, how to perform a laparoscopic cholecystectomy, and how to use the simulator. In more detail, it involved the following:

1. Background: Brief history of laparoscopic surgery
2. Fundamental skills: Description of the 2-dimensional nature of laparoscopic surgery as well as using tools with fulcrum points
3. Error training: Description of a laparoscopic cholecystectomy, the different steps involved, and the common pitfalls of the procedure.
4. Introduction to a new environment: Demonstration of the LAP Mentor cholecystectomy, how to change the surgical tools and how to use the simulator
5. Consolidation: A complete narrated simulated surgery done by a senior consultant.

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