Simulation-based Surgical Education

Best practices across surgical specialties relating to simulation-based training

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Introduction. *Simulation-based training is playing an increasingly important role in surgery. However, there is insufficient discussion among the surgical specialties regarding how simulation may best be leveraged for training. There is much to be learned from one another as we all strive to meet new requirements within the context of Undergraduate Medical Education, Graduate Medical Education, and Continuing Medical Education.*
Method. *To address this need, a panel was convened at the 6th Annual Meeting of the Consortium of the American College of Surgeons-Accredited Education Institutes consisting of key leaders in the field of simulation from 4 surgical subspecialties, namely, general surgery, orthopedic surgery, cardiothoracic surgery, urology, and otolaryngology.*
Conclusion. *An overview of how the 5 surgical specialties are using simulation-based training to meet a wide array of educational needs for all levels of learners is presented. (Surgery 2015;158:1395-402.)*

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SURGICAL EDUCATION is evolving faster than ever. Knowledge, skills and behaviors expected of students, residents, and surgeons are being defined, new methods are being pursued to assess core competencies, and expectations for documenting achievement of specific milestones are changing. For these and other reasons, simulation-based training is playing an increasingly important role in surgery. However, there is insufficient discussion among the surgical specialties regarding how simulation may best be leveraged for training. There is much to be learned from one another across the continuum of undergraduate medical education, graduate medical education, and continuing medical education.

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To address the need to cross-fertilize ideas across surgical specialties, a panel was convened at the 6th Annual Meeting of the Consortium of the American College of Surgeons-Accredited Education Institutes (ACS-AEIs), consisting of key leaders in the field of simulation from 5 surgical subspecialties, namely, general surgery, orthopedic surgery, cardiothoracic surgery, urology, and otolaryngology. What follows is an overview of how the 5 surgical specialties are using simulation-based training to meet a wide array of educational needs for all levels of learners.

SIMULATION IN GENERAL SURGERY

Dating back to the 1990s, several factors, including patient safety concerns, the need to introduce new procedures and technologies in practice, and the focus on the high costs of training in real environments, fueled the use of simulation-based training.[1-4] By 2000, pioneering studies began to emerge affirming that structured skills lab training resulted in significant improvement in surgeon performance during actual operations.[5,6] Over the ensuing years, additional regulations and imperatives, including duty-hour limitations, increased expectations for supervision,

and greater demands on productivity, resulted in further emphasis on the use of simulation.[7] In 2004, the Society of American Gastrointestinal and Endoscopic Surgeons (SAGES) in conjunction with the ACS launched the Fundamentals of Laparoscopic Surgery (FLS) program, which was the first major national simulation initiative in surgery and included both cognitive (web-based modules) and hands-on components (box trainer exercises). This program has received widespread acclaim because of its rigorous validation, and is now required by the American Board of Surgery (ABS) as a prerequisite for the initial certification.[8-11] SAGES has created a similar offering with the introduction of the Fundamentals of Endoscopic Surgery program, focusing on competencies relating to performance of flexible endoscopy. It includes high-stakes cognitive and virtual reality simulator-based skills examinations, and is now also required by the ABS for initial certification, similar to FLS. SAGES has recently introduced the Fundamental Use of Surgical Energy program. The ACS established standards for accreditation of simulation centers that are called ACS-AEIs. This program was launched in 2005 and there are now >80 accredited centers both within the United States and abroad. Additional centers will be reviewed for accreditation on a continual basis. Ongoing activities of the network of these centers include sharing of best practices, pursuing simulation-based research, and developing new high-quality curricula.[12] One of the most comprehensive initiatives has been a collaborative project between the ACS and the Association of Program Directors in Surgery (APDS) that has led to a standardized surgical skills curricula for residency programs to address a wide variety of skills.[13] This national skills curriculum was launched in 2007 and now includes 20 part-task, 15 procedural, and 10 team training modules. This is currently undergoing revision. Simulation became a bona fide part of residency training in 2008 when the Residency Review Committee (RRC) for Surgery mandated that all programs include training in skills laboratories.

Currently, there are strong motivators to continue embracing simulation in resident training, especially to verify achievement of specific competences.[14] One metric of concern is that ABS pass rates are suboptimal; only 79% of graduates passed their written examination and only 78% passed the oral examination in 2014.[15] The RRC introduced Milestones in 2014 to increase opportunities to verify that residents are achieving expected levels of performance with regard to knowledge, skills, and behaviors. Many educators expect that simulation will play an increasingly important role in this endeavor.

Efforts are also underway to strengthen the preparation of medical students for surgery residency training. Most efforts have focused on students planning to enter surgery residencies and have included preparatory electives or "boot camps," which have become well-developed and popular.[16,17] A national initiative is underway to identify best practices and create a standardized offering for the fourth year of medical school, and to use simulation in several modules. This work is being pursued as a collaborative venture between the ACS, the APDS, and the Association for Surgical Education (ASE). The ABS has issued a statement that the board "recommends and endorses that all incoming surgical residents beginning with the 2014 year complete a preparatory course before beginning surgical training."[18] To address the training needs of medical students regardless of their career goals, the ACS and ASE have also collaborated to launch the Simulation-Based Surgical Skills Curriculum for Medical Students.[19]

On the other end of the spectrum, simulation activities for practicing surgeons are still in evolution. These endeavors may play a role in credentialing and maintenance of certification, but such practices have not been widely adopted in general surgery. Some data suggest that there may be a need for use of simulation for competency verification of practicing surgeons, because ≤33% of practicing surgeons may not initially pass the FLS examination, which is required for surgery residents.[20] In fact, the ACS and SAGES issued a joint statement recommending that all surgeons practicing laparoscopic surgery be certified through the FLS program.[21]

Through the work performed to date, best practices have emerged for simulation-based training, including establishment of appropriate infrastructures, provision of protected time for learners and teachers, requirements for mandatory participation, and tracking of both attendance and performance. Additionally, skill acquisition is being optimized using deliberate practice to achieve specific goals[22] and through distributed practice whereby sessions are spread out over time.[23,24] Programs have also adopted a proficiency-based paradigm, in which educational experiences are tailored to the needs of the learner and training is deemed completed when individuals have reached performance goals rather than through use of time or repetition parameters.[25]