The Utility of Surgical Simulation in Student Education

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The use of simulation in the field of surgery has become a heavily researched topic over the last few decades, but it is by no means a new concept. The first recorded use of surgical simulation dates back 2,500 years with evidence of nasal models for flap reconstruction made of leaf and clay.[1] But simulation as we know it today did not take shape until the 1980s with the invention of the Comprehensive Anesthesia Simulation Environment (CASE) mannequins. The use of nonorganic simulation tools revolutionized the field and continues to play a large role in medical education. These modalities have become particularly helpful in the field of surgery because they allow for repeated practice of skills without sacrificing patient safety. Current surgical simulation has many forms that include, but are not limited to, live animal surgery, cadavers, benchtop simulators, virtual reality (VR) simulators, and robot assisted surgery (RAS) simulators.[2] Each of these simulation techniques offer unique opportunities to learn, practice, and improve surgical technique in a high fidelity, minimal stress environment.

Speaking from personal experience, surgical simulation has provided me opportunities to learn and practice surgical techniques that would otherwise be inaccessible as a medical student. Through SCALPELS, a longitudinal clinical skills-based surgical curriculum at Jefferson, students have the opportunity to be involved with many of the different modalities of simulation. This program was started by a group of senior medical students and a Jefferson faculty member, Dr. Gerald A. Isenberg, with the hope of increasing students' exposure to the field of surgery in their preclinical years. This curriculum represents a new trend in medical education and is founded on the 2008 AAMC recommendations for clinical skills in medical education. The ability to practice these skills in a simulation setting has been invaluable and has given me the confidence to use the skills learned to assist in a clinical setting.

While anecdotal experiences highlight the impact that simulation can provide for medical students, it is important to examine its broader effects from an objective perspective. One of the most important questions to ask is, "are the skills attained from simulation translating into patient-based scenarios?" A review article by Dawe, et al. found that students who became proficient in simulation-based training performed better in patient-based training than their counterparts without simulation training.[3] The same study found that for procedures including colonoscopy, laparoscopic camera navigation, and endoscopic sinus surgery, simulation-based training was equally as effective as clinical-based training when tested in a clinical setting.[3] These findings are encouraging and suggest that simulation-based training can be a reasonable supplement or even alternative to traditional early patient-based training.

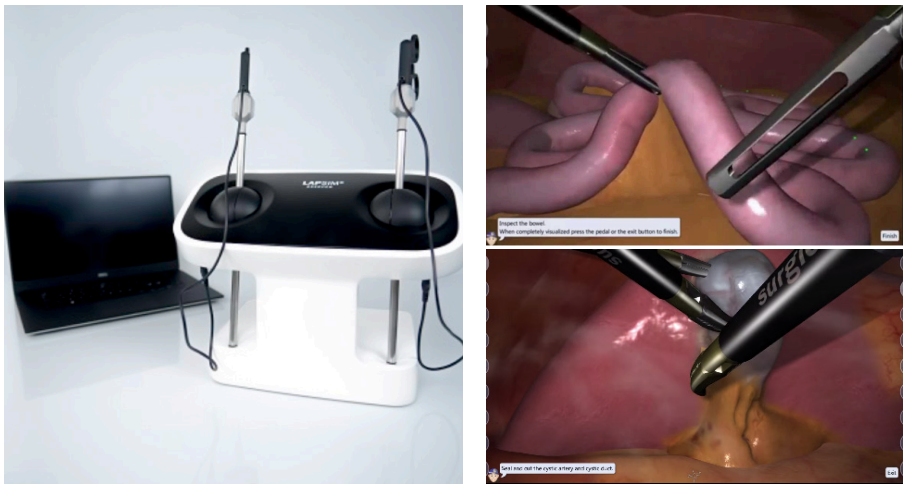
There are many advantages to integrating surgical simulation-based training into medical student education, but limitations do exist. While the isolated use of simulation has been shown to be advantageous, many argue that solely providing sophisticated simulation equipment without integrating it into an educational curriculum will not lead to improved patient outcomes.[4] Current research has found that while multiple simulation-based curricula have been created, there is a significant lag in their implementation due to inadequate human resources, difficulty determining how simulation integrates with existing educational strategies, and logistic barriers.[5] A potential cause is the high cost that is associated with simulation technology and how cost can act as a barrier to its integration into mainstream curriculum. For simulation-based education to reach its full potential, more studies need to be performed to create and optimize complementary curricula to support the new simulation technology available.[6]

These findings expose the reality of the challenges in implementing research findings into practice. The practical integration of new curricula to support simulation technology has been struggling due to unforeseen organization and administrative logistical challenges.[7] This highlights an exciting goal for the field of surgical simulation, which is to explore ways to optimize and logistically implement the new technology and proposed curricula available. Surgical simulation education is a field worth investing in because it has the potential to teach skills in a unique way that

can ultimately lead to improved patient outcomes. I look forward to continuing my involvement in the exciting field of surgical simulation and taking advantage of the opportunities it provides me to improve my own clinical abilities.

REFERENCES:

1. Limberg AA. The planning of local plastic operations on the body surface: theory and practice. 1984. Collamore Press.
2. Badash I, Burtt K, Solorzano CA, Carey JN. Innovations in surgery simulation: a review of past, current and future techniques. *Annals of translational medicine*. 2016; 4(23).
3. Dawe SR, Pena GN, Windsor JA, Broeders JAJL, Cregan PC, Hewett PJ, Maddern GJ. Systematic review of skills transfer after surgical simulation-based training. *British Journal of Surgery*. 2014; 101(9):1063-1076.
4. Kneebone R. Simulation in surgical training: educational issues and practical implications. *Medical education*. 2003; 37(3):267-277.
5. Stefanidis D, Sevdalis N, Paige J, Zevin B, Aggarwal R, Grantcharov T, Jones D, Association for Surgical Education Simulation Committee. Simulation in surgery: what's needed next? *Annals of surgery*. 2015; 261(5):846-853.
6. Tan SSY, Sarker, SK. Simulation in surgery: a review. *Scottish medical journal*. 2011; 56(2):104-109.
7. Kurashima Y, Hirano S. Systematic review of the implementation of simulation training in surgical residency curriculum. *Surgery today*. 2017; 7(7):777-782.



The LapSim® *essence* by Surgical Science (left) is the laparoscopic simulator used at Sidney Kimmel Medical College for the SCALPELS program. Screen captures of LapSim® *essence* modules are shown on the right.

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