A LOOK TO THE FUTURE: TEACHING ORTHOPEDIC SURGEONS

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Orthopedics is a dynamic specialty; we are learning more and more about the basic science of bone and cartilage repair, and hopefully in another generation, we will be putting in far fewer knee replacements because we will be able to grow new cartilage. Tissue engineering is taking off in such a way that there will be different ways to do better biologic repairs rather than replacing bones with metal. Since the change is constant, surgeons need to be accepting of that and recognize that in the field of orthopedics, things continue to change at an ever-increasing rate. we all know that most of the residents and young faculty members are doing fellowships, some are even doing two fellowships because of the perhaps decreased exposure to cases and critical issues to help with decision making. Orthopedic surgeons need to keep themselves up to date on how things are changing and focus their practice on evidence-based medicine. We have to realize that they learn differently than we do, and we have to develop teaching methods that work on computers or on an app and develop e-books instead of good old-fashioned textbooks.

In 1927, William Mayo said there is no excuse today for the surgeon to learn on the patient[(1)]. Eighty-six years later, in 2013, the US Accreditation Council for Graduate Medical Education issued a requirement that residency programs have surgical skills training as part of their curriculum. Surgical simulation would be one part of this requirement. As the general public becomes more educated, they will demand more accountability for surgical interventions. In the aviation industry, pilots would not hold down a job without proof of simulation training. Similarly in medical field, surgical simulation should decrease the incidence of surgical errors and speed up completion of surgical cases. There are some dramatic benefits to doing simulated skills in the lab. Some procedures have a steep learning curve, so it takes a number of repetitions before trainees have the manual dexterity to do it right. Simulators allow trainees to practice over and over again without any harm to the patient. They may have some results that are less than optimal if they do not have good skills when performing the procedure on a patient. Mistakes on the simulator are harmless and are rectified by repeated deliberate practice on the simulator. The use of simulation to demonstrate surgical skills may become a tool for pass-fail certification or maintenance of certification for practicing orthopedic surgeons in the future. Training in arthroscopy is one such area where simulator teaching is in practice in few institutions in developed countries.

Cannon WD conducted a multicentric study on final year orthopedic residents with the purpose to assess whether skills learned arthroscopic knee simulator transferred to greater skill levels in the operating room. He demonstrated transfer validity (transfer of training) of residents trained on a arthroscopic knee simulator showed a greater skill level in the operating room compared with the control group[(2)]. In a another pilot study, Cannon found that the simulator was able to show statistically significant differences in skill level between first year postgraduate residents and both final year postgraduate residents and community-based orthopedic surgeons, but not between the latter two groups. Based on the results of his study, he inferred that junior residents' surgical skills would be enhanced by training on an arthroscopic simulator before beginning their arthroscopic operating room experience. Higher levels of surgeon experience resulted in improved efficiency when performing diagnostic knee arthroscopy on the simulator [(3)] .

The literature is replete with documentation of surgeons who have higher volumes of specific procedures having fewer complications and improved outcomes over those performing similar procedures on an infrequent basis. A learning curve exists for the acquisition of surgical skills and procedural techniques. Simulation for surgery has the potential to afford the opportunity for the trainee to obtain and refine surgical skills in an "inconsequential" manner (i.e., without morbidity to the patient). Although improving surgical skills will be a lifelong endeavor for the practicing surgeon, mastering fundamental techniques prior to performing surgery in the clinical setting can be expected to reduce errors and improve outcomes.

The use of surgical simulation, by itself, will not ensure that the trainee will become a more skilled surgeon. A carefully constructed and validated curriculum must form the foundation and precede the employment of the simulator. The specific tasks on which a trainee has to be trained must be identified and then parameters should be created for that task which should be clear, objective, measurable and achievable. The trainee must know not only how to execute the proper

technique, but also the potential errors to be avoided. Once the parameters for a specific skill or a particular procedure are validated, simulations/simulators can be designed specifically to mimic that experience and train those skills.

Surgical simulation advantages include the following:

1. Providing the trainee with "synthetic experience" with the chance to acquire surgical or procedural skills;
2. Permitting the trainee to enact procedural/technique errors in an "inconsequential" manner (no patient morbidity) and to learn from those errors to improve their technique;
3. Enabling the trainee to engage in repetitive practice;
4. Providing the acquisition of trainee performance data, which helps in:
    a) documenting the progress toward a predetermined benchmark; and
    b) Providing trainee with the feedback focusing on deficiencies exhibited.

Surgical simulation disadvantages include the following:

1. The simulator, by itself without a preexisting validated curriculum, may be ineffective in improving the skill sets necessary to train essential surgical techniques;
2. Practice on the simulator without specific, defined performance goals has the potential to ingrain poor habits/skills;
3. Essential proximate feedback is not provided to the trainee for low- and medium-fidelity simulators; and
4. More expensive simulators used without a validated curriculum may result in poor "value" for training institutions.

Although there might be many advantages of simulator training might be but simulation does not become a substitute for the apprenticeship model. The use of simulators does not take the place of actual one-on-one interaction with faculty mentors and surgeons who help and train the residents on using the equipment and interacting in surgery. Residency should always be an apprenticeship model where faculty takes pride in teaching a junior resident on improving their skills.

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