

Virtual Mentor

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STATE OF THE ART AND SCIENCE

I, Robotic Surgeon

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When Isaac Asimov penned his famous novel, *I, Robot* [1], he presented the world with three Laws of Robotics. His laws were intended for human interactions with fictional *autonomous* robots. We can apply the laws to our understanding of the current surgeon interface with robotic surgical systems if we acknowledge that the autonomy resides in the surgeon. The new technology gets the attention, but robotic surgery still remains a human endeavor of medical practice and should be subject to the same principles of medical education and ethics as any other method of surgery. In this paper, we will apply the concepts of the Three Laws to explore ethical questions surrounding the education of resident physicians in robotic surgery, appropriate responses of trainees to robot system failures, and the financial conflicts of interest facing residents who become robotic surgeons.

First Law: A Robot Must Not Harm a Patient

The First Law of Robotics states that “A robot may not injure a human being or, through inaction, allow a human being to come to harm.” Applying this law with the surgeon as seat of the robot’s autonomous will accords with the ethical principle of nonmaleficence that requires that physicians’ actions not intentionally cause harm. The two questions for the training of new surgeons, then, are can training in robotic surgery hurt patients and can lack of training in robotic surgery, “through inaction, allow a human being to come to harm” [1]? The argument has been made that training in robotic hysterectomy is hampering the development of residents’ skills in traditional techniques [2] and may therefore be contributing to producing newly minted surgeons who are underprepared for practice. In this sense, the training could be said to harm patients.

What about nonuse of robotic surgery allowing “a human to come to harm”? If one views the robot as simply another tool in the surgeon’s armamentarium, one that is neither better nor worse than the tools of traditional laparoscopy or laparotomy, then omitting robotic training from graduate medical education is ethically neutral. If one views robotic surgery as a major advance that allows more patients to have complex minimally invasive surgeries with shorter recovery times, however, then omission of robotic surgical training would in fact, be harmful to the population of patients that the trainee would serve in the future.

An important caveat in attempting to answer both questions is the metaethical principle that good ethics begins with good facts. The facts that could help answer the ethical questions related to dedicated training time for robotic versus

laparoscopic and open techniques of hysterectomy are not available, so these questions remain open.

Second Law: Robot Malfunctions Must Be Reported

Asimov's Second Law of Robotics is: "A robot must obey the orders given to it by human beings, except where such orders would conflict with the First Law" [1]. The Engineering and Physical Sciences Research Council translates this succinctly as, "Robots are products. They should be designed using processes which assure their safety and security" [3].

Surgical tools have become increasingly more complex and prone to failure. This is certainly the case with complex robotic surgery systems, which contain multiple components. Communication among the patient docking arms, camera, and surgeon console are critical for the success of the operation, as well as patient safety, and failure of the system at any of these critical nodes could cause harm to the patient. The responsibility for preventing that harm resides with the surgeon who is using the robot. He or she must report a malfunction of the robotic equipment to the manufacturer, hospital risk management, and, for serious adverse events, the Food and Drug Administration (FDA). Failure to do so is a lapse of the surgeon's ethical duty [4]. This duty is particularly important in light of the FDA's recent warning letter to Intuitive Surgical, Inc., manufacturers of a robotic system, criticizing the company for delaying reports of technical issues that could have resulted in patient harm [5].

Third Law: Promotion of Robots Leads to Conflicts of Interest

The Third Law of Robotics is: "A robot must protect its own existence" as long as doing so does not interfere with the first two laws. Robotic surgery has become big business for both the manufacturers and the hospitals that have invested in the multimillion-dollar equipment [6]. The third law implies that the autonomous robot—in our case, the autonomous robot-using surgeon—protect the existence and promote the use of robotic surgery. Trainees in robotic surgery, however, must be aware of the intense financial pressures to use the technology, and they must be cognizant of a critically important distinction: the primary ethical obligation of a physician is to the patient, while the primary fiduciary duty of the company is to its stockholders. This difference presents a significant danger—co-optation by hospital administrators or industry representatives that may result in treatment choices that do not primarily benefit the patient. Surgeons might be co-opted in a couple of ways.

Advertising. Hospitals may invest heavily in advertising of robotic surgery and anticipate that their surgeons will participate in the advertising. For gynecologic surgery, advertising images (64.1 percent) and text (24 percent) are often provided directly by the manufacturer of the system [7]. Newly minted surgeons should be aware of how their credentials are used in advertising and ensure that any such advertising is accurate. Some surgical specialty organizations hold surgeons responsible for the truth and accuracy of all advertising related to their programs, regardless of whether they were consulted before publication of the advertising

material. For example, the American College of Obstetricians and Gynecologists Committee on Ethics states, “In considering appropriate marketing practices, physicians should evaluate not only their own actions but also those undertaken on their behalf by hospitals or other health care centers that may be marketing their services” [8]. Claims of superiority of the robotic procedure, one surgeon, or one surgical center over another must be backed up by objective data. In the absence of such data, claims of superiority may not only fail the sniff test, but may be considered untruthful, misleading, or deceptive [9] and thereby unethical and possibly illegal. An important and highly relevant problem is that few high-quality data (such as randomized controlled trials) have compared robotic surgery with other methods, so the range of accurate marketing claims is limited [6].

Costs. Hospitals that have made large capital investments in robotic systems are pushing surgeons to have the robots in use daily to increase the return on the hospitals’ investment, as recommended in the memorandum to hospital executives from Intuitive Surgical [10]. The cost of robotic procedures is considerably higher than that of comparable procedures performed by laparoscopy (although the cost differential decreases somewhat with an increasing volume of robotically performed surgeries) [6, 11]. Switching surgeries to the robotic platform is certainly a “high-cost” conversion, and, again, reliable and consistent data that robotic hysterectomy presents higher quality or better outcomes are lacking [12]. In the current health care reform environment, cost and quality are garnering more attention than ever before. By shifting resident teaching time from standard laparoscopy to robotic surgery, we may be producing “high-cost” surgeons who will be penalized by insurers, whether or not the cost is justified by better outcomes.

Conclusion

So is robotic surgery training in residency a good thing or a bad thing? Only time, experience, and reliable data will tell. The market forces driving this technology today may be completely different in 10 years. However, the timeless ethical and educational principles in surgical training will outlast the popular technology of today as well as the next surgical fad. As always, the paramount consideration must be the safety of the patient, rather than the exact tools utilized for the surgery.

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Disclosure

Dr. Spillman has participated in the Intuitive Surgical, Inc. initial robotic surgery training course online and in person, and does perform robotic surgery in her practice

of gynecologic oncology. She also taught robotic surgery to gynecologic oncology fellows and residents at the University of Colorado.

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