



Cutting the optical leash: rethinking the “robot” in robotic surgery

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Since its most impactful iteration in 2000, surgical robotics appears to be entering a new, or second, era of surgical innovation. One in which the promises of nanotechnology, big data, machine learning/artificial intelligence, and automaticity are crossing over from conjecture to a not too distant reality. Yet, I cannot help but think that we have been fooling ourselves, our patients, and our administrators that any of this is truly “robotics.”

Maybe, the advancement of laparoscopic surgery in 1985 and “robotic” surgery 1987 blurred the conceptual boundaries, because all we knew prior was open surgery? Maybe, the label of “robotic” surgery was misapplied to help stimulate excitement at a time when there was no formal definition of “minimally invasive surgery?” That robotic surgery, the second minimally invasive innovation, was actually born from a much more radical, perception changing innovation. It was laparoscopy and thoracoscopy which questioned millennia of surgical dogma and took surgery kicking and screaming from an exclusively open arena into a formidable and challenging closed one. Surgical “robotics” merely gave it an arm to hold the scope, a steady the hand, and a chair for the surgeon to operate.

While we may currently struggle to find a general definition of what is a robot, there is a general sense among professional roboticists that it is a physical machine that is programmable by a computer and can execute tasks autonomously or automatically by itself. What a lot of roboticists tend to follow is the Sense, Think, and Act paradigm. None of which our current surgical systems employ in an integrated manner.

While it is easy to question “robotic” in this current surgical era, I am concerned that by removing the label of “robotics” from surgery, it might diminish decades of clinical

validation and significantly stunt the future development of the technology. My reasoning is based on the power that the word “robot” has for us. It has attained a formidable level of instant recognition for patients, administrators, and physicians. It generates a lot of attention and fascination. Think how much sexier it is to call something a robot than call it a remote-controlled arm?

The prototypical and innovative vision for authentic robotic surgery is based on telerobotics: where the surgeon could remotely operate on a soldier in the field or an astronaut in space- not to sit 10 feet away hitched by a fiber optic leash. The current guise of “robotic” surgery, no matter how much you like the 3D optics and wristed instrumentation, is not truly robotic surgery in the proper sense of the word robotic or telerobotics.

Yet, we do not have to sacrifice the benefits of our current systems. Instead, we should just embrace the fact that we perform digitally enhanced surgery not robotic surgery. In addition, we should recognize that digitally enhanced surgery is the bridging technology to a brighter robotic future.

To be true robotic surgeons, and I am fully supportive of the initiative, we must cut the optical leash. This can be accomplished in future robotic platforms by following two pathways: design a legitimate mainstream Telerobot and/or employ the principles of Sense, Think, and Act. This will not be an easy road, but, for the last 20 years, surgeons and patients have been pioneers exploring together the infinite possibilities of a better digital surgical tool.

We are at the precipice of a new age of surgical robotics, a perceptual change in our field, and we must remain integral as we ask industry to build that platform, so we may continue our most human exploration.

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