The Next Direction for Surgical Robotics

Kasey Panetta

 The world of medical technology has always been a rapidly changing and evolving field. Solutions for long plaguing problems, like reducing human error by using more robotics, begat more problems like an increase in mechanical failure during procedures. Plus, throw in rapidly aging baby boomers, an increase in global population, and a surge in demand for specialized doctors and the problems grow exponentially.

Oddly, one facet of the medical field that has seen very few fundamental changes is surgery, a fact that Simon Karger, a technology and business consultant from Cambridge Consultants says needs to be addressed immediately by exploring something he calls “new surgery.”

“Doing this will rely heavily on developing surgical devices that enable fundamental change in surgical practice—using novel and integrated technologies to change not only how we do surgery, but what we do and who does it,” he says. “They need to learn how to use new technological approaches to work within a broader treatment and connected care ecosystem and understand how to streamline and derisk surgery for all involved.”

First, let’s look at how evolving “new surgery” will affect the role of the doctors. Surgeons are increasingly dealing with problems stemming from too many patients and not enough experts. While surgical devices in the OR are reducing the amount of surgeons needed—articulating camera holders can often replace secondary

surgeons for MIS procedures—they're also requiring surgeons to be more multidisciplinary than ever, says Karger. Experts hope that as the technology becomes more intelligent, surgeons will be able to interact in real-time with multiple robotics systems, including imaging units, handheld tolls, and benchtop generators for electrosurgery.

Insight: Simon Karger

With over 14 years of experience in technology and business consulting, Simon Karger has a long track record of accelerating new innovations in the medical (surgical and drug delivery), consumer wellness and industrial sectors. Prior to joining Cambridge Consultants, Karger was a VP at Sagentia where he worked for 10 years and was responsible for helping to build its operating consulting practice in the US market and opening up US offices in Boston and Washington, DC. Karger has also held positions with Arthur D Little and the non-profit TWI. He holds a bachelor's and master's degrees in mechanical engineering and business from the University of Warwick.

The problem being, despite a recent test trial of Microsoft's Kinetic control system, most ORs are far from integrating "smart" medical technology into their day-to-day. In the meantime, some robotics surgeries actually require an extra secondary scrubbed-in surgeon in case the procedure needs to be converted from robotics to open. The technology just isn't where it needs to be to allow the secondary surgeon to work on an entirely different case.

Though an argument could be made that when the technology evolves to the point where it can be trusted, the reduced role of the surgeon will coincide with a reduction in surgical skills, Karger insists the opposite is true. Surgeons are becoming more specialized so they are able to maintain their position as team leader instead of team member, while taking advantage of technological advances.

"There has been a flood of cardiac surgeons that have moved or are moving to interventional techniques, which deliver better overall outcome for patients, but which also rely on high specialized surgeon skills," Karger says.

Though a traditional healthcare system requires 25 to 27 physicians per 1,000 people, many developing countries have only four to six. His point? Even with an increase in surgical robotics, they'll never replace actual physician care; they simply allow surgeons to focus on other objectives.

“Developing the highly skilled specialists that we rely on today in the volumes needed is impractical,” says Karger. Devices will play a key role in allowing healthcare systems to make better use of their surgeons by reducing the overhead associated with common tasks, automating complex tasks, and removing unnecessary ones.

For the skeptics, Karger lists specific examples about how new surgery will improve the surgical field:

- Connected systems will allow surgeons, caregivers, PCPs, and patients to communicate and monitor postoperative recovery remotely—reducing the burden on both specialist medics and hospitals
- Advanced navigation and visualization systems will allow surgeons to see clearly where they are operating while digital tissue segmentation software will highlight where critical tissue types are
- Sensor rich surgical devices will help less practiced surgeons by warning them when they stray too close to a nerve or other critical structure during dissection

Now, let’s take a look at the technology itself.

For this to become a viable option, there must be some fundamental changes in the design and delivery of surgical technology. Hospitals are often discouraged by the large price tags that can accompany new equipment, but they must begin to think more in terms of long term benefit rather than short term cost.

“For example, a cardiac implant that needs no leads to deliver power and control (like the one developed by Cambridge Consultants for EBR Systems) offers enormous clinical advantage: not having leads to place dramatically reduces procedure length and patient risk, lack of interconnects eliminates the risk of breakage during use and so the need for later procedures, keeping the power and signal transmitter separate from the implant allows for rapid and simple 'tweaking' of the implant postoperatively, reducing risk and specialist overhead,” says Karger. But that device comes at a cost.

On the other side, manufacturers need to adapt technology more quickly, reducing cost and size in a more efficient manner.

The technology also faces a challenge in proving itself. Take, for example, Karger says, the DaVinci system—a multi-task surgical robot that, despite struggling for a while, was found to work for prostatectomies. However, it’s now largely accepted that the machine fails to eliminate any work on the part of the surgeon, requires a second surgeon in case of emergency, and has clinically marginal benefits. However, what the DaVinci system did was showcase the potential for an all-in-one technology. The problem occurs when systems are too specialized and cannot be adapted or used for various situations.

The multi-use aspect is key to any successful surgical tool.

“By having a range of task specific tools—one to suture, one to dissect—it is possible to integrate the best of both worlds: a device that is specialized enough to be usable by less specialized surgeons, yet a system that is flexible enough to be able to support a wide range of procedures,” Karger says.

The future of surgical robotics lies in combination devices. Karger envisions a world where a surgeon has a “down scope” spectroscopy or florescence system so she can identify cancerous cells in real time and not be forced to wait for tests.

With time and technological improvements, surgical robotics technology will evolve to a point where it can be trusted, but it will most likely always require the skilled human hands of a specialized surgeon.

Kasey Panetta is an associate editor with ECN and writes on a variety of subjects.