

THE ROBOTS OF MEDICINE: DO THE BENEFITS OUTWEIGHT THE COSTS?

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In theory, surgical robots should assist clunky humans with tasks that we have trouble with, but we're still outperforming them in many ways.

The image is an entertaining one: A robot-doctor rolls into a surgical suite in scrubs and gloves and asks its human assistants, "So, what are we doing to this guy today?" Unfortunately, the operating room is not quite there yet. In reality, the use of robotics in surgery is still quite subtle in most areas of medicine, and the robots themselves are more like high-tech instruments than they are robo-surgeons. Robotics has gained some momentum in recent years, but there are still a lot of unanswered questions about its efficacy when pitted against conventional surgery. Certain procedures, like prostate removal, routinely use robotics, but even for these, the jury is still out on whether the benefits outweigh the costs – both medical and financial.

In theory, the great benefit of surgical robotics is that it can assist us big, clunky humans with tasks that we have trouble with, or are simply incapable of. For example, there are certain procedures, like suturing the urethra during prostate cancer surgery, that even the most technically skilled doctors have trouble with, so tiny is the prostatic urethra, and so delicate the required suturing action.

A related benefit is that robotic extensions can be extremely tiny, so they can go where human hands simply won't fit: Some incisions through which robotic "arms" can operate are as small as eight millimeters, according to Dr. Michael Argenziano, who directs the Minimally Invasive and Robotic Cardiac Surgery department at New York-Presbyterian Hospital/Columbia University Medical Center. This can reduce the risk of complications and a patient's recovery time.

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Despite the theoretical benefits, some commonly used forms of robotics are generating discussion about their practical benefits. One new study suggested that men who have their prostates removed have no better sexual function or less incontinence with robot-assisted surgery vs. the conventional kind. (In case you're wondering, almost 90 percent of the men reported "moderate or big" problems with sexual function 14 months after surgery, and almost one-third had problems with incontinence after this same period.) Earlier research has found that there are no differences in how well the two procedures actually treat cancer, although robotics may be linked to shorter hospital stay, and less blood loss and transfusion.

Given the mixed evidence, the use of robotics in prostatectomy, which is touted so heavily by some hospitals and robotics manufacturers, may not be the great boon we might be led to believe. But it's also important to remember that both forms of surgery had high rates of adverse effects. Other research has found that skill of the surgeon and the number of prostatectomies done at one's hospital may have more to do with the success of the surgery than anything else.

Another new study found that in hysterectomy, a common treatment for endometrial cancer, the rates of complications in women who had laparoscopic (minimally invasive surgery) surgery vs. robotic surgery were virtually identical after controlling for factors like insurance plans, hospital location, and race. The cost associated with robotics, however, was over \$1,200 more than conventional surgery.

Critics point out (PDF) that the study compared robotics to laparoscopy, which, although now recommended, is still not the norm because of its complexity and use in only the most straightforward scenarios. Using laparotomy as a comparison instead might have led to different results, and possibly more cost effectiveness. In any case, critic Mario M. Leitao Jr. urges us to accept some early costs when putting promising new technologies in place. "How will we ever advance innovative technology in surgery," he asks, "if we cannot understand and accept the associated start-up costs?"

Despite the questions surrounding these conventional robot-assisted surgeries, there are some interesting new developments in the field. One of these is the tiny "crab," which accesses

the innermost hollows of the body -- the gastrointestinal tract -- without having to go through the many layers of tissue between it and the outside world. Using the ergonomic living crab as a model, Lawrence Ho and his team at Singapore's National University Hospital endowed the robotic crab with hook and pincers to remove cancerous tissue, and the ability to cauterize blood vessels.

Attached to the end of an endoscope, the crab goes in through the mouth, the most intuitive avenue for entry, says Ho. The robo-crab could make it much easier to treat gastric cancers, which represent the second-most common cause of cancer deaths across the globe. Because of its recent development, large-scale studies to assess its efficacy compared to other forms of treatment haven't yet been done.

The verdict on the use of robotics is that there is none, which is commonly the answer in many areas of research and medicine. It's important not to hype robotics, but acknowledge their promise for certain types of procedures. "Robotics is a tool, albeit the most technologically advanced and expensive one, but a tool nonetheless," says Dr. Bernard Park, the chief of thoracic surgery at Hackensack University Medical Center. "No technology will ever replace the critical importance of a skilled, thoughtful surgeon."