Applications and Advances in Robotic-Assisted Oncological Surgery: Ready to Dock the ‘Bot

“I have been impressed with the urgency of doing. Knowing is not enough; we must apply. Being willing is not enough; we must do.”

Leonardo da Vinci

In the field of surgical oncology, the robotic surgical system is a tool that allows the surgeon to perform laparoscopic or thoracoscopic procedures by enhancing the skills of the surgeon. Thus, the robotic system provides the surgeon with magnified, 3-dimensional (3D) visualization and wristed instruments that the surgeon can remotely control. Compared with 2D visualization in conventional laparoscopic and thoracoscopic surgery, this 3D visualization heightens the depth perception of the surgeon. In addition, the wristed instrumentation enables the surgeon to precisely dissect structures — in particular, vascular structures and other deep and confined spaces, such as those of the pelvis, retroperitoneum, and mediastinum — compared with the “chopstick”-like instruments of conventional laparoscopic and thoracoscopic surgical procedures. The robotic surgical system’s computer also scales down the large radius of movements and eliminates tremors from the surgeon’s hands. In addition, during robotic-assisted surgery, the surgeon is sitting rather than standing and controls the movements of the robotic arm with his or her hands, with the fingers and wrists adding a very important ergonomic advantage that reduces surgeon fatigue.

Surgical specialties continue to evolve with new and improved techniques and the application of novel technologies, as has been true of surgical techniques improved upon by applying robotics in the surgical oncology specialties. “Robotic surgery” is a misnomer. Procedures assisted by robotic technology are the same as traditional laparoscopic (or thoracoscopic) surgery or minimally invasive operations in that they are still performed by a surgeon who is operating a robot. Thus, the appropriate term is robotic-assisted laparoscopic (or thoracoscopic) surgery.

Although robotic-assisted surgery is now widely available in the United States,1,2 use of the robotic surgical system was then extended to other types of surgical oncology in the fields of gynecological surgery, thoracic surgery, and general surgical oncology.3-5 More recently, techniques in transoral robotic-assisted surgery and robotic-assisted neurosurgery are being developed.5 In this issue of Cancer Control, several authors report on both well-established and developing applications of robotics in surgical oncology.

The first article is authored by Dr Agarwal and colleagues, who review the technique and outcomes of robotic-assisted prostatectomy. Twenty years after the first robotic-assisted prostatectomy was performed, techniques continue to improve, leading to better oncological control and patient quality of life.

Dr Emtage and others review techniques for robotic-assisted oncological kidney surgery. They report that morbidity and patient satisfaction rates are potentially improved with robotic-assisted renal surgery compared with traditional open and conventional laparoscopic renal surgery without compromising oncological control, particularly for nephron-sparing partial nephrectomies.

Dr Luchey and coauthors discuss the evolving techniques and early outcomes with robotic-assisted cystectomy. Although the procedure is not widely performed, increasing numbers of centers around the world are applying robotic-assisted surgery for the management of bladder cancer.

Drs Bush and Apte review techniques and outcomes with robotic-assisted oncological kidney surgery. They report that robotic-assisted surgery has resulted in the increased use of minimally invasive surgical procedures for endometrial cancer and in decreased complication rates in patients who are obese.

Dr Velez-Cubian and colleagues review the benefits of adding a robotic surgical system to videothoracoscopic pulmonary resections. They report that robotic-assisted videothoracoscopic pulmonary lobectomy is as safe as conventional videothoracoscopic lobectomy, and that the robotic-assisted procedure resulted in decreased perioperative complications and shorter lengths of hospital stay than traditional open lobectomy. Mediastinal lymph node dissection and the early detection of occult mediastinal lymph node metastatic disease were also improved when using robotic-assisted videothoracoscopic approaches compared with conventional approaches to videothoracoscopy or...
open thoracotomy.

Dr Straughan and others review the use of robotic-assisted videothoracoscopic surgery for mediastinal resections. They report that robotic-assisted thoracoscopic mediastinal surgery may be superior to open mediastinal approaches and has comparable patient outcomes to conventional videothoracoscopy.

Dr Burton and colleagues review the development, use, and outcomes of robotic assistance for head and neck surgery. They focus on the functional and oncological outcomes associated with the most common application of transoral robotic-assisted surgery.

In a second article, Dr Straughan and coauthors review how the advent of robotic surgical systems has revolutionized the adoption of minimally invasive approaches for managing esophageal disease. They report that robotic-assisted esophageal surgery is safe and effective for treating esophageal disorders, including gastroesophageal reflux disease, achalasia, leiomyomas, and cancer, with benefits over traditional open and conventional minimally invasive approaches.

Dr Rashid and others review the use of robotic-assisted resection of periampullary malignancies (Whipple procedure). They report that robotic-assisted techniques for managing malignant lesions of the pancreas head are safe when well-established guidelines are followed for surgical resection and that preliminary data demonstrate improved periampullary convalescence compared with the open technique.

Dr Doulgeris and colleagues review the evolution, current challenges, and compromises related to the use of robotics in neurosurgery. They explain that the majority of robotic neurosurgical systems assist in stereotactic procedures and that progress in robotic-assisted microsurgery, minimally invasive, and endoscopic neurosurgeries are challenging and hindered by the need to miniaturize current tools. In addition, they elucidate that maximizing control of those tools must be achieved so as to overcome loss of haptic feedback, proprioception, and visualization.

“Ready to dock the ‘bot” is not simply the announcement given to the operating room staff of the surgeon’s readiness to dock the robotic cart to the previously placed 3 or 4 ports. This declaration symbolizes the point when the surgeon has become proficient to perform robotic-assisted surgery. More importantly, it should symbolize the point when an institution has established a robust robotic surgical program, especially when multiple surgical specialties are involved.

Although controversy still exists in several surgical procedures regarding whether robotic-assisted surgery is superior to conventional laparoscopic (or thoracoscopic) or traditional open approaches, robotic-assisted surgery is here to stay, and the technology will continue to improve. Newer generations of robots will allow haptic perception, will have increased portability, and they will become more affordable.

We hope you enjoy and benefit from reading this issue of Cancer Control.

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