Use of Robotics in Oncology Surgery

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Robotic surgery is an exciting technology that allows the surgeon to sit at a computer console near the operating table, using mechanical arms with surgical instruments attached to them. This type of surgery is minimally invasive, and the procedure is performed through tiny incisions. This technology is widely used in the United States and is expected to evolve over time with an increase in the number and types of procedures.

At a Glance

- Robotic surgery will increasingly play a role in oncology surgery.
- Benefits include decreases in blood loss and postoperative pain.
- Barriers include the cost and maintenance of the systems.

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Robotic surgery is a surgical procedure that adds a computer technology–enhanced device to the interaction between a surgeon and a patient during a surgical operation. This technology assumes a degree of control previously only reserved for the surgeon (Herron & Marohn, 2008). The surgeon sits at a console, typically in the operating room, directing and controlling the movements of one or more robotic arms. This technology has taken off in the United States during the past few years. Da Vinci® Surgical System, the leading robotic technology manufactured by Intuitive Surgical, Inc. (2014), has become the first robotic surgical platform commercially available in the United States to be cleared by the U.S. Food and Drug Administration. Use of robotic surgery has seen rapid growth. From 2007–2010, the number of robotic surgeries worldwide has almost tripled, and da Vinci robots have been installed in 1,400 hospitals in the United States, an increase of 75% (Barbash & Glied, 2010).

Potential Benefits

Minimally invasive surgery began in 1987 with laparoscopic cholecystectomy (Polychronidis, Laftsidis, Bounovas, & Simopoulos, 2008). The advantages of laparoscopic surgery over conventional surgery are smaller incisions, less blood loss, less postoperative pain, and shorter hospital stays. The weaknesses of this approach include the loss of natural hand–eye coordination and dexterity, making delicate dissections and anastomoses more difficult (Lanfranco, Castellanos, Desai, & Meyers, 2004). Robotic surgery was developed with the hope of overcoming these laparoscopic obstacles. One of the advantages of robot-assisted laparoscopy over conventional laparoscopy is the provision of three-dimensional images of the operative field instead of two-dimensional images. The robot also stabilizes the instruments, minimizing surgeon tremor and improving ergonomics for the operating surgeon. The surgeon can be in a seated position rather than standing, decreasing surgeon fatigue (Herron & Marohn, 2008; Oppenheimer, Weghorst, MacFarlane, & Sinanan, 1999). Conventional and robotic laparoscopy may have advantages over the open surgical laparotomies, including potentially shorter hospital stays, decreased blood loss, faster postoperative recovery, and improved aesthetics of incision areas because of the smaller incisions (Reza, Maeso, Blasco, & Andradas, 2010). Robotic surgeries are now performed in oncologic (Hayn et al., 2010), nononcologic (Mufarrij, Shah, Berger, & Stifelman, 2007), pediatric (Peters, 2004), and urologic procedures (Ghani et al., 2013).

Barriers

Robotic surgical systems have high fixed costs, with prices ranging from $1 million to $2.5 million for each unit, as well as significant annual maintenance costs of about $100,000–$150,000 per unit (Intuitive Surgical, Inc., 2014). On average, the additional expense associated with robotic-assisted approaches is $1,600 per procedure, as compared to open surgery. If robotic technology replaces traditional surgery, it could mean about a $2.5 billion increase in healthcare costs. In addition, surgeons must perform 150–250 procedures to become adept in using the system (Barbash & Glied, 2010).

One example of a surgery that has a rapidly rising number of procedures performed by a robot is robot-assisted