

Robot-Assisted Laparoscopic Surgery Using the da Vinci System

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Robot assisted laparoscopic surgery is the beginning of a new form of minimally invasive procedures. It allows the surgeon to perform complex surgeries with more accuracy and freedom than ever before. Compared to the standard laparoscopy, this new technology requires a reduced operating time is safer, and is an easier process for the surgeon. The interest in this new form of surgery is worldwide.

To begin, laparoscopy is defined as an operation performed in the pelvis or abdomen through tiny incisions that usually range between 0.5 to 1.5 centimeters. It may be for the purpose of making a diagnosis or to perform a surgery. A small camera known as a laparoscope is used during the procedure, allowing the doctor to execute both minor and complex surgeries with only a few minimal incisions. Some benefits to this type of surgery are that patients experience less pain because of the smaller incisions, have a lesser chance of hemorrhaging, as well as a shorter recovery time.

The standard laparoscopy uses one of two types of laparoscopes: a telescopic rod lens system typically attached to a video camera, or a digital laparoscope. In this case the charge-coupled mechanism is put at the end of the laparoscope, which eliminates the need for the rod lens system. A fiber optic cable system is connected to a light source, so the operative area can be illuminated. This is then inserted through a tiny tube known as a cannula, to view the area being operated on. The abdomen is then insufflated with carbon dioxide (not harmful to the body) to raise the abdominal wall above the organs, making it an easier area to see and maneuver.

The da Vinci System makes this process even easier for the surgeon. This new technique increases the surgeon's capabilities, allowing better visualization and precision of the area in comparison to the typical laparoscopic procedure. These operations are performed without any direct contact between the surgeon and the patient. The doctor is seated a few feet away from the operating table where they sit at a computer console viewing a 3D visual of the operative area. They utilize two masters (similar to a joystick) that each controls a mechanical arm of the robot.

These arms are equipped with specialized tools that make very slight, precise movements that perform the surgery through the few small incisions in the abdomen. Through these incisions the video camera and the robotic arms eliminate any hand tremor from the surgeon and provide high magnification and greater depth perception of the area being operated on. The arms of the robots also have a wider range of motion than a human hand, rotating in six different planes, making it even more capable than a surgeon.

The da Vinci System has been proven to have some problems however. Besides the high cost of around one million dollars for this equipment and the high learning curve for surgeons, there has been evidence of system failure. A study was performed to see how doctors deal with malfunctions during a robot-assisted radical prostatectomy. 100 of the 176 responding surgeons have experienced and irrecoverable intraoperative malfunction and eighty experienced mechanical failure before the start of the surgery which had to be rescheduled. Although these experiences are uncommon, it shows that no matter if a human or a robot is performing surgery, there is always a risk for complications. However, the da Vinci System is providing a safer and quicker surgery than ever before.

Sources:

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