Robot-Assisted Laparoscopic Surgery Using da Vinci System

Elcin Huseyn

Research Laboratory of Intelligent Control and Decision Making Systems in Industry and Economics, Azerbaijan State Oil and Industry University, 20 Azadlig Ave., Baku AZ1010, Azerbaijan, elcin.huseyn@asoiu.edu.az
Robot-Assisted Laparoscopic Surgery

- New form of minimally invasive surgery
- Allows surgeon to perform complex surgeries with greater accuracy and freedom than previous methods
- Compared to standard laparoscopic surgery, new technology offers reduced operating time, is safer, and is a less strenuous process for surgeon
What is laparoscopic surgery?

- Operation performed in pelvis or abdomen through small incisions
- Done for diagnostic purpose or to perform a surgery
- Small camera called laparoscope is used
- Benefits- patients experience less pain, smaller chance of hemorrhaging, and shorter recovery time
Tools for Standard Laparoscopic Surgery

2 types of laparoscopes:
1) Telescopic rod lens system
   - attached to a video camera
2) Digital laparoscope
   - fiber optic cable system is connected to a light source
   - so operative area can be illuminated
   - then inserted through tiny tube (cannula) to see the operation
   - abdomen is then insufflated with carbon dioxide (not harmful to body) to raise abdominal wall above organs
da Vinci System

- Makes laparoscopic surgery even easier for surgeons and less staff is required for the procedure
- Surgery is performed without any direct contact between surgeon and patient
- Doctor sits a few feet away from operating table at a computer console viewing 3D visual of operative region
Components of da Vinci System

- Doctor uses 2 masters that each control a mechanical arm of the robot
- One of the three arms is an endoscope arm
- Provides over a thousand frames per second of the instrument position to get rid of possible background noise
- Endoscope is also programmed to regulate the temperature of the tip to prevent any fogging during the procedure
- Surgeon can switch to different views easily by the touch of a foot pedal
Components (cont...)  

- Other two arms are equipped with specialized tools called EndoWrist detachable instruments.
- Through the incisions, the video camera and robotic arms eliminate hand tremors from the surgeon.
- Robot arms also have wider range of motion than the human hand - rotating in 7 different planes and can rotate around completely.
EndoWrist Instruments

- Each instrument has its own function and can easily be switched using the quick-release lever on each arm.
- The device memorizes the position of the arm before being replaced so the next instrument can be set to the same position.
- Surgeon can also choose how much force to be applied- can go from an ounce to several pounds.
Pros and Cons of da Vinci System

Pros
- Hospital stay is cut in half- cutting cost by around 33%
- Does not leave a large surgical scar
- More high risk patients can undergo surgery because it’s less invasive
- Less staff required for surgery
- FDA approved for use in U.S.

Cons
- Cost of equipment-$1 million
- Steep learning curve for surgeons
- Doctors training on device felt hindered by lack of ability to feel the tissue they’re working on
- Surgery with this system takes 40-50 minutes longer than standard procedure
Survey of Malfunction Experience

- An international survey was performed and published in the Journal of Endourology
- Doctors were asked how they dealt with malfunctions of the da Vinci System
- Of the 176 that responded, 100 said they have experienced irrecoverable intraoperative malfunctions
- 80 experienced mechanical malfunction prior to surgery, which of those surgeries, 46 had to be rescheduled
- There are dangers with any type of surgery, whether done by human or machine, but the new technology of the da Vinci System is providing a much safer and quicker alternative to the standard laparoscopy
References


