ROBOTICS—IN YOUR FUTURE?

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Objectives:
Define Robotics
Discuss the Use of Robotics in Surgery
Describe Cleaning Processes for Robotics

When I was growing up, we watched movies that had robots in them. Mostly they were of the science fiction variety. Everyone I knew really thought this was impossible, just a figment of someone's imagination. The term "robot" was first coined by a Czech playwright, Karel Capek. Capek had written a play called *"Rossom's Universal Robots*" in 1921 and had taken the word from the Czech word "robota" which translates into forced labor in English. Originally robots were developed as dumb machines that were only used to perform menial, repetitive tasks. Now they are used to perform highly specific, precise and dangerous tasks in industry and research that had previously not been possible with people. They are used as bomb robots, in the manufacturing of microprocessors for computers and even exploring under the oceans.

As machines became more complex, inventors and scientists starting looking at ways to develop robots to do more. There was a vision to have a robot to extend the capabilities of human surgeons beyond the original dream of conventional laparoscopic surgeries. In 1985, the first robotic system called the Puma 560 was used by Kwoh to do neurosurgical biopsies more precisely. Three years after that, Davies used the Puma 560 to do the first transurethral resection of the prostate. Using the information obtained from the use of the Puma 560, the PROBOT was developed. This was designed specifically designed to be used only with transurethral resection of the prostate (TURPs). The first surgical robot was the ROBODOC, designed and marketed by Integrated Surgical Supplies out of Sacramento, California. This robot was designed to ream out the femur with greater precision in hip replacement surgeries. It is also considered to be the first surgical robot that was approved by the FDA.

As it became more known in the surgical community about the use of robots, NASA's Ames Research Center wanted to learn more about this new procedure. The researchers there were already working on virtual reality and wanted to take this additional information to see if they couldn't develop telepresence (being able to see and in the presence of) surgery. The concept of telesurgery became the force that brought together researchers and scientists and surgeons in order to develop surgical robots. In the early 1990s, the Stanford Research Institute began working with the NASA-Ames team of robotocists (study & develop robots) and virtual reality experts developed a telemanipulator for hand surgery. A telemanipulator is a device for transmitting hand and finger movements to a remote robotic device, allowing the manipulation of objects that are too heavy, dangerous, small, or otherwise difficult to handle directly.

The U S Army also became interested about the same time. Their thoughts were robots could be used to decrease wartime mortality by bringing the surgeon directly to the soldier. The Army had already been using a program called MASH (Mobile Advanced Surgical Hospital) Units and thought at some point the soldier could be loaded onto a van set up for surgery and the surgeon could operate from home base. However, at this point in time, the Army has not tested nor has it been approved for military use.

The surgeon is situated at this console several feet away from the patient operating table. The surgeon has his head tilted forward and his hands inside the system's master interface. The surgeon sits viewing a magnified three- dimensional image of the surgical field with a real-time progression of the instruments as he operates. The instrument controls enable the surgeon to move within a one cubic foot area of workspace. The detachable instruments allow the robotic arms to maneuver in ways that mimic fine human movements.

1. T, 2. F, 3. T, 4. T, 5. T, 6. F, 7. T, 8. T, 9. F, 10. T

Each instrument has its own function from suturing to clamping, and is switched from one to the other using quick-release levers on each robotic arm. The device memorizes the position of the robotic arm before the instrument is replaced so that the second one can be reset to the exact same position as the first. The instruments' abilities to rotate in full circles provide an advantage over non-robotic arms. The seven degrees of freedom (meaning the number of independent movements the robot can perform) offers considerable choice in rotation and pivoting. Moreover, the surgeon is also able to control the amount of force applied, which varies from a fraction of an ounce to several pounds. The technology also has the ability to filter out hand tremors and scale movements. As a result, the surgeon's large hand movements can be translated into smaller ones by the robotic device. Carbon dioxide is usually pumped into the body cavity to make more room for the robotic arms to maneuver just as for any routine laparoscopic procedure.

Robotic surgery may be used for a number of different procedures, including:

- Coronary artery bypass
- Cutting away cancer tissue from sensitive parts of the body such as blood vessels, nerves, or important body organs
- Gallbladder removal
- Hip replacement
- Hysterectomy
- Kidney removal
- Kidney transplant
- Mitral valve repair
- Pyeloplasty (surgery to correct ureteropelvic junction obstruction)
- Pyloroplasty
- Radical prostatectomy
- Tubal ligation

Robotic surgery cannot be used for some complex procedures. For example, it is not appropriate for certain types of heart surgery that require greater ability to move instruments in the patient's chest.

Penelope, the first surgical robot able to hand instruments and assist at surgery is transfer ring to another department — central sterile reprocessing — and her name will be Penelope CS. Penelope, named for Ulysses' wife in the mythic Odyssey by Homer, was invented by Michael R. Treat, MD, associate professor of clinical surgery in the College of Physicians and Surgeons of Columbia University in New York City. Penelope's software brain allowed her to focus on surgical instruments, count them, know where they were, and hand them to the surgeon. Penelope also could unpack instruments, arrange them, pick up an instrument, and put it back. Thus, it wasn't much of a stretch to move Penelope into CS and use her to clean, sort, inspect, and count instruments and repack them to go back to the OR.

Because of the complexity of the instrumentation, there is an intense involvement of the CS Tech. In order to have adequately trained staff, the CS department needs to be involved from the beginning of the process to purchase a robotic unit. This is to ensure the staff is involved in the training process from the beginning. The CS department needs to know specifically the disassembly & cleaning, disinfecting, assembly and sterilization instructions so the staff can be comfortable with the processing of the robotic equipment.

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The involvement starts when a case is posted. It would be really beneficial if all parties involved could watch a procedure being done so they could see how the instruments go together and are used. This helps staff understand the intricacies of the equipment. Each manufacturer will be able to provide cleaning and sterilizing instructions and

One thing that is important to discuss prior to scheduling cases is the amount of time necessary to completely process the instrumentation.

Surgeons need to be involved in these discussions so they are aware of the limitations of scheduling two cases back to back. Robotic surgery is an up and coming process and at sometime in the near future we will all be involved in the processing of this new and somewhat futuristic concept. Ask questions and become involved so you know all there is to know.

References:
"Robotic Surgery-A Current Perspective" Annals of Surgery—January 2004
Web site: www.allaboutroboticsurgery.com

CS Questions & Answers Taken From Healthcare Purchasing News, July 2013 Issue
Written by Ray Taurasi

We only have one ultra-sonic washer in our decon area. A new nurse in our ophthalmic surgery clinic recently toured SPS and was concerned we are processing eye instruments through the same ultra-sonic washer we use for other surgical instruments. She said this was not an acceptable practice and that there should be separate washers exclusively for eye instruments. She also stated we should not be using enzymatic detergents on eye instruments. … Is it required to have two washers, with one just for eye instruments? Can enzyme detergents be used?

ANSWER: First and foremost, it is imperative that the IFUs of the eye instrument manufacturer, detergent manufacturer and the ultrasonic equipment manufacturer be followed. Eye instruments should not be processed with other surgical instruments. There is great concern relative to the proper and careful processing of ophthalmic instrumentation due to the high risk of TASS (toxic anterior segment syndrome) which could result from improper processing techniques and protocols. The ideal situation would be to have an exclusive ultrasonic washer for eye instruments, but if this is not the case, the ultrasonic should be drained, thoroughly cleaned, rinsed and wiped with alcohol prior to processing each load of eye instruments. You might find that some ophthalmic instrument manufacturer will recommend a manual cleaning process and a specific cleaning agent. I am not aware of any universal recommendation against the use of enzymatic cleaning agents on eye instruments but here again, you must follow the IFUs of the specific manufacturer.

Robots—In Your Future
Post test 2nd quarter

1. Robots were developed as dumb machines used only to perform menial tasks.
   TRUE FALSE

2. PROBOT was designed to be used with sigmoid surgeries.
   TRUE FALSE

3. The 1st surgical robot approved by the FDA was the ROBODOC.
   TRUE FALSE

4. A telemanipulator is a device for transmitting hand and finger movements to a remote robotic device allowing manipulation of objects that are too small, heavy or to difficult to handle directly.
   TRUE FALSE

5. The U S Army became involved when they decided robots could be used for field surgery.
   TRUE FALSE

6. Surgeons operate from a console at the head of the table.
   TRUE FALSE

7. The computer memorizes the position of the arm so when instruments are changed, the position for the second is exactly the same as the first.
   TRUE FALSE

8. The console computer can translate the surgeon's hand movements to much smaller and more delicate movements.
   TRUE FALSE

9. Robotic surgery is appropriate for all types of surgery.
   TRUE FALSE

10. Penelope CS is a robot that can be used in Central Sterile to assist with tray building among other jobs.
    TRUE FALSE

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