LAPAROSCOPIC AND ROBOTIC SURGICAL INSTRUMENTS

LEARNING OBJECTIVES
1. Discuss the similarities of and differences between laparoscopic and robotic instrumentation
2. Review the importance of following manufacturer instructions for cleaning, testing, and sterilizing laparoscopic and robotic instrumentation
3. Discuss the critical need for thorough inspection and testing of instrument insulation coatings
4. Explain how Central Service professionals impact patient and surgical team member safety during laparoscopic and robotic surgeries

LAPAROSCOPIC AND ROBOTIC INSTRUMENTATION IS COMMONLY used in gynecological, thoracic/cardiac, general, and urological surgeries in the United States. Patients are increasingly educated about these alternatives and are requesting use of these procedures because of their advantages, including more precision, less pain, and faster healing time. This lesson explores how this technology impacts the work of Central Service (CS) professionals and is important because the instrumentation has evolved through several “generations.” While each has its own advantages and disadvantages, newer versions have more complex designs and functions, and greater care and attention to detail is needed to effectively reprocess these instruments.

OBJECTIVE 1: DISCUSS THE SIMILARITIES OF AND DIFFERENCES BETWEEN LAPAROSCOPIC AND ROBOTIC INSTRUMENTATION
Laparoscopic and robotic instruments are surgical devices that are inserted via ports placed by the surgeon through the patient's abdominal wall or chest. The ports are tubular sleeves that, after insertion, hold the small incisions open.

Both laparoscopic and robotic instruments use several styles of grasping, dissecting, cutting, probing, and electrocautery devices, with a variety of operating tips that are inserted and removed through the ports as needed during the surgical procedure. Note: electrocautery is used to burn and seal blood vessels and to burn and cut through tissue. All laparoscopic and robotic instruments must be properly insulated to prevent unintentional burns to other patient tissue or to members of the surgical team.

During a laparoscopic procedure, the surgeon stands at the operating table where he or she can manipulate the instruments. Visualization is limited to a two-dimensional view on monitor screens of a three-dimensional work space in the patient's abdomen or chest. Laparoscopic instruments are limited in their movements and depend on the surgeons' and assistants' hands for mobility and function. The laparoscopic operating tips are manipulated by the hand grip at the instrument's opposite end. Electric current only flows through the instrument when the surgeon activates the electrocautery control.

In contrast, robotic instruments are like laparoscopic instruments on steroids. The major difference between them and their laparoscopic counterparts relates to where instrument control originates. After the ports are placed in the patient, the surgeon leaves the sterile field of the operating table and takes position at the robotic console. The surgeon directs the assistant to insert each robotic instrument into specific ports as needed to perform the procedure. The instruments are then connected to up to five robotic arms that function under the surgeon's direct control.

The surgeon using robotic instruments has almost unlimited freedom of
movement of the instruments’ operating tips and a three-dimensional view of the operative area inside the patient. This enables him or her to much more accurately manipulate the required instruments and tissue during the procedure than is possible with laparoscopic instruments. Once the procedure is completed, the instruments are removed from the ports (taken out of the body cavity) and disconnected from the robotic arms. The surgeon then returns to the sterile field to close the incisions needed to place the ports.

Robotic instruments are very complex electronic instruments that depend on electronic connections, couplers and electric signals from the console to manipulate the operating tips. As a result, these instruments are very delicate and can be easily damaged by mishandling. Electricity is always flowing though the instrument when connected to the robotic arm; however, electocautery uses a much higher level power of electricity which flows though the instruments only when activated by the surgeon at the robotic console.

OBJECTIVE 2: REVIEW THE IMPORTANCE OF FOLLOWING MANUFACTURER INSTRUCTIONS FOR CLEANING, TESTING, AND STERILIZING LAPAROSCOPIC AND ROBOTIC INSTRUMENTATION

The US Food and Drug Administration requires surgical instrument manufacturers to provide detailed instructions for cleaning, disinfection and sterilization of their devices. Less experienced technicians may assume that all generations of laparoscopic and robotic instruments made by the same manufacturer should be reprocessed in the same manner. However, this is not true. Note: similar instruments manufactured by different companies can also add to confusion.

The importance of strictly adhering to the applicable manufacturer’s Instructions for Use (IFU) cannot be overstated. For example, soaking an instrument in an enzymatic solution with the incorrect pH can destroy it; therefore, adhering to the IFU is a major step in helping to ensure that the full life of the instruments can be achieved. Doing so is the first line of defense to prevent an instrument malfunction that can injure a patient or surgical team member.

Laparoscopic and robotic instrumentation also represents a million dollar investment for even the smallest facility and grows exponentially with facility size and the types and numbers of surgical procedures that are performed at a facility. Money spent providing adequate education regarding appropriate reprocessing techniques is like insurance, and these expenditures help to ensure a successful laparoscopic/robotic program for your facility.

OBJECTIVE 3: DISCUSS THE CRITICAL NEED FOR THOROUGH INSPECTION AND TESTING OF INSTRUMENT INSULATION COATINGS

Insulation coating is the primary safety device to prevent unintentional burns from laparoscopic and robotic instrumentation; therefore, the need for a careful and thorough inspection process is critical. Multiple studies have reported
that insulation failures (IF) were detected without visual indicators of failure in 57% of the instruments that were evaluated. One study found IF in 3% of disposable instruments fresh out of the package.1,2

These findings are alarming because visual inspection with lighted magnification can eliminate the need to further test almost 50% of the remaining instruments.2 Visual indicators of IF include missing portions of insulation, cracks or holes in the insulation, and slippage of the insulation. Certified Instrument Specialist (CIS) technicians who inspect the insulation should confirm that the insulation does not slide back and forth or up and down the shaft of the instrument. Further testing should follow on all instruments without visual IF.

The testing process increases the time required to inspect all laparoscopic and robotic instruments so identifying the easy (visual) IF save time. A properly trained team and adequately prepared inspection station will enable thorough testing in the minimal amount of time.

When IF are determined, the instrument should be tagged and immediately removed from service.

Choosing the insulation test device is a decision best made with input from professionals in CS, Surgical Services, and Engineering. Currently there are testing devices available that are designed only for use in CS and other models that can be used in CS and from the sterile field in the operating room (OR). After a testing system is selected, CS team members should be trained to always follow prescribed safety procedures provided by the manufacturer. Depending on the manufacturer, safety procedures may require that processing personnel remove all jewelry and wear rubber or vinyl gloves. Other tactics involve using caution to avoid making inadvertent contact with the electrical circuit and ensuring that the surrounding area is free of excess moisture and flammable materials such as CS wrap material. Some instrument models caution that persons with an implanted pacemaker or other electrical device should not operate the testing equipment.

**OBJECTIVE 4: EXPLAIN HOW CENTRAL SERVICE PROFESSIONALS IMPACT PATIENT AND SURGICAL TEAM MEMBER SAFETY DURING LAPAROSCOPIC AND ROBOTIC SURGERIES**

CIS technicians share a great responsibility for providing OR personnel with laparoscopic and robotic instrumentation that is properly cleaned, thoroughly inspected, and effectively sterilized. Consistent adherence to the manufacturer’s instructions when performing each of these activities on each instrument helps ensure a safe surgical procedure for the patient and the surgical team. Studies have indicated that 5% of laparoscopic and robotic procedures result in an unintentional burn. Of the patients who experience such a burn, each will require further surgical intervention with 25% resulting in patient death. The responsibility of CS staff members is very significant.
Protecting patients and surgical team members from unintentional burns during laparoscopic or robotic surgery requires a total team effort. Inspection of each instrument is necessary to assure safety. Using IF testing equipment is the best way to prevent burns. The device manufacturers recommend repair or replacement of any instrument that demonstrates an IF.

The Association of periOperative Registered Nurses (AORN) includes the use of IF test equipment in their recommended practices for using electrosurgery devices. Understanding that an unintentional burn to the patient’s intestines or other internal organs may not be witnessed by any member of the operating team is the key.

Burns are not a result of inattention to the procedure. Instead, the visual area is limited by the scope’s distance from the operative site: the closer the scope’s tip is to the operative site, the less visual field is available for viewing. This effect is just like that of a camera with a zoom lens. Zoom in and one sees a wide picture. Zoom out and one sees the picture’s object becomes larger, but less surrounding area is visible.

The length of laparoscopic and robotic instruments ranges from 23cm to 45cm in length, and the devices are round. Every millimeter of their length must be inspected every time the instruments are reprocessed. Remember that the surgical personnel only visualize, at most, the distal third of the instrument during a procedure, and burns almost always occur outside their direct vision. The patient and the team members depend on the thorough inspection of the instruments for IF to prevent unintentional burns and the life-threatening complications that ensue.

IN CONCLUSION
Laparoscopic and robotic instrumentation is challenging for CS professionals to manage. Ongoing technological advances require effort from the CS team to remain current in reprocessing knowledge. They must also be proficient in the reprocessing procedures necessary to ensure that instruments are cleaned properly, are sterile, and are functioning as designed. Patients entrust their lives to their surgical healthcare teams.

CS professionals are vital partners on this team as they help to deliver the safest and most advanced care that is possible.

REFERENCES

ADDITIONAL READINGS

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IAHCSMM is seeking volunteers to write or contribute information for our CIS Self-Study Lessons. Doing so is a great way to contribute to your own professional development, to your Association, and to your Central Service department peers.

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