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Lesson No. CIS 265 (Instrument Continuing Education - ICE)

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Safe Reprocessing of Robotic Instruments

LEARNING OBJECTIVES

1. Discuss the importance of point-of-use cleaning of robotic instruments
2. Review the fundamentals of the decontamination of robotic instruments
3. Discuss the specialized procedures involved in the inspection of robotic instrumentation

Instrument Continuing Education (ICE) lessons provide members with ongoing education in the complex and ever-changing area of surgical instrument care and handling. These lessons are designed for CIS technicians, but can be of value to any CRCST technician who works with surgical instrumentation.

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ROBOTIC-ASSISTED SURGERY REPRESENTS THE USE OF TECHNOLOGY to enhance the skills of a surgeon and create a patient experience that involves minimal stress and optimal recovery time. Because the mechanics of a surgeon's hands are translated through a robot's processing unit, the movements become more precise than what the hand could produce on its own. Robotic systems have the ability to scale the movements of the surgeon's fingers by a ratio of 3:1 (e.g., 3mm of movement from the practitioner becomes 1mm of movement by the robot instrument at the surgical site). Scaling has the potential to greatly reduce trauma to organs at the surgical site, thereby, allowing patients to enjoy faster recovery times[1].

Robotic technology is used in a growing number of minimally-invasive surgeries (MIS), including cardiovascular, gynecological, urological, thoracic, head and neck, vascular, brain and spine, and arthroscopic surgeries. A typical robotic surgery system consists of a control console in the Operating Room (OR) where the surgeon sits, a robot with multiple arms and attachments that operate inside the body cavity, and a video tower that displays the activity at the surgical site. The fixed mechanisms of the robot are typically draped for infection protection and cleaned in situ after the procedure.

Of special interest to the Central Service (CS)/Sterile Processing department are the reprocessable instruments that attach to the arms of the robot and perform the work inside the body (See Figure 2).

The reprocessable elements of a typical

Figure 1: A robotic surgical suite

Figure 2: Reprocessable robotic instruments

Figure 3: Robotic patient cart with instruments and telescope in place

Figure 4: Distal tip of a robotic instrument showing exposed cables

robotic surgery set-up include robotic instruments that perform the work inside the body cavity, as controlled by the surgeon, and a scope for viewing the surgery site. In this example, the robotic instrument is comprised of a housing that attaches to the arm of the robot, a long-insulated shaft containing cables, a wrist that articulates based on the impetus of the surgeon's hand and finger movements, and a functional tip which may be jaws, scissors or a cautery tip. The telescope is attached to a camera in a dedicated arm of the robot.

Following the manufacturer's instructions for use (IFU), the telescope in this example is manually cleaned, dried, and processed at low temperature in a hydrogen peroxide sterilizer. The robotic instruments, however, require a more involved process, which is the subject of this lesson.

OBJECTIVE 1: DISCUSS THE IMPORTANCE OF POINT-OF-USE CLEANING OF ROBOTIC INSTRUMENTS

At the point of use, after the instruments are used in a procedure, they must be cleaned in the surgical suite to prevent bioburden from drying on them. Bioburden can develop into biofilm. Biofilm is a matrix of bacteriological cells that gather together and exude a protective polysaccharide gel that renders the colony resistant to cleaning by both chemical and physical means. Point-of-use cleaning in the surgical suite immediately after the procedure is an essential factor in the prevention of biofilm development. The Association of periOperative Registered Nurses (AORN) recommends instruments be cleaned as soon as possible after use and kept free of gross soil during procedures[2]. This is especially important with regard to robotic instruments. The fine cables that run down the shaft of the instruments are exposed at the distal tip between the end of the insulation and the working tip. These fragile parts of the instruments are especially prone to corrosion and the development of biofilm.

Corrosion of these cables, caused by blood or other bodily fluids, could cause them to degrade and lose usefulness before the end of their expected lifespan. At the bedside, surgical staff should wipe the instruments with sterile water after they are used. The instruments must be kept moist while awaiting transport from the surgical suite to the decontamination area. Products exist to keep the distal tips of robot instruments moist between use in surgery and cleaning in the CS department. Alternately, a towel wet with water (not saline, which will cause corrosion) may be used to cover the instruments.

Upon reaching the decontamination area, the manufacturer's IFU directs CS professionals in the further cleaning of these instruments.

OBJECTIVE 2: REVIEW THE FUNDAMENTALS OF THE DECONTAMINATION OF ROBOTIC INSTRUMENTS

Robotic instruments are typically delicate and complex surgical devices; therefore, in the decontamination area, robotic instruments often require specific methods and dedicated equipment to process safely.

All personnel working in the decontamination area should wear appropriate personal protective equipment (PPE). To effectively protect the decontamination technician, PPE should include an impervious bouffant, a face mask, eye protection, a gown, shoe covers and gloves. Following the IFU, decontamination personnel should

Figure 5: Ports on the end of the body of a robotic instrument

Figure 6: Pressure-specific hose for flushing the ports of a robotic instrument

wipe the instruments clean in enzymatic solution to remove gross soil. Special attention should be paid to the distal tips, which must be scrubbed with a nylon brush. The distal tip is the part of the instrument that becomes most coated with bodily fluids (this is also the most fragile part of the instrument). A nylon brush can be used for cleaning; however, a metal one should never be used. Aside from breaking the cables that are exposed at the tip of the instrument, metal brushes will scratch and pit the soft metal of the robotic instrument's working tip. Pits and scratches will provide refuge for bacteria from the cleaning process and will become conduits for the transference of bacteria between patients. Metal brushes can also harm the insulating coating on the shafts of the instruments.

After surface cleaning, robotic instruments with flush ports require flushing and priming. The instruments' insulated shafts are hollow to allow movement of the cables inside. Shafts can fill with bodily fluids during the procedure, requiring them to be flushed as part of the cleaning process. When ports are present at the end of the instruments, they typically must be flushed with water to clear any bodily fluids inside the shaft.

The manufacturer may specify the water pressure to be used when flushing ports to ensure proper cleaning, while avoiding damage to the mechanism inside. Pressure-rated hoses help reprocessing professionals achieve the proper pressure. Once the ports have been flushed, they may need to be primed prior to being placed into the ultrasonic cleaner. This is done by injecting a specified amount of enzymatic solution into them. Priming allows the ultrasonic to work at maximum efficiency.

Having been pre-cleaned at the point of use and in the decontamination area, the robotic instruments may require ultrasonic cleaning. There are ultrasonic systems that have been designed with robotic instrumentation in mind. These machines come with specific accessories for the cleaning of robotic instruments, including irrigation hoses with adaptors. These machines may also feature robot-specific cycles that work to ensure cavitation throughout the entirety of the instrument.

Instruments must be washed before being inspected in CS, and best practices direct that they be thermally disinfected before being handled by technicians without PPE. If endorsed by the IFU, robotic instruments should be run through a cycle in an automated washer-disinfector after ultrasonic cleaning and before inspection by CS technicians.

Figure 7: Robotic instrument accessory for an ultrasonic cleaner

OBJECTIVE 3: DISCUSS THE SPECIALIZED PROCEDURES INVOLVED IN THE INSPECTION OF ROBOTIC INSTRUMENTATION

On the clean side, robotic instruments must be inspected after cleaning by trained CS professionals. The procedures for inspecting robotic instruments are similar to those for the inspection of general surgical instruments, but may involve additional steps to keep the instruments in good repair and safe for use on the next patient. Each step must be performed during the inspection of the

Figure 8: Robotic instrument proximal end

instruments.

The instruments must first be inspected for bioburden and to ensure the instruments are in good working order. The technician should visually inspect the insulation for cracking or holes. Electrocautery is regularly used during robotic procedures. Flaws in the insulation of robotic instruments can cause electricity to be discharged inside the body cavity, behind the surgical site. As the surgeon is visualizing only the surgical site through the telescope, stray electrical burns may not be noted during the procedure. It may take three to seven days for symptoms of electrosurgical burns to present in a patient[3]. Inspection of the insulation on robotic instruments is an indispensable step in protecting robotic surgery patients.

Verifying that the insulation is sound and intact, the technician should then inspect the instrument's wrists or other visible operating mechanisms for bioburden and loose cabling. Robotic instruments may require a lubrication step at the wrist to keep the mechanism supple during use. The technician should then inspect the jaws for bioburden and also for pitting and scratches.

After inspection, robotic instruments with flush ports should be flushed with distilled or sterile water, depending on the IFU, to ensure that the inner shaft is free from bioburden. The instruments must then be thoroughly dried. Compressed medical-grade air is acceptable for drying most robotic instruments; however, compressed air must never be forced into the flush ports of the instruments as damage to the inner mechanism may occur.

The technician will then package the instruments for sterilization, in accordance with the manufacturer's IFU.

CONCLUSION

Robotic-assisted MIS is a positive development for patient care, allowing surgeons greater precision with a wide variety of procedures, as well as minimized tissue trauma and reduced patient recovery times. Still, the instruments used for these procedures present unique challenges for CS professionals, and teamwork is needed to ensure the sophisticated instruments are effectively cleaned and reprocessed. Following each robotic surgical procedure, OR staff play an essential role in point-of-use cleaning and preparing the reprocessable robotic instruments for further cleaning and sterilization in the CS department. In the CS department, technicians in the decontamination and inspection areas have specific and specialized tasks to carry out to ensure the safety of the next patient on which the robotic instrumentation will be used. Healthcare providers, OR staff and CS technicians must all work together to ensure that robotic instruments are cleaned and properly cared for and that robotic surgery will continue to grow as a safe and desirable option for patients.

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