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GENERAL SURGERY NEWS

As Robot Technology Surges, Sterilization Lags Behind

By DAVID TAYLOR, MSN, RN, CNOR

Whether you use robotic-assisted surgery (RAS) or not, this technology has undoubtedly advanced the field of surgery. It can increase surgeon visualization, accuracy and performance, and reduce patient incision size, blood loss and hospital length of stay. According to Intuitive Surgical, more than 5,500 da Vinci systems have been installed in 67 countries around the world, and more than 10 million robotic-assisted surgical procedures have been performed using its systems. That number is only going to grow, especially with expansion into the ambulatory surgery setting.

RAS improves on both laparoscopic and open techniques by combining a minimally invasive approach with the supplementary benefit of a 3D, magnified image. It also allows for improved ergonomics and dexterity compared with traditional approaches because it's designed to replicate a surgeon's natural movements, but with more precision.

Nevertheless, the investment in robust robotic programs is generally still lacking in healthcare organizations. As such, it's critical that surgeons and OR leadership work with their administrators to not only define their hospital's robotic needs, but also to insist they commit to the infrastructure needed to support these efforts. This may include a program that provides the necessary components to train surgical staff and provide the financing for critical support areas, such as central sterile processing (CSP).

Along with those requirements, robotic systems are a big investment that can exceed $2 million and the spending doesn't stop there. RAS also requires limited-use consumables, such as surgical arms, staplers and other accessories. These ongoing costs can range from hundreds to thousands of dollars, and will vary greatly with the type of robot and the surgical specialty using the device.

These expensive pieces of equipment must be handled thoughtfully, not just in the surgical suite, but also in CSP to protect the facility's asset and maintain the safety of patients. Over the past decade, CSP departments (CSPDs) across the country have encountered numerous challenges regarding routine surgical instrumentation. In my experience, it's rare to find a CSPD that has the equipment and skill to keep up with fast-paced changes occurring in surgery.

The problem is that instruments have become more complex in their design. These devices can have multiple articulation points that are controlled by wires and pulley systems, which can easily become contaminated with blood and body tissue during a surgical procedure. Although CSP can attempt to clean around the wires and cannulas, it's extremely difficult because these consumables cannot be taken apart, making it hard to visualize every aspect. Unfortunately, manufacturers rarely design an instrument with reprocessing in mind. It's only after the devices are engineered that they attempt to replicate the cleaning process and create their manufacturer's instructions for use (IFU).

The last thing administrators want to hear after spending millions of dollars on a new robot is that CSP needs more money (sometimes upwards of $150,000) to purchase the right equipment, as well as the time it will take to train their staff, and ongoing costs for the proper tools and chemicals used in the cleaning process.

Even so, many IFUs used today are vague and use nonspecific language, which leaves a great deal of the responsibility to the CSP staff. Each instrument may require different steps or chemicals that can add time to the process. Because time is money, surgery departments often push CSP to quickly turn over instruments and sets, and this can lead to shortcuts and mistakes made.

The bottom line is many healthcare organizations have not considered what's needed to properly clean, reprocess and effectively sterilize limited-use consumables. The last thing administrators want to hear after spending millions of dollars on a new robot is that CSP needs more money (sometimes upwards of $150,000) to purchase the right equipment, as well as the time it will take to train their staff, and ongoing costs for the proper tools and chemicals used in the cleaning process.

The Cleaning Process: Necessary Steps

All instrumentation that passes through the CSPD must go through multiple steps to ensure proper cleaning and sterilization. Manual washing and brushing are inconsistent even when best practices are followed. No one can guarantee all areas of a robotic instrument, including the crevasse and interior lumens, are cleaned correctly.

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Robot Sterilization

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The goal of reprocessing is to remove all debris and bioburden from the instruments so sterilization of all surfaces can occur. Soil level, brush size, brushing repetition and/or time, as well as human error all play parts. The likelihood of every instrument being consistently cleaned to the same level is low, which can increase the probability of bioburden remaining on or in the instrument. Removing all bioburden and soil is critical because they can lead to instrument damage and malfunctions, which can cause surgical delays, patient exposures, injuries and surgical site infections, and/or place healthcare workers at risk for exposure to healthcare-acquired diseases.

The good news is the challenges CSPDs face when reprocessing these instruments can be mitigated. First, point-of-use cleaning in the OR is a critical initial step. Training OR staff and supplying them with all necessary materials and equipment for point-of-use in each case cart will help this process. Supplies may include flushing solution, syringes, adapters and other point-of-use treatment products. Keeping the soiled instruments damp begins to loosen bioburden, which in turn quickens the cleaning process.

When instruments arrive in the CSPD, technicians need the right tools to do their job. For example, reassembly stations and lighted magnification at the sink enable technicians to see residual soil that otherwise may be missed with the naked eye. Having the correct brushes, syringes and attachment accessories to scrub and flush fluids through channels helps with cleaning and can prevent internal damage from occurring. Furthermore, ultrasonic cleaners validated and designed to meet the cleaning parameters outlined in the IFU for reprocessing should always be used. Robotic instrument channels may be too small to accommodate manual brushing, so it is critical that cleaning solution is flushed through the channels during ultrasonication. For reference, an ultrasonic cleaner is an automated processor that uses a combination of high-powered washing actions (ultrasonics, enzymatic soaks, agitation, exterior and interior sprays, and an air injection bubble cavitation stream) that aids in the removal of bioburden.

The final step in the cleaning process is thermal disinfection. This ensures instruments are safe to handle without the use of personal protective equipment in the assembly area. Unfortunately, many ultrasonic cleaners currently in use aren't capable of thermal disinfection and require the additional step of placing instruments into a basket and processing them through the automated washer disinfector. Although this may seem like a good idea, it can pose serious risks if the ultrasonic step is skipped. Not only can bioburden remain, but the cleaning solutions used during these processes can become trapped in the channels of these instruments during the cleaning cycle. The instrument may be thermally treated, but chemical residues may build up and interfere with sterilization.

Conclusion

Advancements in surgery are here to stay. They will continue to evolve and advance therapeutic techniques, improving the lives of our patients. Consistent reprocessing is critical for every instrument set; and with the proper equipment, planning, training and quality control measures in place, CSPDs will be better able to mitigate risks and support the unique processing needs of all the new advancements to come. Ultimately, organizations that lack the right cleaning and disinfecting apparatuses can impede their RAS program, and more importantly harm the patients they are trying to help. ■

Hernia Repair

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the robotic repair's margin was only 4% of the open repair margin. This led to a final calculation of the value of each minimally invasive repair compared with the open approach as follows: Laparoscopic repairs reduce value by 3%, whereas robotic repairs reduce value by 69%.

The authors conducted a well-done cost analysis of a highly debated topic regarding value, and their findings echo those of cost analyses by Charles et al (*Surg Endosc* 2018;32[4]:2131-2136) and Abdelmoaty et al (*Surg Endosc* 2019;33[10]:3436-3443). Based on this study, more expensive technology for unilateral inguinal hernia repair is associated with increased cost. However, limitations in this cost analysis include selection bias and the assumption that quality is equal among all three repairs for all inguinal hernias. Due to the consecutive nature of procedure selection, rather than a randomized controlled trial, the reason for selecting each method is unclear and may introduce bias in the findings. Although the authors assume the quality of repair is equivalent for all three techniques, minimally invasive approaches in certain patient populations (morbidly obese, women, bilateral hernia and recurrent hernia after prior open repair), have been recommended due to their reduced recurrence and complication rate. Additionally, surgical team factors, such as the participation of a trainee and staff experience, can affect the operative case time, and thus the variable costs.

As of 2015, 46% of surgeons provide only an open approach to inguinal hernia repair. Preperitoneal dissection should be part of a surgeon's armamentarium for inguinal hernia repair and provides value to the patient and the hospital system. It is unclear whether robotic surgery allows for an increased adoption of the preperitoneal repair, but based on current evidence from Kudsi et al (*Hernia* 2021;25[3]:755-764), the learning curve for robotic repair is much shorter than for the laparoscopic approach. Surgeon experience, patient selection, surgical team factors and operating equipment preferences affect procedure costs, especially given the relatively small cost-related differences between open and laparoscopic approaches. Nevertheless, as robotic surgery continues to expand in use, surgeons should recognize the potential increased costs associated with the technology. ■

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