LEARNING OBJECTIVES
1. Review laparoscopic instrument cleaning and decontamination methods recommended by the Association for the Advancement of Medical Instrumentation (AAMI)
2. Discuss how AAMI-recommended cleaning and decontamination methods relate to specific laparoscopic instrumentation
3. Explain procedures to address problems that may be encountered when cleaning and decontaminating laparoscopic instrumentation
4. Describe post-cleaning and pre-sterilization testing procedures for laparoscopic instrumentation

Hand-held laparoscopic instrumentation typically consists of a handle with a long barrel that has a working distal tip. A laparoscope and camera are needed to visualize the surgical site, and robotic instrumentation is also available to perform various laparoscopic procedures. All of this instrumentation is complex in design and requires special handling procedures because most of these devices are very delicate. They are usually difficult to clean and may require special mechanical cleaning methods.

Objective 1: Review Laparoscopic Instrument Cleaning and Decontamination Methods Recommended by the Association for the Advancement of Medical Instrumentation (AAMI)

Cleaning is the first step in the decontamination process. Any soil present on a device after cleaning may render subsequent disinfection or sterilization processes infective because the soil may prevent the disinfectant or sterilant from reaching the device's surface. High bioburden levels may not allow the disinfectant or sterilant to be effective during the prescribed exposure time. If this occurs, the process will be ineffective, and viable microorganisms will still be present on the device.

Cleaning and decontamination processes vary according to the complexity of the device. The manufacturer's instructions for use (IFU) should always be consulted and closely followed. Failure to follow them may result in a device that is not adequately cleaned or sterilized. The IFU should provide all information needed to clean and sterilize the device, including:

1. Pre-cleaning requirements

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Soil should not be allowed to dry because it will be more difficult to clean the device. It may be necessary to soak instruments with an enzymatic or other solution, or use some other means of maintaining soil moisture, such as a damp towel or plastic bag. Preferably, soiled devices will be transported to the decontamination area immediately after use, and cleaning will begin upon arrival in the decontamination area.

The instruments should be sorted and any which are multi-part should be disassembled. Containment devices should be used for small devices, such as screws, nuts or washers. Some parts are not interchangeable, so care must be taken to ensure these parts remain together.

Different cleaning agents attack the soil in various ways and enable its removal. Proteinaceous material is water soluble and easy to remove unless it has been allowed to dry on the instrument. If blood has coagulated, neutral pH detergents will not dissolve the fibrin filaments that form. However, enzymes will dissolve the proteinaceous blood material and allow the neutral pH detergent to remove the blood. Note: high pH detergents are capable of dissolving fibrin filaments but may cause damage to some materials. The manufacturer’s IFU must be consulted to ensure that any cleaning agent used is compatible with the medical device being cleaned.

Cleaning methods can be manual or mechanical. Some medical devices cannot be submerged and must be cleaned manually. Care is required to ensure that internal channels or electrical connections do not become wet as this may permanently damage the instruments.

Ultrasonic washers are used to remove soil from hard-to-reach places. One type (sonic irrigators) can remove soil from inside lumens. A high-impact spray process may be used to provide a “scrubbing” action to help loosen any soil present. For more delicate instruments, a low impact spray may be used. When low impact washers are used, the chemical action of the detergent cleans the equipment.

Cleaning must be followed by a thorough rinsing with water to remove soil and detergent residues. Tap water can be used for the initial rinse, but this should be followed by a rinse with purified water: deionized, distilled or reverse osmosis water. Purified water will ensure that staining or recontamination does not occur. Some devices may need to be subjected to a chemical or thermal disinfection process before employees can safely handle them for preparation and packaging. Automated cleaning processes may include disinfection as part of the cycle. Personal protective equipment (PPE) is needed at various steps during the cleaning and decontamination of laparoscopic instruments. PPE can include hair covers, eye and facial protection, gowns, bunny suit, or other protective attire for the body, and shoe/boot covers.

**OBJECTIVE 2: DISCUSS HOW AAMI-RECOMMENDED CLEANING AND DECONTAMINATION METHODS RELATE TO SPECIFIC LAPAROSCOPIC INSTRUMENTATION**

It is especially important that laparoscopic instruments be cleaned as soon as possible after use as recommended in the AAMI recommended practices. If debris is allowed to dry inside internal channels, it may become virtually impossible to remove it. If cleaning cannot begin immediately the organic debris must not be allowed to dry on the instruments. This can be accomplished by immersing the instruments in water and drawing water into any lumens, placing a damp towel on top of the instruments, or placing the instruments inside a humidified bag. Removal of dried debris will require extensive use of cleaning agents,
brushing, and copious flushing to clean the instruments. This will greatly increase the time needed to clean an instrument. Mechanical processes may not be effective until extensive pre-cleaning and soaking is performed.

AAMI standards require that laparoscopic instruments be separated according to the wash process that will be used. Some instruments must be manually washed, some instruments can be cleaned manually or mechanically, and some require a combination of manual and mechanical cleaning methods.

Laparoscopes require manual cleaning as some mechanical processes may loosen adhesives that hold the optical surfaces in place. There are three optical surfaces to clean on a laparoscope: the distal optic, the fiberoptic surface, and the eyepiece's proximal optic surface. A mild pH detergent and soft bristle brush are usually used to clean these surfaces. After cleaning, the optical surfaces must be rinsed with water to remove any organic and detergent residues. A final rinse with purified water should then be performed. The manufacturer's IFU should be consulted for detergents and specific cleaning instructions.

Manual cleaning begins with soaking the instrument in a neutral pH detergent, which is usually an enzyme. Areas where debris can collect should be brushed with a soft bristle nylon brush. Multi-part instruments must be disassembled before beginning the cleaning process to enable cleaning agents to reach all parts of the instrument being cleaned.

All lumens must be cleaned. A syringe may be used to draw enzymatic solution into the lumen. After the solution is drawn into the lumen the instruments can be allowed to soak in a vertical soaking cylinder to help remove body fluids from the lumen. The manufacturer's IFU should be consulted for length of soaking time needed.

Care must be taken when handling laparoscopic instruments as they are delicate and may be easily damaged. A lens can be broken by placing a heavy object on top of it. Shafts can easily be dented or bent. Fibers in light cables can be damaged by pulling on the cord or coiling it too tightly.

After cleaning, rinse all lumens with tap water until the water runs clear. A final rinse with purified water should be performed after the final tap water rinse. A water pistol can also be used to clean instrument lumens. Depressing its trigger releases water at high pressure. Various tips are used to connect the instrument to the water pistol and allow the lumen to be flushed at high pressure.

Prior to mechanical cleaning, instruments must be prepared for the cleaning equipment. All instruments should be opened to enable the cleaning solution to reach all surfaces. Mechanical cleaning methods include washer sanitizers, washer disinfectors, washer decontaminators, ultrasonic washers, and sonic irrigators. Some machines have adapters that allow for automated washing of lumens. If this cannot be done, this process must be performed manually. Mechanical cleaning methods speed up the cleaning process without sacrificing quality. They also allow the Central Service (CS) technicians to perform other tasks while the machine is running and will enable the processing of several instruments at the same time.

OBJECTIVE 3: EXPLAIN PROCEDURES TO ADDRESS PROBLEMS THAT MAY BE ENCOUNTERED WHEN CLEANING AND DECONTAMINATING LAPAROSCOPIC INSTRUMENTATION

One significant problem that can occur when reprocessing laparoscopic instruments relates to organic debris that dries on or inside the device because it is difficult to clean. Wiping the instrument with a damp cloth during surgery and soaking the instrument in water or an enzymatic solution after use and before cleaning will help prevent debris from drying on the instruments.

Many features in laparoscopic instruments are difficult to reach and, therefore, difficult to clean. It is very important that the manufacturer's IFU be followed exactly. Manual cleaning instructions usually prescribe a minimum amount of time (example: 20 seconds) that internal channels must be flushed. Since less time may not allow for adequate removal of organic debris, it is important that the lumens in each instrument in a set be flushed for the prescribed time.

Some instructions state that a minimum water pressure must be used to flush lumens. A lower pressure may not remove all debris. Cleaning laparoscopic instruments can be a very time-consuming process. Instruments may be needed for turnover cases, but it is never acceptable to use less time than specified in the IFU.
Care must be taken when handling laparoscopic instruments as they are delicate and may be easily damaged. A lens can be broken by placing a heavy object on top of it. Shafts can easily be dented or bent. Fibers in light cables can be damaged by pulling on the cord or coiling it too tightly. Dropping a laparoscope even just a few inches can break one of the optics. Repairs to laparoscopic instruments can be very expensive. Repeated damage may render the instrument unrepairable and require replacement.

OBJECTIVE 4: DESCRIBE POST-CLEANING AND PRE-STERILIZATION TESTING PROCEDURES FOR LAPAROSCOPIC INSTRUMENTATION

After completing the cleaning process CS personnel must verify that the cleaning process was effective. This inspection process begins with a visual inspection for visible soil. Magnification can be used to inspect areas such as crevices and serrations where it is difficult to see residue. If residue is detected the device must be returned to decontamination for re-cleaning.

Lumens in laparoscopic instruments must be checked to ensure that all debris is removed. There are devices that can be inserted in lumens that will create a color change in the presence of organic soil. Other test procedures are available to verify that a device is clean, including tests for presence of protein, hemoglobin or organic debris. Each facility should develop a comprehensive cleaning verification program.

In addition to verifying that the cleaning process was effective, the technician must check to ensure that the instrument is functioning properly. After cleaning, a laparoscope should be inspected to ensure it is possible to see through the lens and that the image is not dark or hazy. A dark or hazy appearance may indicate that some fibers are broken. The appearance of black dots also indicates that some fibers are broken.

Fiberoptic cables can be inspected by attaching them to a light source and seeing if the fibers appear unbroken. The appearance of dots of bright lights along the length of the cable also indicates broken fibers. Placing the end of the cable that attaches to the instrument within 3-4 inches of a white background will also assist in determining that adequate light is being transmitted along the cable. Diminished illumination or dark spots on the background field indicate broken cable fibers.

The insulation on laparoscopic instruments should be inspected to ensure that the surface is intact. This can be done with a meter designed to detect electrical current leakage. Be sure to follow testing instructions from both the instrument and meter manufacturers. Any bare metal can cause electrical arcing during the surgical procedure and potentially burn vital organs inside the patient, but outside the surgeon’s view.

Visual inspection should be performed to ensure that there are no missing parts, abrasions or burrs on the instrument. The instrument including all valves should be operated to ensure that all parts move freely and do not stick. Scissors can be tested by cutting a piece of test material. The material should show a clean cut, with no bunching or separation in the cut. Scissor test material may be purchased from several companies.

IN CONCLUSION
Laparoscopic instruments are complex medical devices. Cleaning of these devices requires close attention to the manufacturer’s IFU. It may not be possible to sterilize improperly-cleaned devices. Instruments with damage to the insulation may cause serious harm to a patient. All personnel involved with maintaining laparoscopic instrumentation must be knowledgeable about the care, maintenance, handling, cleaning, and sterilization of these instruments.
OBJECTIVE 1
1. The cleaning process for laparoscopic instrumentation begins:
   a. Upon arrival in the decontamination area
   b. During transport to the decontamination area
   c. After sorting instruments according to wash process to be used
   d. During the surgical procedure
2. Personal protective attire is needed when cleaning and decontaminating laparoscopic instruments.
   a. True
   b. False
3. High pH detergents are capable of dissolving:
   a. Bone chips
   b. Hard water components
   c. Fibrin filaments
   d. Detergent residues
4. High impact spray cleaning processes provide:
   a. A “scrubbing” action to help loosen any soil present
   b. Chemical actions that dissolve soil that is present
   c. A “sheeting” action to help rinse soil that is present off devices
   d. Improved drying of devices after soil removal
5. A purified water rinse is used to ensure:
   a. Complete drying of devices after the cleaning process
   b. Soil completely rinses off device surfaces
   c. Staining or recontamination does not occur
   d. Devices are disinfected after cleaning
6. Failure to follow a manufacturer’s IFU may result in a device not being adequately cleaned or sterilized.
   a. True
   b. False

OBJECTIVE 2
7. Removal of dried debris will require extensive use of:
   a. Cleaning agents
   b. Disinfecting agents
   c. Sterilants
   d. Acids
8. Optical surfaces on laparoscopes require manual cleaning as some mechanical processes may:
   a. Loosen adhesives
   b. Cause fogging
   c. Damage fibers
   d. Warp lumens
9. If cleaning cannot begin immediately after use, organic debris can be kept moist by all of the following EXCEPT:
   a. Immersing instruments in water and drawing water into any lumens
   b. Placing a damp towel on top of the instruments
   c. Placing instruments inside a humidified bag
   d. Keeping instruments inside a covered or enclosed cart
10. A water pistol is used to:
    a. Flush a lumen at high pressure
    b. Remove debris from serrations
    c. Check a device for cleanliness
    d. Check a device for functionality
11. To enable cleaning agents to reach all parts of a device being cleaned, multi-part instruments must be:
    a. Kept moist
    b. Disassembled
    c. Flushed with water
    d. Soaked in an enzyme
12. After cleaning, rinse all lumens with purified water until the water runs clear.
    a. True
    b. False
13. Mechanical cleaning methods speed-up cleaning processes by:
    a. Reducing operating costs
    b. Allowing the technician to multi-task
    c. Eliminating the need for PPE
    d. Improving detergent residue removal
14. What are the three optical surfaces that must be cleaned on a laparoscope?
    a. Distal optic, proximal optic and lens
    b. Distal optic, fiberoptic and lens
    c. Distal optic, proximal optic and fiberoptic
    d. Proximal optic, fiberoptic and lens
15. Laparoscopic instruments are delicate and may be:
    a. Damaged easily
    b. Cleaned easily
    c. Processed quickly
    d. Stained easily
16. It is acceptable to use less time than specified in an IFU when the instruments are needed for a turnover case.
    a. True
    b. False

OBJECTIVE 3
17. Non-intact insulation on laparoscopic instruments may cause:
    a. Patient burns
    b. Lens to fog
    c. Instruments to malfunction
    d. Moving instrument parts to stick
18. The inspection process for laparoscopic instrumentation begins with:
    a. Testing of lumens
    b. Testing instruments for functionality
    c. Visual inspection for visible soil
    d. Visual inspection to ensure presence of all parts
19. The appearance of black dots in a laparoscope indicates:
    a. A cracked lens
    b. Presence of water in the light channel
    c. Malfunctioning valves
    d. Some of the fibers are broken
20. Cleaning of laparoscopic instruments requires paying close attention to:
    a. Cleaning verification
    b. Manufacturer’s IFU
    c. Documentation of the cleaning process
    d. Testing instrument integrity

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