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Learning Objectives

1. *Define "cleaning" as it pertains to healthcare environments*
2. *Explain the types of cleaning chemistries commonly used in SPDs and discuss their differences*
3. *Explain the physical and chemical effects of water on cleaning processes*
4. *Understand and discuss the impact of cleaning formulations on the cleaning process*

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Maintaining instrument quality and washer performance in the SPD

by Erin Linville and Nancy Kaiser

Surgical instrument processing has evolved into a complex science with many important elements. The everyday function of a sterile processing department (SPD) involves both the production of high quality sterile goods and the maintenance of highly efficient workflow, to keep the hospital or surgical center operating efficiently and profitably. This balance of quality and productivity requires SPD staff to have specialized skills and knowledge, and to apply proven industry standards.

Protect the instrument investment

Surgical instruments are defined as tools or devices that perform functions such as cutting, dissecting, grasping, holding, retracting, or suturing. Most high-quality surgical instruments are made from stainless steel. Some instruments may contain a variety of other metals, including titanium, chromium, vanadium and molybdenum, which help achieve various requirements such as creating more resistant surface finish or a stronger cutting edge.

All medical professionals who come into contact with surgical instruments need to maintain the quality and integrity of these critical tools at all times. The considerable investment made in a hospital's medical devices must be protected. Medical devices are costly to repair and even more costly to replace. Furthermore, there is a hidden cost associated with the impact of instrumentation problems on operating room (OR) productivity. There are more than 10,000 types of hand-held surgical instruments in use today and instrument issues are among the most frequent causes of surgical delays. These delays, due to incorrectly assembled or contaminated instruments sets, can cost an average of $1,000 per hour.[1]

As key participants in the instrument reprocessing cycle, SPD personnel must understand the importance of all the reprocessing steps required to produce a "clean" surgical instrument. They must be properly trained in preventive maintenance, proper handling, and optimal cleaning processes, which can go a long way towards protecting the quality of surgical instruments.

Define the cleaning process

Instrument cleaning, as defined by the Association for the Advancement of Medical

The considerable investment in a hospital's surgical instruments must be protected.

Cleaning removes organic and inorganic matter that could interfere with disinfection or sterilization.

Instrumentation (AAMI), is "the removal, usually with detergent and water, of adherent visible soil, blood, protein substances, and other debris from the surfaces, crevices, serrations, joints, and lumens of instruments, devices, and equipment by a manual or mechanical process that prepares the items for safe handling and/or further decontamination."[2] There is currently no standard to define when a device is "clean," but it is generally accepted that a cleaning process to produce an aesthetically "clean" instrument should include the reduction of the microbial bioburden and removal of any organic and inorganic matter, so as to provide an instrument that can be effectively disinfected or sterilized.

All surgical instruments should be cleaned and disinfected as soon as possible after use. Blood and other debris should not be allowed to dry on the instruments, since dried soils are much harder to remove from the surfaces of instruments. In addition to removing the bioburden that is present on surgical instruments after use, the cleaning process removes organic and inorganic matter that could react or interfere with the subsequent steps of disinfection or sterilization. Studies have demonstrated that bacteria and spores can be occluded by both rust and hard water deposits, which allow these organisms to survive steam sterilization cycles, prevent instruments from being sterilized, and provide possible transfer points of infectious organisms.[3]

Proper preparation and cleaning immediately after use can also protect expensive instruments and keep them from deteriorating. In many cases, what may be perceived as rust is in reality dried blood, which, if left on an instrument, can be a focal point for corrosion. Once an instrument has started to rust it will become weak and the damage will eventually destroy or cause an instrument to break. Rust can occur on any stainless steel instrument or utensil. Once corrosion begins, instruments can be further corroded by washing and autoclaving.

The cleaning process can be carried out manually, in an automated washing system, or by a combination of these methods. Optimal cleaning conditions include the correct type of detergent and mechanical cleaning system, acceptable water quality, well maintained and sanitized equipment, and consistent processing techniques.

Select the optimal formulations for cleaning

An important factor in reducing the risk of cross-contamination and instrument damage is the detergent that is used. The choice of cleaner can make the difference between a process that is efficient and effective and one that can contribute to incompletely cleaned instruments and surface damage over time.

Although there are a wide variety of detergent and lubricant products used to clean instruments, three types are most commonly used. These include neutral detergents, alkaline detergents and enzymatic detergents. These three types all have their specific advantages, limitations and patterns of use.

Neutral detergents are used when there is a wide variety of instrument, tray and utensil components and surface materials being processed. Neutral detergents typically do not clean protein soils as well as enzymatic or alkaline detergents.

Alkaline detergents tend to clean protein soils and handle water hardness better than neutral detergents, but also typically have a much more limited material compatibility profile.

Enzymatic detergents can be the most versatile formulations and are critical to ensuring a clean instrument or endoscope. They can clean protein soil more rapidly than the other cleaners and can do it at a neutral pH, which makes them more compatible with a wide variety of soft metals and plastics. If formulated with the proper surfactant systems, protease-based enzyme products can also aid in the cleaning of fatty and carbohydrate soils. Enzymatic detergents are used in three ways: as pre-cleaning agents prior to automated washing; as part of an automated cleaning process in combination with other chemistries; and as manual cleaning agents for those instruments or scopes that do not go through automated equipment. It is critical that enzymatic products are thoroughly rinsed away, so they work best when they are used before another cleaning process with a different chemistry type (such as an alkaline or neutral detergent).

*See **SELF-STUDY** on page 42*

STERIS Corporation's Prolystica® ultra-concentrate instrument cleaning system

Self-Test Answers: 1. E; 2. A; 3. A; 4. D; 5. B; 6.B; 7. E; 8. E; 9. D; 10. A

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The power and challenge of water in cleaning

Water is the universal cleaning agent, and water serves as the medium for carrying the cleaning agent/detergent to all surfaces of the item being cleaned. Water can also serve as a physical force removing soil from instruments within an automated washer, and it aids in the removal of separated organic matter and other soil. Although deionized or reverse-osmosis water is recommended for rinsing surgical instruments to prevent water spots, any quality or type of water may be acceptable for use in the wash cycle *if the detergent being used has the ability to handle the water characteristics*. If there is a mismatch between the detergent capability and the type of water used, symptoms of potential instrument damage, such as instrument staining, spotting or inadequate removal of soil will become apparent.

Water quality or type can vary from one geographic location to another and even from one season to another. Water can be "hard" in tap or potable water. It is determined by the concentration of calcium and magnesium ions present in the water. Water hardness is usually represented in parts per million (ppm) of the equivalent amount of calcium carbonate and other ions. Metal ions such as iron, copper and zinc may also be present in water. These metal ions in water can contribute to galvanic corrosion on instruments. The variables of water hardness, metal ions in solution, pH and alkalinity should all be considered when selecting the type, quality of formulation, and concentration of detergent required to effectively remove soil and control water contaminants in a particular facility. In general, the harder the water or the more the metal ions that exist in solution, the higher the concentration or quality of detergent formulation needed to clean a load effectively. It is important to assess the level of contaminants in the water used for instrument processing, and to use this information to make informed decisions about procedures, equipment and appropriate cleaning formulations.

It is also important to protect instruments from the corrosive effects of water. Even the highest quality water, such as deionized or reverse-osmosis processed, can exhibit corrosive properties and can damage instruments or automated equipment. Aluminum and other metals can actually become more corroded in deionized water than in tap or hard water. In fact, if stainless steel instruments are allowed to soak in water alone for extended periods of time, rust can appear.

Cleaning formulations to the rescue!

Fortunately, there are formulated cleaning chemistries that can protect instruments and automated washer components when used properly, and can prevent or counteract the damaging effects of water. SPD professionals should become familiar with the types of agents contained in various cleaning products. Cleaning chemistries should be nondamaging to instrument and washer surfaces, but should also contain corrosion inhibitors to be able to control water damage.

It has never been more important to ensure clean and sterile products.

Automated washer equipment in an SPD must perform optimally to ensure that surgical instruments are cleaned in the most effective and productive way each time a cycle is run. For this reason, it's important to note that improper use of cleaning chemistries can cause a reduction in effectiveness of automated equipment. For example, high-foaming cleaning products will be harder to rinse and can affect pump pressure in the washer, which in turn can affect proper washer arm movement. This reduced pressure and slowing (or even stopping) of the washer arms can result in poor impingement (impact) of water and detergent against instrument or utensil surfaces, and can reduce cleaning effectiveness and increase equipment repair costs.

Conclusion

SPD professionals contribute significantly to the success of hospitals and surgical centers, and ultimately to the quality of patient care. It has never been more important to ensure that the SPD maintains a quality process and produces clean and sterile "products." The ever-increasing complexity, cost, and number of instruments being processed, and the hospital's dependence on those instruments, make the selection of cleaning methods and materials critical. These choices can determine whether or not the SPD is producing thoroughly cleaned instruments and sets, maintaining the optimal condition of the instruments, and optimizing the performance of the washers. The proper cleaning products can also help the SPD improve turnaround time and maintain high productivity levels, which in turn can help improve surgical productivity as well. HPN

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2. Association for Advancement of Medical Instrumentation (AAMI). *Standards and recommended practices*. Sterilization, Part 1. Sterilization of health care facilities. Sterilization Part 2. Hospital equipment and industrial process control. Arlington, VA: AAMI, 1995.

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Maintaining instrument quality and washer performance in the SPD

Circle only one answer:

1. **Optimal cleaning conditions include:**
   a. The correct type of detergent
   b. The correct mechanical cleaning system
   c. Well maintained, sanitized equipment
   d. Consistent techniques
   e. All of the above
   f. a and b only
2. **All surgical instruments should be disinfected and cleaned as soon as possible after use.**
   a. True
   b. False
3. **Water hardness and metal ions in solution can potentially affect sterilization.**
   a. True
   b. False
4. **The effects of corrosion (rust) on surgical instruments may include:**
   a. Breakage
   b. Interference with sterilization and disinfection
   c. There is no effect
   d. a and b
5. **It is important to use deionized or softened water in every phase of cleaning an instrument.**
   a. True
   b. False
6. **Alkaline detergents have broad materials compatibility.**
   a. True
   b. False
7. **Enzymatic detergents are used:**
   a. As manual cleaning agents
   b. As part of an automated cleaning process
   c. As pre-cleaning agents
   d. As rinsing agents
   e. a, b, and c only
8. **High foaming detergents in a washer can affect:**
   a. Rinsing
   b. Washer arm movement
   c. Impingement
   d. Washer repair costs
   e. All of the above
   f. a, b and c only
9. **Enzyme products can be the most versatile formulations because:**
   a. They can clean protein soils more rapidly than the other types
   b. They have a neutral pH and are more compatible with instrument materials
   c. They can be formulated with surfactants that help them clean fatty and carbohydrate soils
   d. All of the above
   e. a and b only
10. **Understanding the level of contaminants in water used for instrument processing is important because it can provide the information to make educated decisions about optimal procedures, equipment and cleaning formulations.**
    a. True
    b. False

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