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LEARNING OBJECTIVES

1. *Discuss the four stages of endoscope processing*
2. *Identify opportunities for cross contamination during the cycle*
3. *List straightforward ways to prevent cross contamination when processing endoscopes*

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Cross out cross contamination in endoscope processing

by Heide Ames and Pam Boulet

Flexible endoscopes are among the most complex and indispensable medical devices used in healthcare. And yet, despite mounting evidence identifying cross contamination opportunities during endoscope processing, many sterile processing and endoscopy departments dedicate little space to the proper cleaning, rinsing, and disinfection or sterilization of these lumened scopes. At the same time, regulatory and guidance organizations are taking a hard look at the details of this process and are updating best-practice recommendations. This is likely to lead to changes in processes, equipment and workflow space to enable compliant flexible endoscope processing.

Contamination level related to the stage of processing

Endoscope processing roughly divides into five stages. The first stage consists of receipt, cleaning, and rinsing. Processing staff move soiled endoscopes from the decontamination holding area to the cleaning area. At this point in the cleaning process, the endoscope has its highest level of contamination. The endoscope is leak tested and submerged in cleaning solution as it is brushed and flushed. Once cleaned, the endoscope moves to a rinsing sink. Once again, the endoscope is submerged, and its channels are flushed per the manufacturer's instructions to help ensure complete removal of cleaning solution and soils.

Rinsed endoscopes move to the second stage, the inspection. Despite cleaning and rinsing, pathogenic microorganisms are still on the endoscope. The endoscope is placed on an absorbent pad and is dried using a non-linting cloth. Lighted magnification is used to examine the external surfaces, and a borescope may be used to view some of the internal channel surfaces that run through the endoscope.

Once inspection is completed, the endoscope is moved to the high-level disinfection or liquid chemical sterilization area, which is the third stage. High-level disinfection and sterilization start with an endoscope with a low level of contamination and end with an endoscope virtually free of living pathogenic microorganisms. Both of these processes can be manual or automated. In a manual process, the endoscope is placed in high-level disinfectant or sterilant solution for a specified amount of time at a specified temperature. Once the time has passed, the endoscope is removed and rinsed several times to remove the solution from the endoscope. For automated processes, the endoscope is placed within an automated reprocessor. The adaptors are connected to ensure flow of the solution though all channels of the endoscope. The automated reprocessor performs both the disinfection/sterilization and rinsing steps.

The fourth and final stage of activities is drying and storage. At this stage, the endoscope has no pathogenic microorganisms and must be kept this way until used on a patient. Once at the drying area, a clean non-linting cloth is used to dry the external surface. All channels are purged with instrument quality or HEPA-filtered air for 10 minutes or longer, until all channels are dry. Once dry, the endoscope is transported to the storage cabinet where instrument quality or HEPA-filtered air keeps the cabinet at a positive pressure as compared to the room environment.

During this processing cycle, endoscopes follow a path from highest to lowest contamination. Cross contamination frequently happens when an endoscope is exposed to contamination from an earlier stage.

Identifying sources of cross contamination

The first well-publicized source of cross contamination is inadequate cleaning and disinfection. Residual soils left by inadequate cleaning protect microorganisms from subsequent high-level disinfection or liquid chemical sterilization processes. In addition, endoscope damage that goes undetected during inspection can harbor residual soils and biofilms that also shield microorganisms. And when a properly

cleaned and rinsed endoscope undergoes improper or inadequate high-level disinfection or liquid chemical sterilization processes, microorganisms can survive and transfer to the next patient, creating an opportunity for infection.

Properly processed endoscopes may be exposed to contaminated surfaces or fluids before they are used. During leak testing and cleaning, sink fluids become contaminated by the endoscope. Brushing and flushing during cleaning create opportunities for splashes, spills and aerosolization of the contaminated fluids, which can reach as far as six feet from the sink. Moving or storing endoscopes within this space exposes them to contaminated fluids, creating an opportunity for cross contamination.

Another commonly forgotten source of contamination is personnel protective equipment (PPE). While PPE protects staff from splashes, spills, and aerosolized contaminants, the PPE materials and surfaces become contaminated. Gloves are the most likely equipment to create cross contamination opportunities. When PPE is not changed between highly contaminated tasks, like cleaning, and tasks with less contamination, such as removing endoscopes from automated reprocessors, cross contamination can occur. It is commonly believed that changing gloves (and not the fluid-resistant gown) prevents contamination. However, one touch of a cleaned endoscope to a contaminated gown can recontaminate the endoscope.

Another source of cross contamination is the air. Room air can become contaminated from aerosolized cleaning fluids, external contaminants coming in with the heating and cooling system air, and lint or dust carried by lint-generating activities, such as unpacking items from corrugated shipping boxes. Airborne contaminants can settle on drying or stored endoscopes.

Pseudomonas aeruginosa and Klebsiella legionella are two microorganisms often found in small numbers within facility water. When these microorganisms colonize a water system, large colonies can form, creating biofilms. Biofilms can release microorganisms into the water that could contaminate endoscopes during rinsing. Normally, this would not be a concern. However, when the conditions are right, these microorganisms can create a mature biofilm within endoscopes, which is extremely difficult to remove and kill.

Biofilms can form anywhere moisture pools or items remain damp for long periods of time. Residual soils, holes in endoscope coverings, and damaged seals are perfect locations for biofilm formation. Endoscopes stored wet can give rise to biofilms in the residual moisture. Sink drains, wet floors, and absorbent towels retain moisture for long periods of time and contributes to biofilm formation and the opportunity of cross contamination.

Simple ways to prevent cross contamination

Preventing cross contamination requires a multi-pronged approach involving education, physical barriers, and mechanical controls to stop the spread of microorganisms. The process begins with best practice. Several agencies provide guidance for processing flexible endoscopes. The Society of Gastroenterology Nurses and Associates (SGNA), the Association of Professionals in Infection Control and Epidemiology (APIC), the Association for the Advancement of Medical Instrumentation (AAMI), and the Association of peri-Operative Registered Nurses (AORN) publish guidelines and standards for processing flexible endoscopes. Of these organizations, AAMI and AORN have issued the most recent guidelines, both released in 2022.

Follow all equipment instructions

Policies, procedures, and work instructions should strictly follow the endoscope's instructions for use and the instructions of all items used to process the endoscope. Additionally, departments should implement a documented and rigorous training program that tests the competency of staff members processing endoscopes, and this competence should be regularly reviewed. Some organizations recommend certifying staff members who process flexible endoscopes. Several trade organizations, colleges and universities offer programs specific to the processing and management of endoscopes. Facilities should consider implementing programs that encourage certification in flexible endoscope processing.

Separate dirty and clean

Most organizations agree that processing should be divided into two rooms. The first room, decontamination, receives soiled endoscopes, leak tests, cleans, rinses, and inspects. In the second room, or clean room, technicians high level disinfect or liquid chemically sterilize the endoscopes and dry them. Endoscopes should always travel unidirectionally from areas of high to low contamination.

The decontamination room should be at a negative pressure as compared to the adjacent hallways and rooms. This ensures that air flows into the room from the adjacent areas, keeping microorganisms that may be in the air, from escaping to adjacent areas causing cross contamination. The heating and cooling system should exchange the room air with fresh air to reduce the total airborne contamination within the room. ANSI/ASHRAE/ASHE Standard 170 Ventilation of Health Care Facilities specifies the relative negative pressure, room air exchange rate, and air management for potentially contaminated air. Endoscopy processing supervisors should work with facilities to ensure compliance to the standard's revision that applies to the specific model of ventilation system in their facility.

Keep sinks away from inspections

Within the decontamination space, splashes, spills, drips and aerosolization of contaminated cleaning solution and rinse water carry microorganisms to surfaces, counters, walls, floors, and equipment around them. One study showed that splashes could reach as far as six feet from the sink. For this reason, it is necessary to physically separate sinks from endoscopes undergoing inspection. AAMI recommends a minimal distance of four feet. If this is not possible, a physical barrier extending four feet from the sink's rim towards the ceiling should separate the sink from inspection space.

Clean sinks and surfaces

To prevent potential cross contamination between endoscopes, sinks should be drained, cleaned, and disinfected after each endoscope. Clean spills, sprays, and drips immediately. Regularly clean and disinfectant surfaces that may become contaminated during decontamination of endoscopes. Faucet handles, cleaning solution dispensers, leak testing equipment, flushing tubing and connectors, counters, and floors are a few items to consider. Ensure regular cleaning and disinfection of high contact points like door handles, cabinet pulls, and equipment contact points within the room. Always follow manufacturer instruction for use to ensure proper use of cleaning solutions, disinfectants, and disinfection methods for equipment.

Clean inspection equipment

During inspection, drips, aerosolization from blowing channels clear of fluid, and

Self-Study Test Answers: 1.A, 2.B, 3.D, 4.B, 5.A, 6.D, 7.C, 8.D, 9.C, 10.C

missed residual soils on or in endoscopes are potential sources of contamination. Use a fresh clean towel to dry each endoscope. Change absorbent pads regularly to prevent potential biofilm formation and cross contamination between endoscopes. Lighted magnification used to inspect endoscopes can become contaminated as staff manipulate the magnifier. Borescopes used to visualize the internal channels and ports can become contaminated as it touches the contaminated scopes. This is especially true when finding residual soil in an endoscope channel. Policies and procedures are needed for cleaning and disinfecting inspection equipment and surfaces.

Transfer endoscopes that are ready for high level disinfection or liquid chemical sterilization through a pass-through window to the clean side. Avoid using doors between the decontamination and clean sides, as they make it difficult to maintain positive pressure within the room and allow contaminated air to cross into the clean side. Also, segregate cleaned endoscopes from high level disinfected or liquid chemically sterilized endoscopes. Placing a disinfected endoscope on a surface that held a cleaned (but not disinfected or chemically sterilized) endoscope could transfer contamination from one scope to another.

Change PPE

Be sure to change PPE between the decontamination and clean processing areas. PPE, such as gloves, become contaminated when handling clean but unprocessed endoscopes. Touching processing equipment or removing processed endoscopes with those contaminated gloves is an opportunity for cross contamination.

Replace manual disinfection/sterilization

Manual high-level disinfection and liquid chemical sterilization is discouraged by many organizations. Manual processing increases the chance of staff exposure to disinfectants and sterilants, and manual processes are more likely to create spills, splashes, and aerosols. As in the case of cleaning sinks, consider physical barriers between processing and drying areas.

Many standards indicate that automated high level disinfection or liquid chemical sterilization systems are best practice. These systems do not have the same splash, spill and aerosolization cross contamination opportunities as a manual process. Pass-through automated systems allow loading of the cleaned endoscopes into the unit on the decontamination side of the wall and unloading of processed endoscope on the clean side of the wall. This unidirectional flow significantly reduces the possibility of cross contamination by offering an efficient and complete separation of dirty and clean. It also helps support the negative and positive pressures of the rooms by allowing only one door of the reprocessor to be open at a time.

Endoscopes must be dried prior to storage or terminal sterilization. Clean non-linting cloths dry surfaces and forced instrument or HEPA-filtered air dries internal channels. Dry endoscopes are critical since any moisture that stays in the endoscope can become a breeding place for biofilm. Drying cabinets can help to dry surfaces, channels, or both. Using pass-through drying cabinets between decontamination and clean sides can help prevent contamination. Be sure to assess the drying cabinet's ability to dry surfaces and channels completely.

The clean room should be kept at a positive pressure as compared to the decontamination room, adjacent hallways, and other adjacent rooms. This ensures that air flows out of the room to the adjacent areas and keeps microorganisms from entering and contaminating the processed endoscopes. As discussed, ANSI/ASHRAE/ASHE Standard 170 Ventilation of Health Care Facilities provides guidance.

Figure 1 Pass thru automated systems give separation between loading of the cleaned endoscopes in decontamination and unloading of processed endoscopes on the clean side of the wall.

Attention to detail protects patients

Guidance for many healthcare processes is based on evidence and designed to offer practices that help reduce avoidable patient infections. The physical separation of dirty and clean processing environments is a globally recognized infection prevention best practice. Add to that some simple department practices that focus on the cleanliness of surfaces, PPE and processing equipment will help reduce the risk of recontamination and help to ensure patient-ready endoscopes for every procedure. HPN

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CONTINUING EDUCATION TEST • NOVEMBER 2022

Cross out cross contamination in endoscope processing

Circle the one correct answer:

1. **At which stage is the endoscope most contaminated?**
   a. Cleaning
   b. Inspection
   c. High level disinfection
   d. Drying
2. **Manual high level disinfection is preferred by all organizations**
   a. True
   b. False
3. **Why is drying prior to storage important?**
   a. It identifies leaks
   b. It prevents soils from touching the endoscope
   c. It helps kill microorganisms
   d. It prevents the formation of biofilms
4. **In which direction should endoscopes travel through processing?**
   a. From low to high contamination
   b. From high to low contamination
   c. From cleaning to leak testing
   d. From sterilization to cleaning
5. **What is connected to the endoscope when using an automated endoscope reprocessor?**
   a. Adapters
   b. Air / water valves
   c. Leak tester
   d. Syringe
6. **Which personal protective equipment can contaminate an endoscope?**
   a. Gloves
   b. Gown
   c. Face shield
   d. a and b
7. **What biofilm agent can be found in tap water?**
   a. Calcium
   b. Water
   c. Pseudomonas aeruginosa
   d. Staph. Aureus
8. **What can cause contamination in room air?**
   a. Lint
   b. Rinse water aerosolization
   c. External air
   d. All of the above
9. **What is the best way to prevent contamination between clean and dirty activities?**
   a. Putting distance between the activities
   b. Cleaning and disinfecting between activities
   c. Placing a barrier between activities
   d. Separating the activities in two buildings
10. **How do pass-through endoscope reprocessors prevent contamination?**
    a. Prevents staff from touching the endoscope
    b. Prevents staff exposure to disinfectants
    c. Separate loading of clean from unloading of disinfected endoscopes
    d. Separates drying from storage

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