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flexible scope dryer

Standards Related to Drying Scope Channels

AAMI ST91: 10.2 Storage of High-Level Disinfected Endoscopes

Before storage, the channel of the high-level disinfected endoscope should be dry to help prevent bacterial growth and the formation of biofilm. The endoscope should hang in a way to prevent damage to the scope and prevent the formation of moisture. Special care should be taken to avoid coiling of any part of the endoscope to reduce chances of any droplets forming within the channels. Endoscopes should be stored suspended vertically in a way to allow circulation of air. Endoscopes should hang freely. Caps, valves and other detachable components should not be installed on the endoscope during storage. Detachable parts that are to be reused (e.g., air/water and suction valves/pistons) should be processed together and stored with the specific endoscope as a unique set in order to allow traceability. Valves should be dried and lubricated according to the manufacturer's written IFU. Each scope should be identified with a tag or other means so that when it is pulled from storage, the user is able to verify that the scope has been processed and is ready for use.

AAMI ST91: Section 6

(The microbial quality of the rinse water will vary and may recontaminate the processed device (AAMI TIR34). To avoid recontaminating the device with the rinse water, the incoming AER water should be at least filtered using bacterial retentive filters as recommended in the AER manufacturer's written IFU. The water handling systems, which do not come into contact with the LCS/HLD solution, should be disinfected on a regular basis as directed by the manufacturer. Some AERs have self-disinfection cycles using either an LCS/HLD solution or thermal methods. The water filters should be changed per the manufacturer's written IFU. In addition, the endoscopes should be flushed with alcohol and purged with pressurized air prior to storage, as described in Section 5.7.4.3.)

AAMI ST91: 5.7.4.3 Manual Drying

Effective drying of endoscopes can reduce the risk of microbial contamination following high-level disinfection (e.g., recontamination of the endoscope by waterborne microorganisms during rinsing). Certain waterborne microorganisms, such as Pseudomonas aeruginosa, can pose an infection risk to a portion of the endoscopy patient population, especially those receiving a bronchoscopy procedure or endoscopic retrograde cholangiopancreatography (ERCP) procedure. Further, the presence of such microorganisms in conjunction with retained moisture can lead to the development of biofilms and further patient risk. This is a particular risk when tap water is used to rinse the endoscope following high-level disinfection.

Drying can be achieved by flowing air through all endoscopes channels for a specified period of time. Drying should be facilitated by using 70–80% ethyl or isopropyl alcohol. When using alcohol, personnel should follow the manufacturer's written IFU on the volume of alcohol and method to be used for each endoscope lumen and ensure any remaining alcohol is removed with medical-grade forced air until no visual signs of moisture remain (or as otherwise recommended by the endoscope manufacturer). Refer to the endoscope manufacturer's written IFU for guidance on correlating the force of air pressure in psi or other measure to channel size. The use of syringes to dry channels is not recommended. Thoroughly dry all removable endoscope parts. To reduce the risk of trapping liquid inside the instrument, do not attach these parts (such as valves) to the endoscope during storage. Valves (including rinsing valves) should stay with a named endoscope as a set to prevent cross-infection and enable full traceability.

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SGNA | Standards of Infection Prevention in Reprocessing Flexible Gastrointestinal Endoscopes

8. DRYING

Drying is a critical element in reprocessing. Moisture allows microorganisms to survive and multiply; therefore, all channels and the surface of the endoscope must be thoroughly dried before storage. Outbreaks of Pseudomonas aeruginosa, Acinetobacter spp., carbapenemase producing K pneumoniae, and other pathogens have been traced to inadequately dried endoscopes (Alfa, 2013; Carbonne et al., 2010; Kovaleva et al., 2013). Even when reprocessing steps are performed meticulously, a few microorganisms may survive HLD. Those few microorganisms can multiply to over a million colony-forming units in just a few hours if any moisture remains in the endoscope channels or on its surface (Miner, 2013).

Moisture also promotes biofilm development (Alfa, 2013; Kovaleva et al., 2013). Drying the endoscope after every reprocessing cycle, both between patient procedures and before storage, is a requisite practice crucial to the prevention of bacterial transmission and nosocomial infection. Drying is as important to the prevention of disease transmission and nosocomial infection as cleaning and HLD (Kovaleva et al., 2013; Muscarella, 2006).

Alfa and Sitter (1991) demonstrated that endoscopes that had been dried with compressed air for 2 minutes were colonized with over 10 million units of gram-negative bacteria after 48 hours of storage, but endoscopes that had undergone 10 minutes of forced air drying had no microbial growth after 48 hours.

Alcohol will displace water and evaporates more easily than water. Alcohol mixes with the remaining water on the channel surfaces and encourages evaporation of the residual water as air flows through the channel.

Store the alcohol in a closed container between uses. Alcohol evaporates rapidly when exposed to air, and the remaining solution may be too diluted to effectively promote drying of endoscope channels.

In order to ensure that endoscopes are thoroughly dried, they must be flushed with 70% to 90% isopropyl alcohol and dried with pressurized, filtered, air (either by AER or manually) (Kovaleva et al., 2013; Peterson et al., 2011; Rutala et al., 2008). Follow the manufacturer's instructions for specific AER, endoscope model, and channel.

a. Flush all channels with 70% isopropyl alcohol until the alcohol can be seen exiting the opposite end of each channel. Alcohol flushes should be used even when sterile water is used for rinsing.

b. Purge all channels with air.
   1. Use compressed air that has been filtered to remove microorganisms.
   2. Avoid the use of excessively high air pressure that can damage the internal channels of flexible endoscopes.

c. Remove all channel adapters.

d. Dry the exterior of the endoscope with a soft, clean, lint-free towel.

e. Thoroughly rinse and dry all removable parts. Do not attach removable parts (e.g., valves, etc.) to the endoscope during storage. Note that storage of endoscopes with the removable parts detached lowers therisk of trapping liquid inside the instrument and facilitates continued drying of the channels and channel openings.

f. Once there is confirmation that an endoscope has been properly reprocessed, it is suggested that a system exist for identifying scopes that are clean and ready to use (CDC, 2015).

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9. STORAGE

Endoscopes must be stored in an area that is clean, well-ventilated and dust-free in order to keep the endoscopes dry and free of microbial contamination. An endoscope that is not dry must be reprocessed before use. Endoscopes should also hang freely so that they are not damaged by physical impact. Endoscopes should be stored in accordance with the endoscope and storage cabinet manufacturers' IFU.

Two major types of storage cabinets exist: conventional cabinets and drying cabinets. Conventional cabinets are favored in the United States, and drying cabinets are used mainly in Europe and Australia.

Drying cabinets are designed to control air quality and humidity, and access to endoscopes (Courné & Geyssens, 2011; Foxcroft, Monaghan, & Faoagali, 2008; Grandval, Hautefeuille, Marchetti, Pineau, & Laugier, 2013; Pineau, Villard, Luu & Marchetti, 2008). They have bacteria-free air under pressure to keep surfaces dry. High efficiency particulate air (HEPA) filters provide microbial-free air that is blown through the endoscope channels to ensure that they remain dry.

Length of storage is a controversial issue. A number of researchers have investigated the safety of various lengths of storage (Brock et al., 2015; Foxcroft et al., 2008; Grandval et al., 2013; Ingram et al., 2013; Rejchrt, Cermak, Pavlatova, Mickova, & Bures, 2004; Riley, Beanland, & Bos, 2002; Vergis, Thomson, Pieroni, & Dhalla, 2007; Wardle, 2007).

The authors of a recent systematic review concluded that endoscopes can be stored for 7 days if they have been effectively reprocessed to remove all pathogens and almost all other microorganisms, and are stored in a way that keeps them completely dry and free from environmental and human contamination (Schmelzer, Daniels, & Hough, 2015).

Key considerations in storage include:

a. Use storage cabinets that are made of a material that can be disinfected.

b. In conventional storage, hang endoscopes in a vertical position (with caps, valves, and other detachable components removed) to prevent moisture accumulation and subsequent microbial growth. Make sure that they hang freely so they are not damaged by contact with one another.

c. When using drying cabinets, follow the cabinet manufacturer's instructions. Since drying does not rely on gravity, the endoscopes can be stored horizontally or vertically depending on the design of the cabinet.

d. Literature suggests that reusable buttons and valves should be reprocessed and stored together with the endoscope as a unique set for tracking purposes (BSG, 2014).

e. SGNA supports a 7-day storage interval for reprocessed endoscopes-but only if they were reprocessed and stored according to professional guidelines and manufacturer instructions.

Summary

Reprocessing of flexible gastrointestinal endoscopes according to the manufacturer's instructions and professional guidelines is critical to patient and staff safety. Understanding the reprocessing continuum from procedure room to storage is imperative. Diligence in the application of all reprocessing steps remains paramount in the safe delivery of endoscopic services.

SGNA supports further research in the areas of infection prevention that promote optimal and effective endoscope reprocessing. These areas include but are not limited to:

- Detergent efficacy against biofilm;
- Improved endoscope design;
- Clear and concise reprocessing steps;
- Most efficient drying methods;
- Water quality, and
- Standardized quality monitoring to validate effective cleaning and reprocessing.