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Standard Practice for Cleaning and Disinfection of Flexible Fiberoptic and Video Endoscopes Used in the Examination of the Hollow Viscera[1]

This standard is issued under the fixed designation F 1518; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This practice covers the flexible fiberoptic and video endoscopes that are fully immersible in liquid and are used in the examination of the hollow viscera (that is, colonoscopes, gastroscopes, duodenoscopes, sigmoidoscopes, and enteroscopes). These endoscopes will be referred to as flexible gastrointestinal (GI) endoscopes.

1.1.1 It is strongly recommended that only immersible endoscopes be used in order to assure that all parts of the endoscope will be high-level disinfected; however, it is recognized that, in some instances, portions of endoscopes that neither contact patients nor patient fluids may not be immersible. In these instances, care must be taken to disinfect the nonimmersible portions to the highest degree with which they are compatible, according to the manufacturer's directions.

1.2 This practice is intended to complement, not replace the instructions and labeling provided by product manufacturers. Endoscope manufacturers must provide instructions and labeling necessary for users to know the basic design, specifications, nomenclature, and components of specific flexible GI endoscopes and to properly inspect, prepare, use, clean, disinfect, rinse, dry, and store these instruments.

1.3 Endoscopic technique and the medical aspects of gastrointestinal endoscopy are not covered in this practice.

1.4 This practice details the steps necessary to properly reprocess flexible GI endoscopes and render them patient-ready.

1.5 This practice details manual reprocessing as well as automated reprocessing of flexible GI fiberoptic and video endoscopes.

1.6 The application of all practices relating to endoscopic reprocessing will ultimately fall into the purview of the individual assigned to that task in an endoscopic area.

1.6.1 To ensure the proper adherence to this practice, those personnel should themselves meet certain requirements as specified in 4.8.

1.7 This practice does not detail the steps necessary for the reprocessing of endoscopic accessories.

1.8 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.* Specific precautionary statements are given in Note 1 and Note 2.

2. Terminology

2.1 *Definitions of Terms Specific to This Standard:*

2.1.1 *clean, adj*—visibly free from debris.

2.1.2 *endoscope, n—flexible GI endoscope*, flexible fiberoptic or video endoscopes used in the examination of the hollow viscera (that is, colonoscope, gastroscope, duodenoscope, sigmoidoscope, and enteroscopes).

2.1.3 *High-Level Disinfectant*—A liquid chemical sterilant used under the same contact conditions as for sterilization except for a shorter contact time. A sterilant is a liquid chemical germicide, which has passed the AOAC sporicidal test with no failures; therefore, to qualify for a high-level disinfection claim, a germicide must be a sterilant as defined by the AOAC sporicidal test. In addition, the claim should be supported by efficacy data from potency tests, simulated-use tests, and in-use tests.

2.1.3.1 *Discussion*—A high-level disinfectant is a liquid chemical germicide cleared by FDA for market with a claim for high-level disinfection.

2.1.4 *high-level disinfected, adj*—devoid of all vegetative bacteria, viruses, and fungal spores and some but not all bacterial endospores.

2.1.5 *patient-ready endoscope, n*—an endoscope rendered clean after being subjected to a validated cleaning procedure, subjected minimally to a high-level disinfection process, and rinsed so that it does not contain residual chemicals in amounts that can be harmful to humans.

2.1.5.1 *Discussion*—It is recognized that in limited circumstances, portions of an endoscope that neither contact patient fluids nor contact the patient directly, may not be immersible (for example, ultrasound endoscopes). In these instances, care must be taken to disinfect the non-immersible portions of the endoscope to the highest degree with which they are compatible according to the manufacturer's directions.

2.1.6 *reprocessing, n*—the cleaning and high-level disinfection necessary to render an endoscope patient-ready.

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2.1.7 *reprocessing chemicals, n*—detergents and liquid chemical germicides used for reprocessing endoscopes.

2.1.8 *residual chemical, n*—freely extractable residual reprocessing chemicals in amounts that can be harmful to humans.

3. Summary of Practice

3.1 Each brand, type, and model of endoscope has unique specifications, nomenclature, interior design, function, and components.

3.2 Endoscopes used in gastrointestinal endoscopy are considered semi-critical medical devices because they normally only come into contact with mucous membranes.

3.3 To prevent the spread of microorganisms during endoscopy, semi-critical medical devices must receive scrupulous manual cleaning followed minimally by high-level disinfection.

3.4 Upon removal of the endoscope from the patient, the instrument should be manually cleaned followed by high-level disinfection, rinsing, and drying. If due to time constraints, it is not possible to complete the reprocessing immediately, the endoscope should be leak-tested, flushed, brushed, and allowed to soak in a detergent solution until it can be thoroughly reprocessed.

3.4.1 Follow the endoscope manufacturer's recommendations for the maximum liquid exposure time.

3.5 After cleaning and high-level disinfection, endoscopes must be stored in a manner that allows air to circulate around the endoscope.

3.6 Refer to the endoscope manufacturer's instructions for proper storage.

4. Significance and Use

4.1 Because endoscopes are used to diagnose disease in immunocompetent and immunocompromised individuals, care must be taken to ensure that only endoscopes that are patient-ready are used for each examination.

4.2 Endoscopy of patients with diagnosed or suspected infections such as hepatitis B or human immunodeficiency virus is not contraindicated. Further, endoscopes do not need to be dedicated for use in only these patients.

4.3 By nature of their design requirements, endoscopes are more difficult to reprocess than other medical instruments.

4.4 Endoscopes have long narrow internal channels making inspection for cleanliness difficult if not impossible.

4.5 Endoscopes made from elastomeric materials cannot be subjected to heat sterilization, thus requiring high-level disinfection or sterilization with compatible chemical agents. Contact the endoscope manufacturer for liquid chemical sterilant compatibility.

4.6 Each user needs to understand the specifications, nomenclature, function of component parts, and interior channel design of endoscopes in order to render them patient-ready.

4.7 Persons responsible for the reprocessing of endoscopes should follow this practice and associated labeling and instructions from manufacturers after each endoscopic procedure to ensure that the endoscope is patient-ready for the next patient.

4.8 Reprocessing of endoscopes should be the specific responsibility of appropriately trained personnel. Temporary employees without the requisite training should not be given these responsibilites.

4.8.1 The responsibility for this activity should not be delegated from person to person unless each has the appropriate credentials for the position.

4.8.2 Persons responsible for processing the endoscopes should have the ability to read, understand, and implement instructions from manufacturers and regulatory agencies as they relate to endoscopic disinfection.

4.8.3 Reprocessing personnel should have the opportunity to become completely familiar with the mechanical aspects of the endoscopic equipment. This should be done by study of the manufacturer's information, and demonstration by the manufacturer's representatives.

4.8.4 Reprocessing personnel should participate in an institutionally developed, competency-based training program dedicated to endoscope reprocessing.

4.8.4.1 The competency-based training program should incorporate currently published national standards, such as ASTM, SGNA, APIC, and ASGE.

4.8.5 Reprocessing personnel should be made fully aware of the potential chemical and infectious hazards for patients and health care personnel associated with the reprocessing of the endoscope.

4.8.5.1 Training should include a thorough background regarding the potential for negative patient outcomes resulting from lapses in compliance with written reprocessing guidelines.

4.8.5.2 Training should include a thorough background in infection control principles and concepts based on written in-house infection control procedures.

4.8.5.3 Training should include familiarization with Occupational Safety and Health Administration (OSHA) regulations and in-house policies regarding the appropriate and safe handling of liquid chemical reagents and equipment used during the reprocessing of the endoscopes. OSHA guidelines are directed only toward healthcare worker safety and health but also may benefit patient safety.

4.8.5.4 Training should include information on the safe handling of endoscopes contaminated with patient tissue and fluids. This should include familiarization with principles and practices of standard (Universal) precautions.

4.8.6 Each endoscopic unit should have appropriately motivated individuals with the proper educational background or experience, or both, to assume the responsibility for the reprocessing of endoscopes. Temporary employees without the requisite training should not be given this responsibility.

4.9 This practice is not intended to replace the cleaning and disinfection instructions provided by the manufacturers of the endoscope, endoscope disinfector, or chemicals used for cleaning and disinfection. Rather, it is to be used together with the manufacturer's instructions that provide specific instructions for specific products.

4.10 This practice is not intended to cover the endoscopic techniques, patient care, or other medical aspects of gastrointestinal endoscopy.

4.11 This practice does not include instructions for the use or reprocessing of endoscopic accessories.

5. Reagents

5.1 *Alcohol*—seventy percent isopropyl or seventy percent ethyl alcohol. Keep alcohol in a closed container. Alcohol stored in an open container is a fire hazard and may not remain effective because of evaporation. Do not reuse.

5.2 *Air*—Air flow provided by an air pump or compressor. Refer to the endoscope manufacturer's instructions and avoid using excessively high air pressure.

5.3 *Detergent*—Low-sudsing detergent formulations recommended by the manufacturer of the endoscopes.

5.4 *High-Level Disinfectant*—A liquid chemical germicide as defined in 2.1.3.

5.4.1 A high-level disinfectant is a liquid chemical sterilant used under the same contact conditions as for sterilization except for a shorter contact time. A sterilant is a liquid chemical germicide, which has passed the AOAC sporicidal test with no failures; therefore, to qualify for a high-level disinfection claim, a germicide must be a sterilant as defined by the AOAC sporicidal test. In addition, the claim should be supported by efficacy data from potency tests, simulated-use tests and in-use tests.

5.4.2 A high-level disinfectant is a liquid chemical germicide cleared by the FDA for market with a claim for high-level disinfection.

Subject valves and other removal parts to high-level disinfection by soaking in a basin of disinfectant, or if possible, place the valves and other removable parts in the designated accessory basket of the automated disinfector.

5.5 *Water*—Clean, potable water or potable water that has been filtered by passage through a 0.2-µm filter or otherwise treated by a method documented to improve the microbiological quality of the water.

6. Equipment and Supplies

6.1 *Reprocessing Adapters*—Adapters provided by the endoscope or disinfector manufacturer specifically for injecting fluids through the internal lumens of the endoscope, or for partially restricting or capping a lumen opening.

6.2 *Brushes*, must be high-level disinfected or disposed of after each use.

6.2.1 Cleaning brushes, of appropriate size and configuration, designed for use with specific endoscopes, and

6.2.2 Soft toothbrush or similar brush used for cleaning the exterior of the endoscope.

6.3 *Basin(s)*, must be large enough to totally immerse the endoscopes without coiling them too tightly. See the endoscope manufacturer's instructions for maximum coiling of specific endoscopes:

6.3.1 Cleaning basin, and

6.3.2 Disinfectant basin for soaking:

6.3.2.1 Nonmetal, and

6.3.2.2 Must include a tight-fitting lid to minimize escape of disinfectant vapors. This lid should be kept in place at all times except when transferring instruments into or out of the solution.

6.3.3 *Automated Disinfector*, must include a tight-fitting lid to minimize the escape of disinfectant vapors.

6.4 *Cloth*—Soft, lint-free cloth or sponge for wiping the exterior of the endoscope.

6.5 *Personal Protective Equipment*:

6.5.1 *Gloves*:

6.5.1.1 High-quality, impervious latex, butyl or nitrile rubber gloves should fit properly and be of adequate length to prevent skin exposure.

6.5.1.2 Gloves must be changed regularly as needed or as recommended by the manufacturer. They must be discarded if they are cracked, pealing, punctured, or when their ability to function as a barrier is compromised.

6.5.2 *Gowns*:

6.5.2.1 Impervious protective clothing must be worn when handling contaminated endoscopes and when working with liquid chemical germicides.

6.5.2.2 Gowns used during endoscope reprocessing must be removed prior to leaving the decontamination area.

6.5.3 Face masks or shields and protective eye gear should be worn to protect the face and eyes from contact with reprocessing chemicals and infectious material.

6.6 *Adequate Air Ventilation*—A large well-ventilated area with eight to ten air exchanges per hour is necessary to help protect personnel from chemical vapors.

7. Procedure

7.1 *Cleaning*:

7.1.1 Put on all necessary personal protective equipment.

7.1.2 Prepare detergent in accordance with the manufacturer's specifications.

7.1.3 Immediately after removing the endoscope from the patient:

7.1.3.1 Wipe all debris from the insertion tube using a soft lint free cloth and water to which you have added a lowsudsing detergent recommended by the endoscope manufacturer and diluted in accordance with the detergent manufacturer's instructions.

7.1.3.2 Place the distal end of the endoscope into the water and detergent solution and suction through the biopsy/suction channel until the exiting solution is visibly clean. Alternate suctioning detergent solution and air several times. Finish by suctioning air.

7.1.3.3 Flush or blow out air and water channels in accordance with the endoscope manufacturer's instructions.

7.1.4 Detach the endoscope from the light source and suction pump.

7.1.5 Take the endoscope to the reprocessing area. Put on all necessary personal protective equipment if this was not done in 7.1.1.

7.1.6 Attach any necessary water-tight caps to the electrical portion of the umbilicus.

7.1.7 Inspect and leak test the endoscope following the manufacturer's instructions.

7.1.7.1 Inspect the insertion tube and universal cord for damage and the bending section for deflection.

7.1.7.2 Leak test the endoscope to ensure the integrity of the water-tight design.

7.1.7.3 Follow the endoscope manufacturer's instructions if the instrument appears damaged.

7.1.8 Fill a sink or basin with a freshly made solution of water and a low-sudsing detergent recommended by the

endoscope manufacturer and diluted in accordance with the detergent manufacturer's instructions.

7.1.9 Immerse the endoscope. Wash all debris from the exterior of the endoscope by brushing and wiping the instrument while submerged in the detergent solution. Whenever practical, leave the endoscope submerged in detergent solution when performing all subsequent cleaning steps.

7.1.10 Detach the distal end hood if present and brush the distal tip with a small soft brush.

7.1.11 Detach the suction and air/water valves, the biopsy channel cover, and all other removable parts.

7.1.11.1 Discard those parts that are labeled as single-use disposable.

7.1.11.2 Use a small soft brush to scrub all reusable, removable parts.

7.1.11.3 Use a brush to clean inside all reuseable vavles and valve housings including but not limited to suction, air/water, and biopsy port openings as per manufacturer's instructions.

7.1.12 Brush the entire channel system that includes the body, the insertion tube, and the umbilicus of the endoscope in accordance with the manufacturer's instructions.

7.1.12.1 After each passage, rinse the brush before retracting it and before reinserting it.

7.1.12.2 Continue brushing until there is no debris visible on the brush.

7.1.13 Attach channel adapters for suction/biopsy, air, and water channels.

7.1.13.1 Cover the biopsy port in accordance with the instructions from the manufacturer of the endoscope.

7.1.13.2 Attach any cleaning devices provided for special features of the endoscope.

7.1.14 Flush all channels with detergent to remove dislodged debris.

7.1.15 Fill all channels with detergent solution and soak in accordance with the detergent manufacturer's instructions.

7.2 *Rinse After Cleaning*:

7.2.1 Rinse the endoscope and all removable parts in clean water.

7.2.2 Rinse all channels well with water to remove debris and detergent.

7.2.3 Purge water from all channels and wipe dry the exterior of the endoscope with a soft clean cloth to prevent dilution of the disinfectant chemical used in subsequent steps.

7.3 *Manual Disinfection*:

7.3.1 Follow all steps in accordance with 7.1 and 7.2 for thorough manual cleaning and rinsing of the endoscope prior to disinfection.

7.3.2 Prepare disinfectant in accordance with the disinfectant label. If the disinfectant solution is reused, it should be tested regularly in accordance with the manufacturer's instructions or the individual institution's protocol to ensure the minimum effective concentration of active ingredients.

7.3.3 Attach reprocessing adapters for suction/biopsy, air, and water channels.

7.3.3.1 Cover the biopsy port in accordance with the instructions from the manufacturer of the endoscope.

7.3.3.2 Attach any reprocessing devices provided for special features of the endoscope.

7.3.4 Completely immerse the endoscope in a basin of disinfectant.

7.3.5 Inject disinfectant into all channels of the endoscope until it can be seen exiting the opposite end of each channel. Take care that all channels are filled with disinfectant and that no air pockets remain within the channels.

7.3.6 Subject all valves and other removable parts to highlevel disinfection by soaking in the basin of disinfectant.

NOTE 1—**Caution:** In order to prevent damage to the endoscope, DO NOT soak any other accessory equipment with the endoscope.

7.3.7 Cover the disinfectant soaking basin with a tightfitting lid to minimize chemical vapor exposure.

7.3.8 Immerse the endoscope in the disinfectant for the the recommended time and temperature as indicated on the label of the disinfectant. Use a timer to ensure adequate immersion time.

7.3.9 Before completely removing the endoscope from the disinfectant, flush all channels with air to remove disinfectant.

7.4 *Rinse After Manual Disinfection*:

NOTE 2—It is suggested that all rinsing after disnfection should be done with water that has been filtered by passage through a 0.2 micron filter or otherwise treated by a method documented to improve the microbiological quality of water.

7.4.1 Thoroughly rinse the exterior of the endoscope with large amounts of clean water.

7.4.2 Thoroughly rinse all of the channels by flushing with large amounts of clean water.

7.4.3 Purge all channels with air.

7.4.4 Flush all channels with alcohol until the alcohol can be seen exiting the opposite end of each channel.

7.4.5 Purge all channels with air.

7.4.6 Remove the cleaning/disinfection adapters and devices.

7.4.7 Dry the exterior of the endoscope with a soft clean towel.

7.4.8 Thoroughly rinse and dry all removable parts. Do not attach removable parts (valves, etc.) to the endoscope prior to storage.

7.5 *Automated Disinfection*:

7.5.1 Check with the automated disinfector manufacturer to confirm the ability of the disinfector to disinfect a particular endoscope model or channel, or both.

7.5.2 Follow all steps in accordance with 7.1 and 7.2 for thorough manual cleaning and rinsing of the endoscope prior to disinfection.

7.5.3 Carefully insert the endoscope into the disinfector in accordance with the directions of the manufacturer of the automated disinfector .

7.5.4 Subject valves and other removable parts to highlevel disinfection by soaking in a basin of disinfectant or if possible place the valves and other removable parts in designated accessory basket of the automated disinfector.

NOTE 3—**Caution:** If the disinfector does not have dedicated space for accessories, in order to prevent damage to the endoscope DO NOT disinfect any other accessory equipment along with the endoscope.

7.5.5 Attach all channel connectors from the disinfector to the endoscope including those for special features of the

endoscope. Closely follow the directions provided by the manufacturer of the automatic disinfector.

7.5.6 If the machine has a wash or predisinfection cycle which uses detergent, use a formulation recommended by the manufacturer of the endoscope and disinfector. Dilute in accordance with the disinfector manufacturer's instructions.

7.5.7 Prepare disinfectant in accordance with the disinfectant label. If the disinfectant solution is reused, it should be tested regularly in accordance with the manufacturer's instructions or the individual institution's protocol to ensure the minimum effective concentration of active ingredients.

7.5.8 Set the machine for the time and temperature for the chosen disinfectant.

7.5.9 Start the machine and allow it to complete all cycles/phases.

7.6 *Drying*:

7.6.1 Flush all channels, with alcohol until the alcohol can be seen exiting the opposite end of each channel.

7.6.2 Dry all channels with air.

7.6.3 Remove the reprocessing adapters and devices.

7.6.4 Dry the exterior of the endoscope with a soft clean cloth.

7.6.5 Thoroughly rinse and dry all removable parts. Do not attach removable parts (valves, etc.) prior to storage.

7.7 *Storage*:

7.7.1 Do not attach the removable parts (valves, etc.) to the endoscope prior to storage.

7.7.2 Hang the endoscope vertically with the distal tip hanging freely in a well-ventilated, dust-free cabinet.

8. Keywords

8.1 cleaning; endoscope; flexible fiberoptic; high-level disinfection; reprocessing; video GI endoscopes

APPENDIX

(Nonmandatory Information)

X1. RATIONALE

X1.1 Manufacturers of endoscopic devices provide an operating manual for each type/model produced. These have not been standardized in the past. Professional organizations have produced guidelines for cleaning and disinfection which have also not been standardized. This has led to confusion among users of the devices as to how to properly care for the instrumentation.

X1.2 According to reports in the medical literature, many cases of patient infection or cross contamination are the result of "short cuts", breaks in proper reprocessing procedure, use of inappropriate chemicals, or a misunderstanding of the consequences of eliminating important steps of the reprocessing process.

X1.3 Avoid the use of excessively high air pressure. Highpressure air can damage the internal channels of flexible GI endoscopes. It is recommended that endoscope manufacturers publish the maximum allowable pressure for drying the internal channels of their instruments.

X1.4 *Low-Sudsing Detergents*—The presence of excessive suds can prevent good fluid contact with internal channels. Excessive suds will also inhibit the performance of some automated disinfectors.

X1.5 *High-Level Disinfectant*—The use of an improper disinfectant may result in unexpected disinfection outcome; for example, instrument is not high-level disinfected or is damaged.

X1.6 *Basin Size*—Coiling a flexible GI endoscope too tightly will damage the instrument. Refer to the endoscope manufacturer's instructions regarding the minimum radius of curvature.

X1.7 *Tight-Fitting Lid:*

X1.7.1 Disinfectant vapors can be irritating to personnel in the area.

X1.7.2 Exposure of patients and medical staff to disinfectant vapors should be minimized.

X1.8 *Soft, Lint-Free Cloth*—Abrasive materials will damage the endoscope. Lint may collect in or occlude the smaller internal channels of the endoscope.

X1.9 *Personal Protective Equipment:*

X1.9.1 Gloves and gowns help prevent the health-care worker from coming into contact with contaminated endoscopic equipment, patient secretions, blood, stool, and reprocessing chemicals, which may be irritating to the skin.

X1.9.2 Face masks and protective eye gear help prevent reprocessing chemicals from contacting the face or eyes.

X1.10 Immediate cleaning of flexible GI endoscopes prevents drying of organic material on the interior and exterior surfaces of the endoscope, removes large numbers of microorganisms from the endoscope, and is a necessary prerequisite to high-level disinfection.

X1.11 Alternate suctioning of fluid and air is more effective than suctioning fluid alone in removing debris.

X1.12 It is very important to either flush or blow out the small internal air and water channels of the endoscope immediately after the procedure. Debris that is allowed to dry in these channels both impedes the flow of air and prevents these channels from being adequately disinfected.

X1.13 Some types of electrical connectors are not water tight. These connectors must be capped prior to immersion in

order to prevent invasion of fluid into the connector and into the interior portions of the endoscope.

X1.14 The leak test detects damage to the interior or exterior of the endoscope that allows fluids to pass into areas inside the endoscope that would be damaged by fluid exposure. The leak test is done before immersion of the endoscope in reprocessing chemicals in order to minimize further damage to the endoscope.

X1.15 All removable parts must be removed to be completely cleaned. In addition, the areas underneath these parts must be brushed to remove debris.

X1.16 Thorough manual brushing is required to remove all organic debris such as blood, mucus, and feces. High-level disinfection can not occur unless the organic debris is removed.

X1.17 It is important that all internal channels of the endoscope be adequately filled with detergent and disinfectant solution. Channel reprocessing adapters and reprocessing adapters for special features of endoscopes are the only means of filling these channels. Internal endoscope channels offer various resistances to fluid flow due to differences in diameter and length. In order to achieve adequate flow through all channels, various adapters or channel restrictors may be required. Refer to the manufacturer's instructions for specifics.

X1.18 Channels must be irrigated to remove dislodged organic debris before disinfection.

X1.19 The concentration of the disinfectant chemical must be routinely monitored since it may become ineffective through dilution, organic load, or expired life.

X1.20 It is critical that all internal channels be subjected to high-level disinfection. Only by direct injection of a liquid chemical sterilant into these channels can all air pockets be eliminated.

X1.21 All internal channels of the endoscope must be emptied of disinfectant chemical and flushed with water to avoid the possibility of retained disinfectant chemical which could be injected into a patient during the next examination.

X1.22 Alcohol evaporates rapidly and facilitates the drying of endoscope channels.

X1.23 Storage of endoscopes with the removable parts detached lowers the risk of trapping liquid inside the instrument and facilitates continued drying of the channels and channel openings. To prevent the growth of waterborne organisms, the endoscope and all detached parts should be thoroughly dried prior to storage.

X1.24 If the reprocessing procedure is performed correctly, all internal channels should be devoid of water droplets. However, hanging the endoscope in a ventilated environment versus coiling it in a closed environment (such as a carrying case) will further discourage growth of any potential residual organisms.

X1.25 This practice represents current standard practice and is generic in nature. The steps in this practice may be modified should an alternate reprocessing procedure be developed and appropriately validated.

Bibliography

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