Infection Prevention and Control Guidelines for Anesthesia Care

Chapter XX: Equipment and Environmental Cleaning, Disinfection, and Sterilization

Introduction

The following guidelines outline essential practices for equipment and environmental cleaning, disinfection, and sterilization in healthcare settings. This information is not exhaustive; for comprehensive guidance, refer to the CDC *Guidelines for Disinfection and Sterilization in Healthcare Facilities*, as well as applicable federal, state, and local law and regulations, manufacturer recommendations, and facility policies and procedures.[1]

The following are general considerations for equipment and environmental cleaning and should not substitute review and adherence to previous referenced resources:

- **Policy Development**: Facilities should establish infection control policies specific to disinfection and sterilization of anesthesia equipment and monitor compliance regularly.[1-6]
- **Disinfectant Selection:** Use U.S. Environmental Protection Agency (EPA)-registered disinfectants according to manufacturer instructions regarding concentration, contact time, disposal, and safety.[7,8]
- **Cleaning Protocols**: Anesthesia equipment should be adequately cleaned prior to disinfection and sterilization.[3,5,6,8]
- **Staff Training**: Ensure staff are trained in proper cleaning and disinfection techniques, with regular competency assessments.
- **Environmental Practices**: Minimize personal equipment (e.g., stethoscopes) and belongings (e.g., jackets, backpacks, bags, purses, personal electronic devices) in the operating room and/or patient care areas to reduce contamination risks.[9]

Purpose

To provide guidance on disinfection, sterilization, and waste management practices in healthcare settings, with a focus on anesthesia-related equipment and procedures.

Audience

This resource is intended for Certified Registered Nurse Anesthetists (CRNAs), also known as nurse anesthesiologists or nurse anesthetists, other anesthesia providers, members of the interdisciplinary team, administrators involved in policy developed, and other interested stakeholders.

The Spaulding Disinfection and Sterilization Classification Scheme

The Spaulding scheme classifies disinfection and sterilization methods for medical equipment by the risk of infection involved.[1,2,10,11] View the details of the classification scheme in Table 1.

Table 1. Spaulding Disinfection and Sterilization Classification Scheme.

Device Classification	Device Example(s)	Process	Recommendation
Critical *Devices that enter sterile tissue, the vascular system, or through which blood flows.*	Surgical instruments, cardiac and urinary catheters, implants, and ultrasound probes used in sterile body cavities[1,11]	Sterilization[1,3,4,8,10-12]	• Sterilize between each patient use. • Use sterilization methods that destroy all vegetative bacteria, nonlipid viruses and bacterial spores. • Ensure thorough cleaning before sterilization. • Medical devices can be sterilized using chemical or physical properties depending on degree of contact with the patient. • Rinse with sterile water after chemical sterilization.[3] • Chemical germicides should be used rationally and in accordance with manufacturer recommendations and facility policy.
Semi-critical *Contact mucous membranes or non-intact skin.*	Anesthesia and respiratory therapy equipment, breathing circuits, endotracheal tubes, endoscopes, fiberoptic scopes, Magill forceps,	High-level disinfection[1,3,4,8,10-13]	• Clean thoroughly before disinfection. • Use FDA-approved high-level disinfectants that destroy all vegetative bacteria, mycobacteria, fungi, and viruses. • Rinse with sterile water after chemical disinfection. • Dry equipment using forced air or hanging to air

Device Classification	Device Example(s)	Process	Recommendation
	cystoscopes[1,11]		dry to prevent recontamination • Dry all equipment surfaces to prevent humidity from encouraging microorganism growth. • Follow manufacturer's instructions for disinfectant concentration and contact time. • Store in a clean, dry area to prevent recontamination. • Perform high-level disinfection between patient uses.
	Laryngoscope blades[1,11,13-23]		• Wrap laryngoscope blades individually. • If high-level disinfection is used, a closed plastic bag may be used for storage. If steam sterilized, a peel pack may be used for storage. • Partially remove the blade from the package, attach to light source without touching blade surface, and test. Manipulation of the blade onto the light source/handle can be tested without actually removing the blade from the bag or pack without touching the blade itself. • Following testing, insert the blade back into the package and return to a clean, dry area to prevent recontamination. • Apply this protocol to both reusable and disposable blades.
	Laryngoscope handles[1,11,13,14,18-21,23]		• At a minimum, use intermediate-level disinfection with EPA-registered hospital disinfectant to wipe the handle after use. • Ensure adequate contact time as specified by the disinfectant manufacturer. • After disinfection, store in a clean, dry area to

Device Classification	Device Example(s)	Process	Recommendation
			prevent recontamination. • Apply this protocol to both reusable and disposable handles. • Follow facility-specific policies and procedures for handle reprocessing. Some facilities may opt for high-level disinfection or sterilization based on risk assessment.
Non-critical *Contact intact skin.*	Patient Care Items: Electronic devices, stethoscopes, blood pressure cuffs, arm board, nametags, pulse oximeter sensors, head straps, monitor cables, blood warmers, medication administration pumps, carts, beds and monitors.[1,11]	Intermediate or low-level disinfection[1,11,12,24]	• Clean and disinfect between patients and when visibly soiled in accordance with manufacturer recommendations and facility policy. ○ Low and intermediate-level disinfection differs by disinfectant type, concentration, and exposure to pathogen. • Use EPA-registered hospital disinfectants appropriate for the item. • Stethoscopes may be cleaned with soap and water, then disinfected with 70% isopropyl alcohol. • Use protective covering for non-critical surfaces that are difficult to clean (e.g., keyboard covers). • Hydrogen peroxide gas decontamination is an effective sterilization method for reusable items that are difficult to clean.
	Environmental Surfaces: Bed rails, food utensils, bedside furniture, computer keyboards, floors, mobile devices.[1,11]	Low-level disinfection (unless otherwise noted)[1,11,12]	• Clean and disinfect between patients and when visibly soiled in accordance with manufacturer recommendations and facility policy. • Use EPA-registered hospital disinfectants appropriate for the item. • Use protective covering for non-critical surfaces

Device Classification	Device Example(s)	Process	Recommendation
			that are difficult to clean (e.g., keyboard covers).

Single-Use Devices and Reprocessed Disposable Equipment

- A single-use device (SUD) is a medical device intended for use on one patient during a single procedure. It is not designed or validated for reuse.[25,26] Studies have linked outbreaks of infection to improperly reprocessed medical devices.[1,27-30]
- Reuse of single-use devices may expose healthcare providers and facilities to additional liability.[31]
- The reprocessing of SUDs is regulated by the FDA. Only FDA-registered third-party reprocessors or healthcare facilities that comply with FDA regulations may reprocess SUDs.[25,26] Refer to the FDA for guidance and information on reprocessed single-use devices.[1,25,26]

To mitigate the incidence of outbreaks, it is recommended that healthcare facilities:

- Develop and implement policies to verify the cleanliness and functionality of reprocessed disposable equipment prior to use.[25,26]
- Disassemble, clean, dry, reassemble, repackage, and disinfect or sterilize reprocessed, disposable equipment prior to use as appropriate.[25,26]
- Train staff on the proper handling and use of reprocessed SUDs.

The Anesthesia Machine and Breathing System

Although there is no direct contact between the anesthesia workspace, anesthesia machine controls and the patient, microorganisms can be transferred between the machine and patient by the healthcare provider.[23,32-36] Refer to federal, state or local law and regulations and facility policies as well as specific manufacturer instructions for guidance concerning:[3,8]

- Cleaning and disinfecting the anesthesia machine.
- Pasteurizing or autoclaving of valves.

- Disassembling and disinfecting adjustable pressure-limiting valves.

Anesthesia Machine Surfaces and Carts[3,8,23,32-34,36-39]

- Clean and disinfect anesthesia machine surfaces, knobs, and touchscreens between cases and at the end of each day using an EPA-registered hospital-grade disinfectant appropriate for the surface material.
- Implement measures to protect materials stored on the anesthesia machine from inadvertent contamination by airborne debris or fluids (e.g., blood).
- Regularly remove equipment from drawers, clean and disinfect the drawer interiors according to manufacturer's instructions
- Replace or clean the covering on the top of the anesthesia cart at the beginning of each case to maintain a clean work surface
- For small surfaces that are not visibly soiled, 70% isopropyl alcohol can be used for intermediate-level disinfection. However, for surfaces with visible contamination, use an EPA-registered disinfectant appropriate for the type of contamination.
- Clean carbon dioxide and soda lime absorbent canisters when changing the absorbent. Remove debris from screens and follow manufacturer's instructions for cleaning and maintenance.

Anesthesia Breathing System

Consult the manufacturer's user manual for specific cleaning recommendations for the breathing system.

Filters[3,8,12,40-42]

Breathing system filters are single-use items evaluated by their bacterial filtration efficiency (BFE) and viral filtration efficiency (VFE).[8,41] Bacterial filtration is generally more effective than viral filtration.[3,8] Filters may prove problematic during spontaneous respiration due to increased resistance to air flow.[3] While routine use of breathing system filters is not recommended due to inconclusive data on infection risk reduction, they should be used for patients with known respiratory infections (e.g., *Myobacterium. tuberculosis* infection).[3,12]

- Consider placing high-efficiency filters on both inspiratory and expiratory limbs of the breathing circuit to protect both the patient and the anesthesia machine

- Filters may be placed between the endotracheal tube and the Y-piece.
- Use circuit filters and perform post-anesthesia machine disinfection after caring for patients with known pulmonary infections or trauma.

Carbon Dioxide Absorbers[3,8,40,42]

- Follow manufacturer instructions for disassembly, cleaning, and sterilization of carbon dioxide absorbers.
- Clean canisters when changing the absorbent and remove debris from screens.
- Discard disposable plastic canisters after use.
- Periodically clean and disinfect bellows, unidirectional valves, and carbon dioxide absorbers.

Circuits[1,3,8,41]

Anesthesia circuits may be single-patient use or multiple-patient use. For multiple-patient use circuits, place a new breathing system filter between the Y-piece and endotracheal tube after sterilization or high-level disinfection. Anesthesia professionals should pay close attention to anesthesia circuit product labeling.

- At a minimum, provide high-level disinfection for multiple-patient use breathing circuits.
  - If available, ultrasonic cleaning is effective.
- Disinfect the outer surface of the circuit between each use.
- Change end-tidal carbon dioxide tubing between patients.
- After anesthesia care for a patient with pulmonary infection or trauma, disinfect both internal and external components of the anesthesia machine's respiratory system.

Heat and Moisture Exchangers[41,43-45]

- Heat and moisture exchangers alone are not effective in preventing microorganism transmission to the anesthesia breathing system.

Supraglottic Airway Devices[21,46-52]

- If possible, use disposable single-use laryngeal mask airways (LMAs) due to the difficulty in completely removing protein deposits from reusable LMAs.
- If using reusable LMAs, rinse and soak in enzymatic detergent before autoclaving to remove occult blood.
    - Numerous studies have demonstrated that protein deposits are extremely difficult to eradicate completely from reusable LMAs.
- Consult manufacturer instructions for cleaning and sterilizing supraglottic airway devices.

Equipment Considerations for Special Patient Populations

Creutzfeldt-Jakob Disease[3,12,53-62]

Creutzfeldt-Jakob Disease (CJD) is caused by prions, which are highly resistant to conventional sterilization methods. To properly disinfect equipment, consult the following recommendations:

- If lumbar puncture is being performed, limit the number of clinicians in the room to those who are essential.
- Attach a HEPA grade filter directly to the endotracheal tube.
- The gas sampling line leading to the respired gas analyzer should be connected only to the sampling port on the circuit side of the HEPA filter.
- Use disposable, single-use equipment whenever possible for patients with known or suspected CJD. Incinerate this equipment after use.
- For reusable equipment:
    - Destroy or quarantine laryngoscopes, supraglottic airway devices, and other instruments that have come into contact with high-risk tissues (e.g., spinal cord, eye).
    - Safely discard devices that are difficult or impossible to clean thoroughly.
- For instruments that must be reprocessed:
    - Clean thoroughly to remove visible contamination before sterilization.
    - Steam sterilize using one of the following methods:
        - Gravity displacement sterilizer: 132°C for 60 minutes
        - Prevacuum sterilizer: 134°C for 18 minutes
        - Alternative method for heat-sensitive instruments:

- Immerse in 1N sodium hydroxide for 1 hour at room temperature, rinse with water, then autoclave at 121°C for 30 minutes

- For noncritical items and environmental surfaces:
  - Decontaminate with 1N sodium hydroxide or sodium hypochlorite (i.e. bleach) at room temperature for 1 hour.
- Anesthesia machines used for CJD patients should undergo thorough decontamination, including disposal of the breathing circuit and carbon dioxide absorbent.
- Consult the CDC recommendations for best infection control practices when working with patients with CJD.

Tuberculosis[3,63-67]

- Wear N95 respirators or higher-level respiratory protection.
- Place a HEPA filter between the breathing circuit Y-piece and patient's airway device.
- Perform high-level disinfection or sterilization on reusable equipment contacting patient's respiratory tract. Follow manufacturer's cleaning and sterilization instructions.
- Replace breathing circuit, reservoir bag, and carbon dioxide absorber after use.
- Routine anesthesia equipment culturing not recommended.

Environmental Surfaces

Healthcare facilities should establish and implement a comprehensive environmental cleaning and disinfection policy. This policy should specify:[2,68-73]

- Frequency and level of disinfection (e.g., high-level, low-level)
- List of EPA-registered disinfectants approved for use in the facility
- Staff training on proper cleaning and disinfection techniques
- Procedures for monitoring compliance and performance improvement

Cleaning and disinfection practices:[2,68,69,71-74]

- Procedures for monitoring compliance and performance improvement
- Clean and disinfect environmental surfaces to reduce transmission of HAIs from surfaces to providers and patients.

- Clean and disinfect anesthetizing locations and equipment surfaces (e.g., IV pumps, monitors, point-of-care devices, fluid warmers, forced air warmers) between patient cases and at the end of each day in accordance with facility policy.
- Follow manufacturer's recommendations for disinfectant use, contact time, and disposal.
- Place items that may be used during the next case on clean surfaces.

Product selection and use:[68,69,71-74]

- Use EPA-registered hospital-grade disinfectants appropriate for the surface and suspected pathogens.
- Ensure proper contact time is maintained for effective disinfection.

Follow CDC recommendations for Standard Precautions and Transmission-Based Precautions.[69,75]

Linens and Disposable Drapes[76-78]

- Handle linens and disposable drapes in a manner that minimizes the transfer of blood and microorganisms.
- Handle contaminated laundry as little as possible. Avoid unnecessary agitation of used linens to prevent aerosolization of pathogens.
- Place and transport the laundry in labeled or color-coded bags or containers.
- Do not sort or rinse contaminated laundry in patient care areas. Avoid body contact with soiled items; use appropriate PPE.
- Place and transport contaminated laundry in leak-resistant bags or containers.
- When using Standard Precautions, alternative labeling or color-coding is acceptable if it allows all personnel to recognize the containers as requiring compliance with precautions
- Store clean, laundered items in a clean, dry area to prevent contamination

Biohazardous Waste Management[69,79-84]

Biohazardous waste refers to any item that is contaminated with infectious or potentially infectious materials. Sharps disposal is of particular concern due to the potential for injury when handling (e.g., needles, scalpel blades, drill bits, glass items).

- Dispose of all regulated waste in specified biohazard waste receptacles following federal, state, and local law and regulations.
- If a biohazardous waste container becomes contaminated, place the container inside of another biohazardous waste container.
- Consult relevant EPA and OSHA documents for specific guidance.

Single-Use Items

- Discard disposable single-use devices (e.g., breathing circuits, airway devices, orogastric tubes) in a biohazardous bag/container immediately after use.

Reprocessed Items

- Place items for reprocessing in a designated container immediately after use.
- Close containers before removing from the anesthetizing location.

Sharps Management

- Sharps include any device that may puncture skin (e.g., needles, syringes, scalpels, lancets, blades, glass).
- Use safety-engineered devices when possible.
- Do not bend or recap contaminated needles. If recapping is absolutely necessary, use a one-handed technique or mechanical device.
- Discard sharps immediately in a closeable, puncture-resistant, leak-proof container.

Drug Disposal

- Follow facility policy and applicable federal, state, and local law and regulations for disposal of partially remaining drugs in vials, ampules, syringes, and IV bags.
- Consider using EPA-registered pharmaceutical waste containers for certain medications.

The *Infection Control Guide for Certified Registered Nurse Anesthetists* was adopted by the AANA Board of Directors in 1992 and revised in 1993, 1997, November 2012. In February 2015, the AANA Board of Directors archived the guide and adopted the *Infection Prevention and Control Guidelines for Anesthesia Care*.

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