Guidelines for Selection and Use of Disinfectants

Ref: (a) APIC Guidelines for Infection Control Practice, American Journal of Infection Control; April 1990, Vol 18, 99-113.

To assist health care professionals in their decisions involving the judicious selection and proper use of specific disinfectants. Cleaning, disinfection, or sterilization is indicated on the basis of the items intended use.

- Sterilization is the complete elimination or destruction of all forms of microbial life. It is accomplished in the hospital by either physical or chemical processes. Steam under pressure, dry heat, ethylene oxide gas and liquid chemicals are the principle sterilizing agents used in the hospital.
- Disinfection describes a process that eliminates many of all pathogenic microorganisms on inanimate objects with the exception of bacterial spores. This is generally accomplished by the use of liquid chemicals or wet pasteurization in health care settings. The efficacy of disinfection is affected by a number of factors; each of which may nullify or limit the efficacy of the process. Some of the factors that have been shown to affect disinfection efficacy are the prior cleaning of the object, the organic load on the object, the type and level of microbial contamination, the concentration of and exposure time to the germicide, the physical configuration of the object and the temperature and pH of the disinfection process. The levels of disinfection are defined as sterilization, high-level disinfection, intermediate-level disinfection, and low-level disinfection. High-level disinfection can be expected to destroy all microorganisms with the exception of high numbers of bacterial spores. Intermediate-level disinfection inactivates Mycobacterium tuberculosis, vegetative bacteria, most viruses and most fungi, but, does not necessarily kill bacterial spores. Low-level disinfection can kill most bacteria, some viruses and some fungi, but, cannot be relied onto kill resistant microorganisms or bacterial spores.
- Cleaning is the removal of all foreign material (i.e., soil, organic material) from objects. It is normally accomplished with water, mechanical action, and detergents. Cleaning must precede disinfection and sterilization procedures.
- Germicide is an agent that destroys microorganisms, particularly pathogenic organisms (germs).
- Chemical sterilants are chemicals used for the purpose of destroying all forms of microbial life, including fungal and bacterial spores.
- Disinfectant is a germicide that inactivates virtually all recognized pathogenic microorganisms, but, not necessarily all microbial forms on inanimate objects.
- Antiseptic is a chemical germicide formulated for use on skin or tissue and should not be used to decontaminate inanimate objects.

Instruments and items for patient care are divided into three (3) categories on the basis of the degree of risk of infection involved in the use of the items. The three categories of items are: critical, semi-critical, and non-critical.

- Critical items are objects that enter sterile tissue or the vascular system. These items present a high risk of infection if the item is contaminated with any microorganism, including bacterial spores. Critical items must be sterile. This category includes surgical instruments, cardiac and

urinary catheters, implants, and needles. Items in this category should be purchased as sterile or be sterilized by steam under pressure if possible. If heat labile, the object may be treated with ethylene oxide, or if other methods are unsuitable, a chemical sterilant. The following table lists several germicides categorized as chemical sterilants. Chemical sterilants can be relied on to produce sterility only if adequate cleaning precedes treatment and if proper guidelines as to organic load, contact time, temperature and pH are met.

- Semi-critical items are those objects which come in contact with mucous membranes or with skin that is not intact. These items must be free of all microorganisms, with the exception of high numbers of bacterial spores. Respiratory therapy and anesthesia equipment, endoscopes, diaphragm--fitting rings and vaginal probes are included in this category. Semi-critical items, generally, require high-level disinfection with the use of wet pasteurization or chemical germicides. Glutaraldehyde (Cidex), stabilized hydrogen peroxide, chlorine and chlorine compounds are dependable high-level disinfectants. Refer to the following table for methods. The exposure time required to achieve high-level disinfection is 20 minutes or more. A sterile water rinse after disinfection is required to prevent contamination with tap water organisms.
- Non-critical items come in contact with intact skin, but, not with mucous membranes. Intact skin acts as an effective barrier to most microorganisms and sterility is not critical. Examples of non-critical items include bedpans, blood pressure cuffs, crutches, bed rails, linens and patient furniture. Low-level disinfectants listed in the following table may be used for cleaning non-critical items.

RECOMMENDATIONS

Cleaning, disinfecting, and sterilizing patient equipment: All objects to be high-level disinfected or sterilized should first be thoroughly cleaned to remove all organic matter (i.e., blood tissue) and other residue.

Indications for sterilization and high-level disinfection:

- Critical medical devices or patient care equipment that enters normally sterile tissue or the vascular system or through which blood flows should be sterilized before each use.
- Endoscope accessories: Biopsy forceps or other cutting instruments that break the mucosal barrier should be sterilized. Other endoscope accessories (i.e., suction valves) should be sterilized after each patient use; if this is not feasible, they should receive at least high-level disinfection.
- Laparoscopes, arthroscopes, and other scopes that enter normally sterile tissue should be subjected to a sterilization procedure before each use, if this is not feasible, they should receive at least high-level disinfection. Disinfection should be followed by a rinse with sterile water.
- Equipment that touches mucous membranes (i.e., endoscopes, endotracheal tubes, anesthesia breathing circuits and respiratory therapy equipment) should receive high-level disinfection.

Chemical methods for sterilization are listed in the following table. When sterilization is indicated and other sterilization methods (steam or ethylene oxide) cannot be used, anyone of three chemical sterilants may be employed. Follow the manufacturers instructions for use and recommended exposure time.

Selection and use of high-level disinfectants for semi-critical patient care items:

- Solutions containing glutaraldehyde, hydrogen peroxide, chlorine and chlorine dioxide can achieve high-level disinfection if the objects are properly cleaned. The disinfectant or

chemical sterilant selected should have no or minimal deleterious effects on the object (chlorine may corrode metals).

- The longer the exposure of an item to a disinfectant, the more likely it is that all contaminating microorganisms will be inactivated. With extended exposure to a disinfectant it is also, more likely that delicate and intricate instruments, such as endoscopes may be damaged. Medical equipment, such as endoscopes which are difficult to clean and disinfect because of narrow channels or other areas that can harbor organisms (i.e., crevices, joints) should be exposed to a high-level disinfectant for at least 20 minutes at room temperature after cleaning.

Selection and use of disinfectants for non-critical patient care items.

- Solutions for use on non-critical patient care equipment and recommended concentrations are listed in the following table.
- The contact time is 10 minutes or less.
- Phenolics should not be used to clean infant bassinets and incubators.

Processing HIV or HBV contaminated patient care equipment.

- Standard sterilization and disinfection procedures for patient care equipment are adequate to sterilize or disinfect instruments or devices contaminated with blood or other body fluids from persons infected with bloodborne pathogens, including HIV.
- Non-critical environmental surfaces contaminated with blood or bloody body fluids should be cleaned before an EPA registered disinfectant/detergent is applied for disinfection. Persons cleaning spills should wear disposable gloves.

Methods of sterilization and disinfection (Table)

	Sterilization		Disinfection		
	Critical items (will enter tissue or vascular system or blood will flow through them)		*High-level (semi-critical items; will come in contact with mucous membrane or non-intact skin)*	*Intermediate-level (some semi-critical items[a] and non-critical items)*	*Low-level (non-critical items; will come in contact with intact skin)*
Object	**Procedure**	**Exposure Time (hr)**	**Procedure (exposure time ≥ 20 min)[b,c]**	**Procedure (exposure time ≤ 10 min)**	**Procedure (exposure time ≤ 10 min)**
Smooth, hard surface[a]	A	MR	C	H	H
	B	MR	D	J	I
	C	MR	E	K	J
	D	6	F[d]		K
	E	6	G		L
Rubber tubing and catheters[c]	A	MR	C		
	B	MR	D		
	C	MR	E		
	D	6	F[d]		
	E	6			
Polyethylene tubing and catheters[c,e]	A	MR	C		
	B	MR	D		
	C	MR	E		
	D	6	F[d]		
	E	6			
Lensed instruments	B	MR	C		
	C	MR	D		
	D	6	E		
	E	6			
Thermometers (oral and rectal)[f]				H[f]	
Hinged instruments	A	MR	C		
	B	MR	D		
	C	MR	E		
	D	6			
	E	6			

Modified from Rutala WA: In Wenzel RP, ed. *Prevention and control of nosocomial infections*, Baltimore, 1987, Williams & Wilkins, pp 257-282. And from Simmons BP: *Am J Infect Control* 11:96-15, 1983.

A. Heat sterilization, including steam or hot air (see manufacturer's recommendations).
B. Ethylene oxide gas (see manufacturer's recommendations).
C. Glutaraldehyde-based formulations (2%). (A glutaraldehyde-phenate formulation at full strength also has been shown to sterilize items that are soaked for 6 ¾ hours. Caution should be exercised with all glutaraldehyde formulations when further in-use is anticipated.)
D. Demand-release chlorine dioxide (will corrode aluminum, copper, brass, series 400 stainless steel, and chrome, with prolonged exposure).
E. Stabilized hydrogen peroxide 6% (will corrode copper, zinc, and brass).
F. Wet pasteurization at 75º C for 30 minutes after detergent cleaning.
G. Sodium hypochlorite (1000 ppm available chlorine; will corrode metal instruments).
H. Ethyl or isopropyl alcohol (70% to 90%).
I. Sodium hypochlorite (100 ppm available chlorine).
J. Phenolic germicidal detergent solution (follow product label for use-dilution).
K. Iodophor germicidal detergent solution (follow product label for use-dilution).
L. Quarternary ammonium germicidal detergent solution (follow product label for use-dilution).
MR Manufacturer's recommendations.

[a] See text for discussion of hydrotherapy.
[b] The longer the exposure to a disinfectant, the more likely it is that all microorganisms will be eliminated. Ten minutes' exposure is not adequate to disinfect many objects, especially those which are difficult to clean, because they have narrow channels or other areas that can harbor organic material and bacteria. Twenty minutes exposure may be he minimum time needed to reliably kill *M. tuberculosis* with glutaraldehyde.
[c] Tubing must be completely filled for disinfection; care must be taken to avoid entrapment of air bubbles during immersion.
[d] Pasteurization (washer disinfectior) of respiratory therapy and anesthesia equipment is a recognized alternative to high-level disinfection. Some data challenge the efficacy of some pasteurization units.
[e] Thermostability should be investigate when indicated.
[f] Limited data suggest that at least 20 minutes exposure time is necessary. Do not mix rectal and oral thermometers at any stage of handling or proccessing.