Antiseptics and sterilization methods

By Stephanie Saridakis, DO, and Morgan Amigo, MD

Antiseptics						
Agent	**Mechanism**	**Onset**	**Advantages**	**Disadvantages**	**Residual activity**	**Comments**
Alcohol (isopropyl and ethanol) 70%=optimal strength	Denatures proteins (bacterial cell walls)	Fastest (Skin must remain wet for 2 min for max effect)	Broad antimicrobial coverage: G(+), G(-), mycobacteria, fungi, and many viruses	Inactive against spores and some nonenveloped viruses. Not effective for soiled hands.	None, dissipates upon evaporation	• Inexpensive, but flammable!
Chlorhexidine (2-4%)	Disrupts cell membranes	Fast	Broad antimicrobial coverage: G(+), G(-), mycobacteria, fungi, and viruses. Blood/sputum do not inactivate.	Inactive against spores; Risk of ototoxicity and keratitis/conjunctivitis. Risk of contact urticaria, ICD, and ACD. Anaphylaxis rare.	#1 overall (>6 h, even when wiped from field; binds to stratum corneum)	• Longest acting
Chlorhexidine-isopropyl alcohol combination (Typically, 2% CHG and 70% isopropyl alcohol)	Denatures cell walls, disrupts cell membranes	Fast	Improved broad spectrum coverage: G(+), G(-), mycobacteria, fungi, and viruses	Inactive against spores; ototoxic and ocular toxicity risk (CHG). Supplied as single-use applicator.	48 h	• Provides both short- and long-term effects • More effective than povidone-iodine
Chloroxylenol (PCMX)	Deactivates enzymes, alters cell walls	Intermediate	Fairly broad-spectrum: G(+) > G(-), mycobacteria, and viruses	Decreased efficacy in presence of organic materials.	Several hours; still not as long-lasting as CHG	• Ineffective against *Pseudomonas* unless combined with chelating agent like EDTA
Hexachlorophene	Inactivates enzymes	Slow	Strong effect against G(+) cocci	Ineffective against G(-), fungi and mycobacteria. Neurotoxic in infants; teratogen.	Modest	• No longer in use • High skin absorption
Iodine and Iodophors (e.g., Povidone-iodine)	Oxidation leads to disruption of protein synthesis and cell membranes	Fast (Must wait for it to dry to be effective)	Very broad coverage: G(+), G(-), bacterial spores, mycobacteria, fungi, and viruses	Skin irritation and discoloration. Inactivated by blood and sputum. ACD/ICD risk. Chronic maternal use → risk of neonatal hypothyroidism	Minimal, especially if wiped from skin	• May cross-react with iodine in radiocontrast media and iodides in medications • Stains fabrics
Quaternary ammonium compounds (e.g., Benzalkonium)	Induces leaks in cytoplasmic membranes	Slow	G (+) and lipophilic viruses	Ineffective against G(-), mycobacteria and fungi; inactivated by organic materials and cotton gauze. ACD risk > ICD	Good	• Also found in cosmetics and ophthalmic solutions
Triclosan	Alters cytoplasmic membrane and synthesis of RNA, fatty acids, and proteins	Fast	Broad coverage: G (+), mycobacteria, and candida; not inactivated by organic material	Ineffective against G(-) and filamentous fungi	Good	• FDA banned use in certain OTC antiseptic products for use in health care setting
Soap and water	Detergent; removes dirt, organic substances; disinfects.	Very rapid	Highly effective against *C. Difficile* and Norwalk virus	Skin irritation	None	• Most appropriate for soiled hands

Additional Considerations:

- Antiseptic solutions may become contaminated and support bacterial growth (e.g., *Serratia* colonizing chlorhexidine bottles) leading to infection
- Do not shave prior to procedures, it is best to use clippers and/or chemical depilatories right before procedure. However, lowest risk of infection when hair is left intact within the surgical field.
- Hand hygiene: alcohol or alcohol plus chlorhexidine reduces bacterial counts the most.

Abbreviations:

ACD = Allergic contact dermatitis
G (+) = Gram positive
h = Hours
OTC = Over-the-counter
CHG = Chlorhexidine gluconate
G (-) = Gram negative
ICD = Irritant contact dermatitis
PCMX = Parachlorometaxylenol

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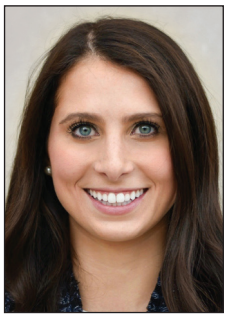

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Sterilization methods:			
Method	**Advantages**	**Disadvantages**	**Settings**
Steam autoclave	• Most popular in office setting • Easiest/safest	• Corrosive → may dull sharp instruments	• Specific settings required (20-30 min at 2atm pressure & 121ºC)
Chemiclave	• Lower humidity than steam, therefore less damage to sharp instruments	• PPE & ventilation, cannot be used in small spaces	• Special chemical required (mixture of formaldehyde, methyl ethyl ketone, acetone, and alcohols)
Dry heat (oven)	• Inexpensive • No risk to instruments	• Cannot use cloth, paper, or plastic	• High temperature, longer duration (1h at 171 ºC; 6h at 121 ºC)
Gas sterilization	• Mostly used in hospitals since better for large volumes • Effective for heat and moisture-sensitive instruments	• Expensive equipment • Toxic and mutagenic gas	• Longer durations (1 day for paper, 7 days for polyvinyl chloride)
Cold sterilization (glutaraldehyde or ortho-phthalaldehyde solutions)	• Simple and inexpensive • Used for heat-sensitive equipment	• ACD risk due to glutaraldehyde • Not recommended as only method; instruments must be used immediately, cannot be wrapped • Not always effective against bacterial spores (ortho-phthalaldehyde has greater sporicidal activity) or hepatitis B virus	

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