

11.10 Other agents

More than 100 years after Semmelweis demonstrated the impact of rinsing hands with a solution of chlorinated lime on maternal mortality related to puerperal fever, Lowbury and colleagues⁴⁰³ studied the efficacy of rubbing hands for 30 seconds with an aqueous hypochlorite solution. They found that the solution was no more effective than rinsing with distilled water. Rotter⁴⁰⁴ subsequently studied the regimen used by Semmelweis, which called for rubbing hands with a 4% hypochlorite solution⁴⁰⁵ until the hands were slippery (approximately 5 minutes). He found that the regimen was 30 times more effective than a 1-minute rub using 60% isopropanol. However, because hypochlorite solutions tend to be very irritating to the skin when used repeatedly and have a strong odour, they are seldom used for hand hygiene today. A number of other agents are being evaluated by the FDA for use in antiseptics related to health care.¹⁹⁸ However, the efficacy of these agents has not been evaluated adequately for use in hand hygiene preparations intended for use by HCWs. Further evaluation of some of these agents may be warranted. Products that utilize different concentrations of traditional antiseptics (e.g. low concentrations of iodophor) or contain novel compounds with antiseptic properties are likely to be introduced for use by HCWs. For example, preliminary studies have demonstrated that adding silver-containing polymers to an ethanol carrier (Surfacine) results in a preparation that has persistent antimicrobial activity on animal and human skin.⁴⁰⁶ A unique chlorhexidine-loaded, nanocapsule-based gel showed immediate bactericidal effect, comparable to isopropanol 60% v/v against aerobic bacteria; surviving anaerobic bacteria were significantly lower compared with ethanol-based gel 62% v/v. Persistent bactericidal effect was observed throughout the 3-hour test period. The immediate and sustained antibacterial effect was explained by an efficient chlorhexidine carrier system which improved the drug targeting to bacteria.⁴⁰⁷ The clinical significance of these findings deserves further research. New compounds with good in vitro activity must be tested in vivo to determine their abilities to reduce transient and resident skin flora on the hands of caregivers.

11.11 Activity of antiseptic agents against spore-forming bacteria

The increasing incidence of *C. difficile*-associated diarrhoea in health-care facilities in several countries, and the occurrence in the USA of human *Bacillus anthracis* infections related to contaminated items sent through the postal system, have raised concerns about the activity of antiseptic agents against spores. The increasing morbidity and mortality of *C. difficile*-associated disease in the USA, Canada, and some European countries since 2001 has been especially attributed to more frequent outbreaks and the emergence of a new, more virulent strain (ribotype 027).⁴⁰⁸ Epidemic strains differ among countries: for instance, while in Canada and the Netherlands ribotype 027 is predominant, the United Kingdom detected three different strains (ribotype 001, 027 and 106) responsible for 70% of *C. difficile*-associated diarrhoea.⁴⁰⁹⁻⁴¹⁷

Apart from iodophors, but at a concentration remarkably higher than the one used in antiseptics,³⁷³ none of the agents (including alcohols, chlorhexidine, hexachlorophene, chloroxynol, and

triclosan) used in antiseptic handwash or antiseptic handrub preparations is reliably sporicidal against *Clostridium* spp. or *Bacillus* spp.^{287,339,418,419} Mechanical friction while washing hands with soap and water may help physically remove spores from the surface of contaminated hands.^{110,420,421} This effect is not enhanced when using medicated soap.⁴²⁰ Contact precautions are highly recommended during *C. difficile*-associated outbreaks, in particular, glove use (as part of contact precautions) and handwashing with a non-antimicrobial or antimicrobial soap and water following glove removal after caring for patients with diarrhoea.^{422,423} Alcohol-based handrubs can then be exceptionally used after handwashing in these instances, after making sure that hands are perfectly dry. Moreover, alcohol-based handrubs, now considered the gold standard to protect patients from the multitude of harmful resistant and non-resistant organisms transmitted by HCWs' hands, should be continued to be used in all other instances at the same facility. Discouraging their widespread use, just because of the response to diarrhoeal infections attributable to *C. difficile*, will only jeopardize overall patient safety in the long term.

The widespread use of alcohol-based handrubs was repeatedly given the major blame for the increase of *C. difficile*-associated disease rates because alcohol preserves spores and is used in the laboratory to select *C. difficile* spores from stools.^{424,425} Although alcohol-based handrubs may not be effective against *C. difficile*, it has not been shown that they trigger the rise of *C. difficile*-associated disease.⁴²⁶⁻⁴²⁹ *C. difficile*-associated disease rates began to rise in the USA long before the wide use of alcohol-based handrubs.^{430,431} One outbreak with the epidemic strain REA-group B1 (≈ribotype 027) was successfully managed while introducing alcohol-based handrub for all patients other than those with *C. difficile*-associated disease.⁴²⁷ Furthermore, abandoning alcohol-based handrub for patients other than those with *C. difficile*-associated disease would do more harm than good, considering the dramatic impact on overall infection rates observed through the recourse to handrubs at the point of care.³²⁰

A guide on how to deal with *C. difficile* outbreaks, including frequently asked questions on hand hygiene practices, is provided in Appendix 2.

A recent study demonstrated that washing hands with either non-antimicrobial soap or antimicrobial soap and water reduced the amount of *B. atrophaeus* (a surrogate for *B. anthracis*) on hands, whereas an alcohol-based handrub was not effective.⁴³² Accordingly, HCWs with suspected or documented exposure to *B. anthracis*-contaminated items should wash their hands with a non-antimicrobial or antimicrobial soap and water.

11.12 Reduced susceptibility of microorganisms to antiseptics

Reduced susceptibility of bacteria to antiseptic agents can be an intrinsic characteristic of a species, or can be an acquired trait.⁴³³ A number of reports have described strains of bacteria that appear to have acquired reduced susceptibility to antiseptics such as chlorhexidine, QAC, or triclosan when defined by MICs established in vitro.⁴³³⁻⁴³⁶ However, since "in-use" concentrations of antiseptics are often substantially

Table I.13.1**Steps before starting surgical hand preparation**

Key steps
<ul style="list-style-type: none"> • Keep nails short and pay attention to them when washing your hands – most microbes on hands come from beneath the fingernails. • Do not wear artificial nails or nail polish. • Remove all jewellery (rings, watches, bracelets) before entering the operating theatre. • Wash hands and arms with a non-medicated soap before entering the operating theatre area or if hands are visibly soiled. • Clean subungual areas with a nail file. Nailbrushes should not be used as they may damage the skin and encourage shedding of cells. If used, nailbrushes must be sterile, once only (single use). Reusable autoclavable nail brushes are on the market.

Table I.13.2**Protocol for surgical scrub with a medicated soap**

Procedural steps
<ul style="list-style-type: none"> • Start timing. Scrub each side of each finger, between the fingers, and the back and front of the hand for 2 minutes. • Proceed to scrub the arms, keeping the hand higher than the arm at all times. This helps to avoid recontamination of the hands by water from the elbows and prevents bacteria-laden soap and water from contaminating the hands. • Wash each side of the arm from wrist to the elbow for 1 minute. • Repeat the process on the other hand and arm, keeping hands above elbows at all times. If the hand touches anything at any time, the scrub must be lengthened by 1 minute for the area that has been contaminated. • Rinse hands and arms by passing them through the water in one direction only, from fingertips to elbow. Do not move the arm back and forth through the water. • Proceed to the operating theatre holding hands above elbows. • At all times during the scrub procedure, care should be taken not to splash water onto surgical attire. • Once in the operating theatre, hands and arms should be dried using a sterile towel and aseptic technique before donning gown and gloves.

Figure I.13.1

Surgical hand preparation technique with an alcohol-based handrub formulation

The handrubbing technique for surgical hand preparation must be performed on perfectly clean, dry hands. On arrival in the operating theatre and after having donned theatre clothing (cap/hat/bonnet and mask), hands must be washed with soap and water. After the operation when removing gloves, hands must be rubbed with an alcohol-based formulation or washed with soap and water if any residual talc or biological fluids are present (e.g. the glove is punctured).

Surgical procedures may be carried out one after the other without the need for handwashing, provided that the handrubbing technique for surgical hand preparation is followed (Images 1 to 17).



1

Put approximately 5ml (3 doses) of alcohol-based handrub in the palm of your left hand, using the elbow of your other arm to operate the dispenser



2

Dip the fingertips of your right hand in the handrub to decontaminate under the nails (5 seconds)



3

Images 3–7: Smear the handrub on the right forearm up to the elbow. Ensure that the whole skin area is covered by using circular movements around the forearm until the handrub has fully evaporated (10-15 seconds)



4

See legend for Image 3



5

See legend for Image 3



6

See legend for Image 3



7

See legend for Image 3



8

Put approximately 5ml (3 doses) of alcohol-based handrub in the palm of your right hand, using the elbow of your other arm to operate the dispenser



9

Dip the fingertips of your left hand in the handrub to decontaminate under the nails (5 seconds)

Figure I.13.1

Surgical hand preparation technique with an alcohol-based handrub formulation (Cont.)

