

# STERILIZATION AND DISINFECTION

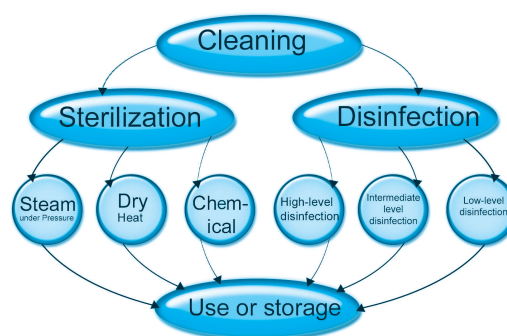
## Cleaning, Disinfection, and Sterilization of Medical Equipment

**S**terilization and Disinfection is a fundamental tool of infection control. A large number of equipments and instruments are designed for reuse, they also can transmit pathogens if any of the steps involved in reprocessing, cleaning, disinfection, or sterilization are inadequate. Because the vast majority of pathogens are present in organic matter, the first step in reprocessing is cleaning which must be done meticulously. Any failure to remove soil at this point creates the potential for transmission of infection as the efficacy of subsequent disinfection or sterilization will be compromised. Decontamination is the process by which microorganisms are removed or destroyed in order to make it microbiologically safe. All hospitals and health care facilities should have a documented policy for decontamination of various equipments used in the HCF. Most sophisticated equipments are decontaminated according to manufacturers instructions which should be included in the policy and staff should be trained accordingly.

### Decontamination

There are two steps of decontamination for items that are used during clinical procedures.

- ✦ Cleaning is the first and the most important step.
- ✦ It is followed by either sterilization or Disinfection. If item is to be used later on it should be properly stored to prevent contamination.



Picture-17: Decontamination Steps

### Risks of Infection from Equipments

The risks of infection from equipments may be classified into three categories. Placing instruments and equipments into one of the following categories can be helpful in choosing the proper level of disinfection or sterilization needed in order to protect the patients and the health care personnel.

#### Low risk (noncritical items)

Noncritical items are the items that come into contact with normal and intact skin as stethoscopes or with the inanimate environment (e.g. walls, floors, ceilings, furniture, sinks, etc.). Cleaning not clear with a detergent and drying is usually adequate. Stethoscopes are usually cleaned and in rare cases they should be disinfected if used on infectious patient or highly susceptible patient.

## Intermediate risk (semi-critical items)

Semi-critical items are items that do not penetrate the skin or enter sterile areas of the body but that are in close contact with mucous membranes or with non-intact skin. Cleaning followed by HLD is usually adequate. Examples include respiratory equipment, flexible endoscopes, laryngoscopes, specula, endotracheal tubes, thermometers, and other similar instruments.

## High risk (critical items)

High risk items are items that penetrate sterile tissues such as body cavities and the vascular system. These items are called critical items because of the high risk of infection if such an item is contaminated with any microorganism before penetrating the tissue. Cleaning followed by sterilization is required. High-level disinfection may sometimes be appropriate if sterilization is not possible, e.g., flexible endoscopes. Examples of high-risk items include surgical instruments, intra-uterine devices, vascular catheters, implants, etc.

## Single Use Items

These items may be used in critical, semi-critical, or noncritical areas; however, they are single use items that are prepackaged with the appropriate level of disinfection or sterilization and are disposed of after a single use. Examples include gloves, needles, syringes, and tongue depressors.

The figure below shows the relationship between types of items and the sterilization or disinfection that they must undergo.



Picture-18: Relation between type of item & its decontamination

## Cleaning

Cleaning is the removal of all foreign material (dirt and organic matter) from the object being reprocessed. Two key components of cleaning are friction to remove foreign matter and fluids to remove or rinse away contamination. Thorough cleaning will remove most organisms from a surface and should always precede disinfection and sterilization procedures. If instruments and other items have not been cleaned, sterilization and disinfection may not be effective because microorganisms trapped in organic material may survive sterilization or disinfection.

Cleaning can be normally accomplished by the use of water, detergents and mechanical actions. Detergent is essential to dissolve proteins and oil that can reside on instruments and equipment after use.

Cleaning may be manual or mechanical. Mechanical cleaning includes ultrasonic cleaners or washer/disinfectors that may facilitate cleaning and decontamination of some items and may reduce the need for handling.

The solution used most often to clean is an enzymatic presoak (protease formula that dissolves protein). Alternatively a detergent can be used. Detergents lower surface tension and lift dirt or oil away from the device. Studies have shown that thorough cleaning alone can provide a 10 000 fold reduction in contaminant microbes from

endoscopes. Cleaning can be used as very effective method of removing microbial contaminants from surgical devices.

## Mechanical Cleaning

Most modern sterilization units are automated and there is minimal handling of dirty equipment by staff. The equipment is placed in trays ready for washing:

- ✦ Washing machine gives a cold rinse followed by a hot wash at 71 °C for 2 minutes. This is followed by a 10-second hot water rinse at 80-90 °C and then by drying by a heater or a fan at 50-75 °C.
- ✦ Washer/disinfector. The washer/disinfector is used for anesthetic equipment. It runs a 45-minute cycle of washing and cleaning plus a 2-minutes cycle with water at 80-100 °C and with a detergent solution.
- ✦ Ultrasonicator. The ultrasonicator is a sophisticated and expensive but extremely efficient piece of equipment. It uses high-power output of 0.44 W/cm and dislodges all organic matter.

## Manual Cleaning

All items requiring disinfection or sterilization

should be dismantled before cleaning. Cold water is preferred; it will remove most of the protein materials (blood, sputum, etc.) that would be coagulated by heat and would subsequently be difficult to remove. The most simple, cost-effective method is to thoroughly brush the item while keeping the brush below the surface of the water in order to prevent the release of aerosols. The brush should be decontaminated after use and should be dried.

Finally, items should be rinsed in clean water and then should be dried. Items are then ready for use (noncritical items) or for disinfection (semi-critical items) or for sterilization (critical items).

## Manual cleaning is necessary when:

- ✦ Mechanical cleaning facilities are not available;
- ✦ Delicate instruments have to be cleaned;
- ✦ Complex instruments need to be taken apart to be cleaned;
- ✦ Items with narrow lumens need to be cleaned (endoscopes).

Manual or hand cleaning must be done with extreme caution. The staff should follow the set procedure:

### Steps for cleaning:

1. Wear heavy-duty rubber gloves, a plastic apron, eye protection, and mask during cleaning.
2. Soak the instruments in normal tap water containing a detergent.
3. Scrub instruments and other items vigorously to completely remove all foreign material using a soft brush or old toothbrush, detergent, and

### Steps for cleaning:



Picture-19

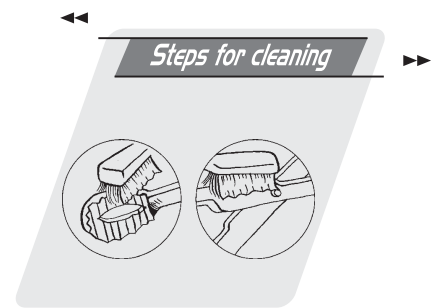
water. Hold items under the surface of the water while scrubbing and cleaning to avoid splashing. Disassemble instruments and other items with multiple parts, and be sure to brush in the grooves, teeth, and joints to items where organic material can collect and stick.

4. Flush through lumens with an adapted water jet.

5. Rinse items thoroughly with clean water to remove all detergent. Any detergent left on the items can reduce the effectiveness of further Processing.

6. Inspect items to confirm that they are clean.

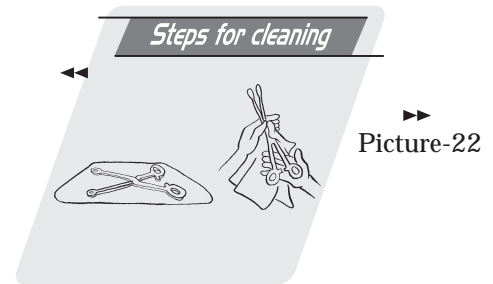
7. Allow items to dry in the air or dry them with a clean towel if chemical disinfection is going to be used. This is to avoid diluting the chemical solutions used after cleaning. Items that will be high-level disinfected by boiling or steaming do not need to be dried.



Picture-20



Picture-21



Picture-22

Picture-19 to 22: Steps for cleaning

## HLD by Boiling

High-level disinfection is best achieved by moist heat such as boiling in water (100°C for one

minute holding time), which kills all organisms except for a few bacterial spores. It is important to note that boiling equipment items in water will not achieve sterilization.

## Steps for boiling

- 1 Clean all items to be high-level disinfected.
- 2 Open all hinged instruments and disassemble those with sliding or multiple parts. Place bowls and containers upright so they fill with water. Make sure that all items are completely submerged because water must touch all surfaces for HLD to be achieved.

## Steps for boiling



Picture-23

3 Cover the pot or close the lid on the boiler and bring the water to a gentle, rolling boil.

4 Once the water is in a rolling boil, start timing for at least 1 minute. Use a timer or make sure to record when the boiling begins. From this point on do not add or remove any water or items.

5 Lower the heat to keep the water at a gentle, rolling boil. Too vigorous boiling may damage items and will speed the evaporation of the water.

6 After 1 minute holding time, remove items using dry, high-level disinfected pickups. Place items to air-dry on a high-level disinfected tray or on a high-level disinfected container that is away from dust and insects and in a low-traffic area. Never leave boiled instruments and other items in water that has stopped boiling; they can become contaminated as the water cools down.

7 Store the dry items in a high-level disinfected and covered container and use items immediately or keep in a covered, dry, high level disinfected container and use within one week.

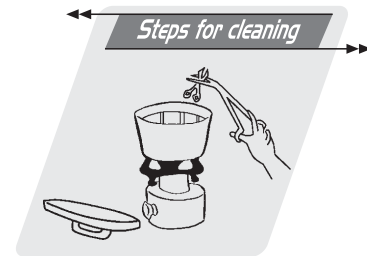
8 The boiler should be emptied and dried daily.



Picture-24



Picture-25



Picture-26



Picture-27



Picture-28

Picture-23 to 28: Steps for boiling

## Soaking of Instruments Prior to Cleaning

Sometimes the level of contamination of the instrument makes it necessary to soak items prior to cleaning (e.g. instruments in operating theatres). A deep container, e.g. a bucket, containing a wire-mesh basket can be filled with water and detergent. The instruments are placed in the wire basket, agitated for 3-5 minutes, and then lifted out. The basket is overturned onto a table or tray in order to separate the instruments prior to cleaning, packing and autoclaving.

## Disinfection

Disinfection can be carried out either by thermal or chemical processes. Thermal disinfection is preferred whenever possible. It is generally more reliable than chemical processes, leaves no residues, is more easily controlled, and is non-toxic. Heat sensitive items have to be reprocessed with a chemical disinfectant.

Organic matter (serum, blood, pus or fecal material) interferes with the antimicrobial efficiency of either method. The larger the number of microbes present, the longer it takes to disinfect. Thus scrupulous cleaning before disinfection is of greatest importance.

## High Level Disinfection (HLD) - Semi-critical Items

There are three types of HLD:

- ✦ Disinfection by boiling
- ✦ Moist heat at 70-100°C
- ✦ Chemical disinfection

### Chemical HLD

Before deciding to use a chemical disinfectant, consider whether a more appropriate method is available. Chemical disinfection is used most

commonly for heat-labile equipment (e.g. endoscopes) where single use is not cost effective.

A limited number of disinfectants can be used for this purpose. e.g.:

- ✦ Glutaraldehyde 2% for 20 min.,
- ✦ Hydrogen peroxide 6%-7.5% for 20 – 30 min.,
- ✦ Peracetic acid 0.2-0.35% for 5 min.
- ✦ Ortho-phthalaldehyde (OPA) for 5-12 min.

The object must be thoroughly rinsed with sterile water after disinfection. If sterile water is not available, freshly boiled water can be used. After rinsing, items must be kept dry and stored properly.

## Sterilization

Sterilization is a process by which, we achieve the complete destruction or killing of all microorganisms, including bacterial spores.

Sterilization is principally accomplished by:

- ✦ Steam under pressure (Autoclaving)
- ✦ Dry heat (Hot Air Oven)
- ✦ The use of chemicals such as ethylene oxide gas (which is mainly used in industry) or other low temperature methods (e.g. hydrogen peroxide gas plasma).

### Pressure Steam Sterilization (Autoclaving)

Steam sterilization is the most common and most preferred method employed for sterilization of all items that penetrate the skin and mucosa if they are heat stable. Steam sterilization is dependable, nontoxic, inexpensive, sporicidal, and has rapid heating and good penetration of fabrics.

### Emergency (flash) sterilizers (these are a form of gravity-displacement sterilizer):

- ✦ Normally located in operating room suite.

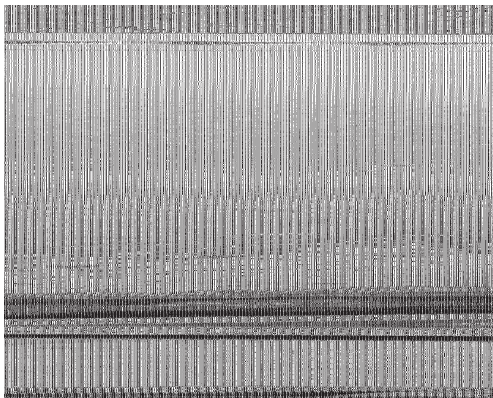
- ✦ Quick sterilization cycle at 134°C for 3-4 minutes.
- ✦ Should be used only when there is insufficient time to sterilize an item by the preferred prepackaged method.
- ✦ Only for unwrapped items.



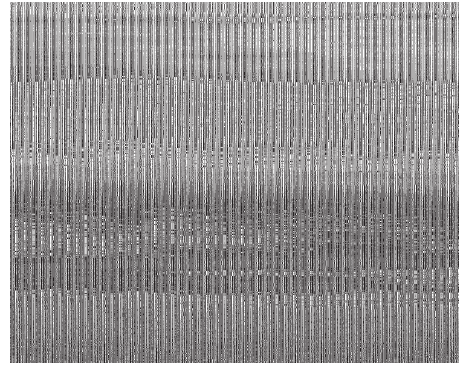
Picture-29: Pressure Steam Sterilization:

### Steps for pressure steam sterilization:

- 1 Clean all items to be sterilized.
- 2 Open or unlock all hinged items and disassemble items with multiple parts. Do not arrange items close together.



Picture-30: Sterilization:



Picture-31: Sterilization:

- 3 Arrange all labeled packs, drums, or unwrapped items in the chamber of the autoclave in a way that allows the steam to circulate freely. **DO NOT STACK.**



Picture-32: Sterilization:

- 4 Follow the manufacturer instruction for operating the autoclave. Adjust time, temperature and pressure according to the table before. It is best to use a timer, which helps ensure that the appropriate timing is achieved.

### Wrapping instruments and other items for steam sterilization

- ✦ Wrapping instruments and other items before steam sterilization helps to decrease the likelihood that, after sterilization, they will be contaminated before use.
- ✦ To wrap instruments and other items for steam sterilization, use two layers of material such as paper, newsprint, or muslin or cotton fabric. Do not use canvas because it is difficult for steam to go through canvas. Make points while wrapping

the instruments and other items so that the packs can be easily opened without contaminating their contents.



Picture-33: Wrapping Sterilized Instruments

### Ethylene oxide gas

Uses: Ethylene oxide can be used to sterilize most articles that can withstand temperatures of 50-60 °C. However, it should be used under carefully controlled conditions because it is extremely toxic and explosive. Although it is very versatile and can be used for heat-labile equipment, fluids, and rubber, etc., a long period of aeration (to remove all traces of the gas) is required before the equipment can be distributed. The operating cycle ranges from 2-24 hours and it is a relatively expensive process. Sterilization with ethylene oxide should be monitored by bacterial spore tests.

### Hydrogen peroxide gas plasma

Uses: Gas plasma is generated in a chamber under deep vacuum and acted on by radiofrequency radiation wherein free radical particles which disrupt microbial cellular components. The plasma is combined with hydrogen peroxide. The cycle time is approximately 75 minutes. Diffusion of the vapor and plasma into long, narrow lumens

can be enhancing with use of additional devices to assure flow of gas through the device's lumen. Diffusion into long lumens even with H<sub>2</sub>O<sub>2</sub> injection is of poor quality assurance.

### Chemical Sterilization

Before deciding to use a chemical sterilant, consider whether a more appropriate method is available. Chemical sterilants are primarily used for heat-labile equipment where single use is not cost effective. Instruments and other items can be sterilized by soaking in a chemical solution followed by rinsing in sterile water. The immersion time to achieve sterilization or sporicidal activity is specific or each type of chemical sterilant. The difficulty lays in the fact that immersion for the appropriate time, rinsing with sterile water, and then transferring the device to a sterile field for use is challenging. Also, in contrast with steam sterilization methods, a biological indicator is not available for most chemical sterilants. Given these limitations most liquid chemical sterilants are instead used for high-level disinfection. If an item is sterilized chemically, it should be used immediately after sterilization, to be sure that it is sterile.

### Monitoring the Effectiveness of Sterilization

To ensure that sterilization has been successful the process of sterilization (and not the end product) is tested. Indicators have been developed to monitor the effectiveness of sterilization by measuring various aspects of the process through different indicators.

### Mechanical indicators

These indicators, which are part of the autoclave or dry-heat oven itself, record and allow you to observe time, temperature, and/or pressure readings during the sterilization cycle.

## Chemical indicators

Tape with lines that change color when the intended temperature has been reached.

Pellets in glass tubes that melt, indicating that the intended temperature and time have been reached.

- ✦ Indicator strips that show that the intended combination of temperature, time, and pressure has been achieved.
- ✦ Indicator strips that show that the chemicals or gas are still effective.
- ✦ Chemical indicators are available for testing ethylene oxide, dry heat, and steam processes. These indicators are used internally, placed where steam or temperature takes longest to reach, or put on the outside of the wrapped packs to distinguish processed from nonprocessed packages.

## Biological indicators

These indicators use heat-resistant bacterial endospores to demonstrate whether or not sterilization has been achieved. If the bacterial endospores have been killed after sterilization, you can assume that all microorganisms have been killed as well. After the sterilization process the strips are placed in a broth that supports aerobic growth and incubated for 7 days. The advantage of this method is that it directly measures the effectiveness of sterilization. The disadvantage is that this indicator is not immediate, as are mechanical and chemical indicators. Bacterial culture results are needed before sterilization effectiveness can be determined.

## Sterile Services Department (SSD)

The sterile services department (SSD) is vital for an effective Infection Control and Prevention program. The expertise and knowledge of SSD personnel is important to ensure high standards of decontamination; an effective SSD always results in long-term savings.

Not all hospitals can afford to have an SSD and a separate surgical services unit to deal with the operating theatres and associated departments. At the least, they should have a single department covering all areas.

## Preparing an Area for Processing Instruments and Other Items

One goal of a comprehensive infection control program is to minimize the level of contamination in areas in which “clean” activities take place. Examples of areas where “clean” activities take place are operating theaters, procedure rooms, and working areas for sterilizing, high-level disinfecting, and storing instruments and other items. Areas in which “dirty” activities take place include rooms where soiled instruments and other items are washed. It is ideal to have separate rooms – one for receiving and cleaning instruments and other items and another room for final processing (sterilization or high-level disinfection) and storage. However, in many settings in Pakistan this is not possible. When only one room is available, it should be arranged so that activities and objects flow in an organized way. It is necessary to have at least one sink (two are preferable), sufficient counter top space for receiving dirty items and for drying and packaging clean items, and for storage space (preferably closed cabinets). It is key to good spatial separation between soiled handling area and the clean, packaging area.

## Establishing an SSD

Soiled, used, and recyclable equipment should be collected from the wards and then should be transferred to the SSD where it is washed, inspected, disinfected or packaged and sterilized, and dispatched back to the wards.

### In the ward:

Collect instruments that are to be re-used in a clearly labeled container.

Arrange for dirty instruments to be delivered to the SSD – DO NOT ATTEMPT TO WASH THEM IN THE WARD.

Discard cotton wool balls and dressings into regular waste disposal containers (for more details see chapter on Waste Disposal I).

### In the SSD:

- ✦ Receive instruments in the dirty area.
- ✦ Wash all instruments in water and detergent or enzymatic presoak either mechanically or manually using appropriate protective barriers.
- ✦ Inspect all equipment for cleanliness and damage.
- ✦ Send damaged instruments for repair after appropriate decontamination or discard them if necessary.
- ✦ Pack cleaned instruments on a tray.
- ✦ Autoclave trays at recommended temperature and/or disinfect as required.
- ✦ Ensure that the packaged trays are dry – inspect tapes.
- ✦ Sort the packaged trays for ward collection.
- ✦ Return equipment to the ward or store in the clean treatment room.

### The layout of the SSD

Ideally, physical barriers should separate dirty and clean areas in the reprocessing room. However, if this is not possible (perhaps because of shortage of space or of funds) the same room can be used, provided that:

- ✦ The air moves from the clean area to the dirty

area.

- ✦ Both areas have separate storage facilities.
- ✦ There are adequate hand disinfection facilities.
- ✦ Activity patterns are established in which soiled objects never cross paths with clean, sterilized, or high-level disinfected instruments and other items.
- ✦ The doors are kept closed in the reprocessing rooms in order to minimize dust contamination and to eliminate flies.
- ✦ There is separate equipment for each area.
- ✦ The staff should work in either area but never in both.

### Storage in the SSD

After items have been reprocessed, the sterile packs should be stored in well-ventilated, clean stores ready for dispatch to the wards. Collection should be regular and there should be a written record of receipt and delivery. This helps to monitor the use and the loss of instruments.

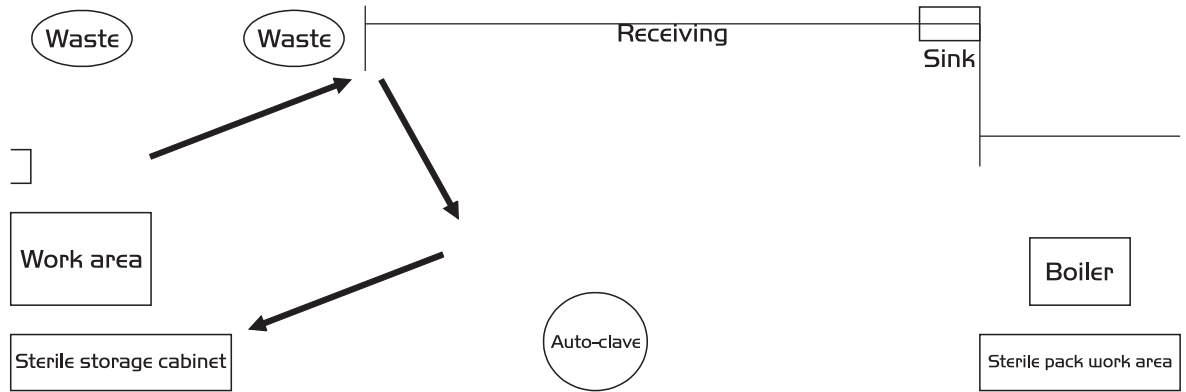
### SSD staff facilities

All SSD staff should be provided with adequate protective clothing (e.g. heavy duty gloves, plastic aprons, and eye protection if manual cleaning is undertaken). Overshoes are not necessary. SSD staff should be immunized against hepatitis B. The flow of work in a single room for reprocessing of instruments should be designed to minimize the likelihood of contamination.

Activity patterns

should be established in which soiled objects never cross paths with clean, sterilized, or high-level disinfected instruments and other items

## Single room for processing instruments and other items



Picture-34: Flow diagram of items processed in SSD

Table 8: Summary of advantages and disadvantages for liquid chemical sterilants used primarily as high-level disinfectants.

Sterilization Method	Advantages	Disadvantages
Peracetic acid	<ul style="list-style-type: none"> <li>✦ No activation required.</li> <li>✦ Odour of irritation not significant.</li> </ul>	<ul style="list-style-type: none"> <li>✦ Materials compatibility concerns (lead, brass, copper, ninc) both cosmetic and functional.</li> <li>✦ Limited linical use.</li> </ul>
Glutaraldehyde	<ul style="list-style-type: none"> <li>✦ Numerous use studies published .</li> <li>✦ Relatively inexpensive.</li> <li>✦ Excellent materials compatiblity.</li> </ul>	<ul style="list-style-type: none"> <li>✦ Respiratory irritation from glutaraldehyde vapour.</li> <li>✦ Pungent and irritating odour</li> <li>✦ Relatively slow mycobactericidal activity.</li> <li>✦ Coagulates blood and fixes tissue to surfaces.</li> </ul>
Hydrogen peroxide	<ul style="list-style-type: none"> <li>✦ No activation required.</li> <li>✦ May enhance removal of organisms.</li> <li>✦ No disposal issues.</li> <li>✦ No odour or irritation issues.</li> <li>✦ Compatible with metals, plastics and elastomers.</li> <li>✦ Does not coagulate blood or fix tissues to surfaces.</li> <li>✦ Inactivates Cryptosporidium.</li> </ul>	<ul style="list-style-type: none"> <li>✦ Material compatibility concerns for brass, zinc, copper, and nickel/silver plating (conmetic only).</li> <li>✦ Serious eye damage if contacted.</li> </ul>
Ortho-phthaladehyde	<ul style="list-style-type: none"> <li>✦ Fast acting high-level disinfectant.</li> <li>✦ No activation required.</li> <li>✦ Odour not significant.</li> <li>✦ Excellent materials compatibility.</li> <li>✦ Does not coagulate blood or fix tissues to surfaces.</li> </ul>	<ul style="list-style-type: none"> <li>✦ Stains skin. clothing and environmental surfaces.</li> <li>✦ Limited clinical use.</li> </ul>
Peracetic acid (Steris System 1)	<ul style="list-style-type: none"> <li>✦ Rapid sterilization cycle time (30-45 min).</li> <li>✦ Low-tempertaure (50-55oC) liquid immersion sterilization.</li> <li>✦ Environmental friendly by-products (acetic aid, O2H2O).</li> <li>✦ Fully automated.</li> <li>✦ No adverse health effects to operators.</li> <li>✦ Compatible with wide varirty</li> </ul>	<ul style="list-style-type: none"> <li>✦ Potential material incompatibility (e.g. aluminium andodized coating becomes dull).</li> <li>✦ Used for immersible instruments only. Biologoical indicator may not be suitable for routine monitoring</li> <li>✦ One scope or a small number of instruments can be processed in a cycle.</li> </ul>

Table 8: Continued

Sterilization Method	Advantages	Disadvantages
	<p data-bbox="700 371 1046 405">of materials and instruments.</p> <ul style="list-style-type: none"> <li data-bbox="700 477 1046 539">✦ Does not coagulate blood or fix tissues to surfaces.</li> <li data-bbox="700 551 927 580">✦ Rapidly sporicidal.</li> <li data-bbox="700 591 1046 714">✦ Provides procedure standardization (Constant dilution, perfusion of Channel, temperatures, exposure).</li> </ul>	<ul style="list-style-type: none"> <li data-bbox="1115 371 1461 434">✦ More expensive (endoscope repairs, operating costs, purchase costs) than high-level disinfection.</li> <li data-bbox="1115 539 1461 602">✦ Serious eye and skin damage (concentrated solution).</li> <li data-bbox="1115 613 1461 674">✦ Point-of-use system, no long-term sterile storage.</li> </ul>

Adapted and modified from Rutala WA, Weber DJ. Disinfection of endoscopes: Review of chemical sterilants vs level disinfectants. *Infection Control and Hospital Epidemiology* 1999; 20: 69-76.

Table 9 Disinfection procedures for individual items and equipment.

Equipment or site	Suggested method(s)	Acceptable alternative or additional recommendations
Airways and endotracheal tubes	Single-use disposable or heat sterilize in the SSD.	Use single-use disposable item or heat sterilize for patients with known infections, e.g. tuberculosis, AIDS, etc.
Ampoules	Wipe neck with a 70% isopropyl alcohol impregnated swab and allow to dry before opening or piercing.	When a sterile ampoule exterior is required it will be processed by the SSD, by agreement with medical and pharmaceutical staff. Do not immerse and ampoule in a disinfectant solution.
Apnoea and enuresis monitors	Clean and dry regularly as part of a routine. If contaminated disinfect and then rinse and dry.	
Arm splint	Wash with detergent, rinse and dry.	
Auroscope tip	Use single-use lips and discard after single-use. if reusable tip then wash and disinfect between patient use.	
Babies feeding bottles and teats	Use pre-sterilized or heat-treated feeds. <i>Non-disposable bottles:</i> Wash thoroughly, rinse and place in fresh hypochlorite (125ppm av Cl <sub>2</sub> ) solution for 30 min.	Chemical disinfectant should be used only when other methods are unavailable. Non-disposable bottles which originate from a milk kitchen must be returned for disinfection.
Baths	<i>Non-infected patients:</i> Clean with detergent or use a non-abrasive cream cleanser to remove stain or scum if necessary. Rinse and dry after cleaning, before and after use.	<i>Infected patients:</i> Disinfect by cleaning with a chlorine-based agent or non-abrasive chlorine releasing powder. patients with open wounds: For patients with unhealed wounds and those who are immunocompromised, disinfect before use with a non-abrasive hypochlorite powder. Apply powder to a wet surface, rinse thoroughly and dry.
Bath water	Do not add an antiseptic bath additive routinely.	For staphylococcal dispensers seek advice from a member of the ICT.
Beds and cots	Wash with detergent and dry	<i>Infected patients:</i> Use hypochlorite (1,000 ppm av Cl <sub>2</sub> ) solution for disinfection. Do not use phenolic disinfectants on infant cots, prams or incubators as residual fumes may cause respiratory irritation.

Table 9 Continued

Equipment or site	Suggested method(s)	Acceptable alternative or additional recommendations
Bed-frames	For normal cleaning use detergent and hot water. Perform cleaning after discharge of each patient and regularly in the case of long stay patients.	<i>Infected patients:</i> Wipe with disinfectant, wash with detergent, rinse and dry.
Bedpans and urinals	Dispose after single-use. If reusable heat disinfect in a washer /disinfector (80oC for 1 min). Store dry.	<i>Infected patients:</i> Gloves and plastic aprons must be worn when handling contaminated items from infected patients. Alternatively, single-use disposable items may be used. These should always be disposed of into a macerator unit.
Birthing pools	Use disposable poole liner. Clean and disinfect paying particular attention to the outlet.	
Bowls (washing)	Individual wash bowls should be available for each patient. After each use, wash with detergent, rinse, dry and store inverted and tilted forward to avoid trapping of water which may harbour microorganisms.	<i>Infected patients:</i> After thorough cleaning, disinfect by wiping with a disinfectant solution.
Bowls (surgical, sterile)	Return to SSD for autoclaving.	
Bowls (vomit)	Empty and rinse. Wash with detergent and hot water, rinse and dry.	For infected patients <i>[see above under Bowls (washing)]</i> .
Breast pumps	For single patient use only. Wash with detergent and water and then rinse. Immerse in hypochlorite (125ppm av Cl <sub>2</sub> ) solution for 30min. Before use by subsequent patients clean, disinfect and autoclave.	
Cardiac monitors, defibrillators and ECG equipment	If patient contact, then surface clean and disinfect unless disposal is necessary (if single-use item).	
Carpets	Suction clean daily with a vacuum cleaner with an periodically by hot water extraction or when soiled.	For known contaminated spills, disinfect with an agent that does not damage carpet and then clean with a detergent. Seek advice from the infection Control Nurse.

Table 9 Continued

Equipment or site	Suggested method(s)	Acceptable alternative or additional recommendations
		circumstance, autoclave daily and store in a fresh 1% clear soluble phenolic disinfectant which must be changed daily.
Cleaning equipment	<p><i>Mops:</i> The detachable heads of used mops must be machine laundered, thermally disinfected and dried daily.</p> <p><i>Mop bucket:</i> Wash with detergent. Rinse, dry and store inverted.</p> <p><i>Scrubbing machine:</i> Drain reservoir after use and store dry.</p>	Colour coded cleaning equipment should be used for each area, i.e. clinical, non-clinical, kitchen and sanitary area according to the local policy.
Commodes	For single patient use only, wash with detergent and rinse. Between use clean and disinfect.	If faecal contamination has occurred, remove soil with tissue. Wash with detergent and hot water. Wipe with disinfectant, wash, rinse and dry.
Crockery and cutlery	Machine wash with rinse temperature above 80°C and dry or hand wash in detergent and hot water (approx. 60°C), rinse and allow to dry thoroughly. Rubber gloves will be required at this temperature.	<i>Infected patients:</i> For patients with enteric infections or open pulmonary tuberculosis, heat disinfect in a dishwasher.
Drains	Clean regularly as outlined in the maintenance programme.	When blockage occurs, contact Works and maintenance Department.
Drip stands	Chemical disinfection is not required.  Clean after each use.	
Duvets	Launder to thermal disinfection temperatures.	Launder after each patient use, weekly or if visibly soiled.
Endoscopes	<p>Flexible fiberoptic endoscopes: Arthroscopes and laparoscopes: Clean and wash and send to SSD for sterilization.</p> <p>If this is not possible a 10 min exposure to alkaline glutaraldehyde is used. The instrument must be dismantled before disinfection and rinsed in sterile water afterwards.</p> <p>Procto/sigmoidoscope: Clean and wash thoroughly. Rinse and dry and send it to SSD for sterilization or use disposable if</p>	If used on a patient where tuberculosis is suspected, then the contact time with 2% alkaline glutaraldehyde must be extended to 60 min.

Table 9 Continued

Equipment or site	Suggested method(s)	Acceptable alternative or additional recommendations
	If this is not possible a 10 min exposure to 2% alkaline glutaraldehyde must be dismantled and thoroughly cleaned before disinfection and rinsed in sterile water afterwards.	If used on a patient where tuberculosis is suspected, then the contact time with 2% alkaline glutaraldehyde must be extended to 60min.
Enteral feeding lines	Single-use disposable.	
Floors (dry cleaning)	Vacuum clean or use a dust-attracting dry mop.	Never use brooms in patient areas.
Floors (wet cleaning)	Wash with a detergent solution. Disinfection is not routinely required.	If contaminated, disinfect and clean.
Fixtures and fittings	In clinical areas damp dust daily with detergent solution.	In known contaminated and special areas, damp dust with a disinfectant solution.
Furniture and ledges	In clinical areas damp dust daily with warm water and detergent.	Seek advice from the ICT.
Haemodialysis machines	Clean and disinfect, paying particular attention to the microbial quality of water and the fluid pathway. Regular microbiological monitoring is essential to validate effective disinfection.	
Host (Patient)	Sling to be washed with detergent, rinse and dry between patients. Examine material and clips for wear or damage before each use. Surface clean the hoist.	Infected patients: After cleaning, wipe with 70% isopropyl alcohol impregnated wipe or with hypochlorite (125 ppm av Cl <sub>2</sub> ) solution before re-use. Do not use phenol disinfectant.
Humidifiers	Clean and sterilize device between patients and fill with sterile water which must be changed every 24 h or sooner if necessary. Single-use disposables are available.	Alcohol may damage the plastic surfaces. Please refer to the manufacturer's instructions.
Hydrotherapy pools	Filter, drain and clean regularly as part of a routine. Maintain disinfectant levels within water. microbiological monitoring is recommended.	Contaminated instruments should be cleaned by trained staff in SSD before sterilization.
Infant incubators	After use, wash all removable	

Table 9 Continued

Equipment or site	Suggested method(s)	Acceptable alternative or additional recommendations
	parts and clean with detergent. Clean and dry regularly as part of a routine. if contaminated disinfect and then rinse and dry.	
Instruments (surgical, sterile)	Return to SSD for machine washing and sterilization. Transport safely in a closed rigid container.	
Laryngoscope blade	Wash with detergent, rinse, dry and wipe with an alcohol impregnated wipe.	Contaminated instruments should be sterilized in SSD.
Linen	Refer to the local policy.	
Locker tops	Treat as 'Fixtures and Fittings'.	
Mattresses and pillows	Clean and disinfect the cover regularly as part of a routine. Rinse thoroughly and dry. Mattresses should be enclosed in a waterproof cover and routinely inspected for damage.	Should be protected by a waterproof cover. <i>Infected patients:</i> Disinfect with a disinfectant solution. Allow 2 min contact time then rinse and dry. Do not disinfect unnecessarily as this damages the mattress cover.
Mops (dish)	Do not use.	
Mops (dry, dust attracting)	Do not use if overloaded or for more than 1-2 days without reprocessing or washing. Alternatively a single-use disposable cover may be used and disposed of after each use.	Non-disposable dust mop covers must be vacuumed after each use. Single-use covers should be of the type which is impregnated with mineral oil to enhance dust attracting properties.
Mops (wet)	Mop heads must be changed daily. Reprocess by machine washing to thermal disinfection temperature and tumble dry.	If chemical disinfection is required, rinse in water, immerse in hypochlorite (1,000 ppm av Cl <sub>2</sub> ) solution for at least 30 min.
Nail brushes	Use only if essential. Heat disinfect in SSD after each use or use sterile pre-packed single-use disposable.	Do not soak in a disinfectant solution. Never use a nail brush to scrub skin.
Nebulizers	Empty in hot wash with detergent between single patient's use. Refill with sterile water only. Dispose of on patient discharge.	
Neurological test pins	Single-use only	

Table 9 Continued

Equipment or site	Suggested method(s)	Acceptable alternative or additional recommendations
Oxygen tents	Wash with hot water detergent solution, rinse well and dry thoroughly.	Store covered with clean plastic sheeting in a clean area.
Pillows	Use only with water impermeable cover Treat a 'mattresses'.	Damaged pillows must be replaced immediately.
Razors (electric)	Detach head, clean thoroughly, and immerse in 70% isopropyl alcohol for 10 min, remove and allow to dry between each patient.	Ideally each patient should have their own shaving equipment or use single-use disposable.
Razors (safety and equipment)	Use disposable of autoclave with single-use disposable head.	For clinical shaving use clipper.
Rhino/laryngoscope	Clean the blade thoroughly with detergent and hot water, Dry thoroughly and wipe with a 70% alcohol impregnated wipe.	In case of suspected/confirmed transmissible infection or visible blood, the blade should be sterilized before further use.
Rooms (terminal cleanong)	Wash surfaces with detergent solutions	<i>Transmissible infection:</i> Disinfect surface with disinfectant solution, wash with detergent, rinse and dry.
Scissors	Surface disinfection with a 70% alcohol impregnated wipe.	
Shaving brushes	Do not use for clinical shaving	Use brushless cream or shaving foam. Patients may use their own brush for face shaves, it should be rinsed under running water and stored dry.
Sheepskins	<i>Synthetic:</i> Return to laundry department for washing in the usual way. <i>Natural fibre:</i> For individual use only.	Seek advice from the ICN.
Speculae	Single-use or clean and steam sterilize.	
Splints and walking frames	Wash and clean with detergent.	
Sputum containers	Use disposable only. Seal and discard as clinical waste daily or sooner if required.	

Table 9 Continued

Equipment or site	Suggested method(s)	Acceptable alternative or additional recommendations
Stethoscope	Surface disinfect with alcohol wipe after each use.	
Suction equipment	Following use, the reservoir should be emptied into the sluice hopper, washed with hot water and detergent, rinsed and store dried. Wear a plastic apron and non-sterile disposable for this procedure. The reservoir of the suction apparatus should be kept empty and dry when not in use.	When using a disposable system, great care is required to ensure the safe disposal of liners according to waste disposal policy. for infected patients seek advice from the ICN.
Thermometers (electronic)	Where possible use a single-use sleeve. If not possible use either single-use thermometer or clean and disinfect between use.	Do not use without sleeve or on patients with an infectious disease.
Thermometers (oral)	<i>Individual thermometers:</i> Wipe with a 70% isopropyl alcohol impregnated wipe after each use and store dry. On discharge, wash with detergent, immerse in 70% alcohol for 10 min. Wipe and store dry.	<i>Communal thermometers:</i> Wipe clean, wash in a cold neutral detergent, rinse, dry and immerse in 70% isopropyl alcohol for 10 min. Wipe and store dry.
Thermometers (rectal)	Wash in detergent solution after each use, wipe dry and immerse in 70% alcohol for 10 min. Wipe and store dry.	
Toilet seats	Wash daily with detergent and dry.	<i>Infected patient</i> or if grossly contaminated: Wash with disinfectant solution, rinse and dry. This is important in areas where soiling is more likely, i.e. gynaecology, maternity, urology department, etc.
Tooth mugs	Use disposable.	Heat disinfect in SSD, if non-disposable.
Toys	<i>Soft toys:</i> Machine wash, rinse and dry thoroughly. Do not soak toys in a disinfectant solution. Others: Wash with detergent, rinse and dry or wipe with an alcohol impregnated swab.	For children with infectious diseases do not use communal toys or those which cannot easily be disinfected. Heavily contaminated soft toys may have to be destroyed.
Trolleys (dressing, patient theatre table)	Clean and surface disinfect.	Wipe trolley tops with an alcohol impregnated wipe before and after

Table 9 Continued

Equipment or site	Suggested method(s)	Acceptable alternative or additional recommendations
		use. If contaminated, clean first, then use an alcohol impregnated wipe.
Tubing (anaesthetic or ventilator)	Reprocess by washing and sterilization in CSSD.	<i>Infected patients:</i> For patients with respiratory infection, tuberculosis or patients with AIDS use disposable tubing. Never use glutaraldehyde to disinfect respiratory equipment.
Ultrasound	Clean and surface disinfect ultrasound head with 70% isopropyl alcohol between each patient.	
Urinals	Heat disinfect in a bedpan washer at a temperature of 80°C for 1 min or use disposables.	Disposable urinals must be disposed of in a macerator unit.
Ventilators	Cleaning and disinfecting the equipment is a procedure which is normally carried out in specified areas (i.e. ICU, special care baby unit, sterile supply department (SSD) according to written protocol based on manufacturer's recommendations.	Contact a member of the ICT for advice if required.
Washbasin/sink	Clean with detergent, use cream cleaner for stains, scum, etc. Disinfection is not normally required.	Disinfection may be required if contaminated. Use non-abrasive hypochlorite powder or
Wheel chairs	Clean and surface disinfect. Rinse and dry.	hypochlorite / detergent solution.
X-ray equipment	Damp dust with detergent solution, do not over-wet and allow surface to dry before use.	Clean with detergent and then wipe with an alcohol impregnated wipe to disinfect. For specialized equipment, draw up local protocol for cleaning and disinfection based on the manufacturer's recommendations.