goggles that fit over glasses are available. Protective eyewear should be changed after each shift.

DECONTAMINATION AND CLEANING

Decontamination and **cleaning** are two highly effective infection prevention measures that can minimise the risk of transmission of HAI to healthcare workers or patients. These measures are also important steps in breaking the infection transmission cycle for patients. Both processes are easy to do and are inexpensive ways of ensuring that patients and staff are at a lower risk of becoming infected from contaminated instruments and other inanimate objects.

Decontamination of the environment surfaces after each patient use is done through use of effective decontaminating agent. The environment area of the patient has to be decontaminated and cleaned after each patient use. The operating tables, examination tables, dressing tables etc. are to be cleaned through use of appropriate disinfectant and as per the hospital policy of cleaning and disinfection.

The cleaning and decontamination of the hospital environment has already been detailed in the "Sanitation and Hygiene" section of these guidelines.

REPROCESSING OF REUSABLE INSTRUMENTS AND EQUIPMENTS

Transmission of the infection through used equipment and instruments can happen between patients through use of unsterile or partially sterilised instruments and equipment and also to the staff through injury from the used instruments. To ensure that the instruments and equipment are safe to use, it is to be ensured by the health facility that it implements and follows basic processes of cleaning, disinfection and has a strong policy for reprocessing of the used instruments and equipment.

There are three types of instruments and equipment which are needed to be reprocessed:

- Items that come in contact with the intact skin (stethoscopes) need to be routinely kept free of visible contamination. These require intermediate to low level disinfection or washing with soap and water depending on the nature and amount of decontamination
- Medical instruments that pierce human tissue like blades and scalpels should be sterilised between each patient contact
- Medical instruments that touch but do not penetrate mucous membrane (anaesthesia breathing circuits, laryngoscope blades, vaginal scapula, flexible fibrotic endoscopes) should ideally be sterilised; if it is not feasible then they should be reprocessed through high-level disinfection.

Splauding's Classification of Medical Instruments and Required Level of Reprocessing

Table 17: Splauding's classification of medical instruments and required level of reprocessing

Classification	Definition	Level of Reprocessing	Example
Critical	Equipment/devices that enter sterile tissues, including the vascular system	Cleaning followed by sterilisation	• Surgical instruments Implants • Biopsy instruments • Foot care equipment • Eye and dental equipment
Semi Critical	Equipment/devices that comes in contact with non-intact skin or mucous membranes but do not penetrate them	Cleaning followed by high-level disinfection (as a minimum). Sterilisation is preferred	• Respiratory therapy equipment • Anaesthesia equipment • Tonometer
Non Critical	Equipment/devices that touch only intact skin and not mucous membranes, or do not directly touch the client/ patient/resident	Cleaning followed by low-level disinfection (in some cases, cleaning alone is acceptable)	• ECG machines • Oximeters • Bedpans, urinals, commodes

The six recommended steps of instrument reprocessing are listed as follows:

- Transportation of instruments/equipment
- Cleaning of instruments and equipment
- Packaging
- Disinfection of the instruments/equipment
- Sterilisation
- Storage and issue

TRANSPORTATION OF SOILED INSTRUMENTS

- Disposable sharps such as needles and blades shall be removed and disposed off in an appropriate puncture-resistant sharps container at point of use, prior to transportation
- If cleaning cannot be done immediately, the medical equipment/devices should be submerged in tepid water and/or detergent and enzymatic to prevent organic matter from drying on it
- Gross soil should be removed immediately at point of use if the cleaning process cannot be completed immediately after use
- Soiled medical equipment/devices should be handled in a manner that reduces the risk of exposure and/or injury to personnel and clients/patients/residents, or contamination of environmental surfaces
- Closed carts or covered containers with easily cleanable surfaces need to be used for handling and transporting soiled medical equipment/devices
- Soiled equipment/devices needs to be transported by direct routes to areas where cleaning will be done.

CLEANING OF THE INSTRUMENTS

The first step of equipment reprocessing is the thorough cleaning of equipment. Cleaning is of importance because:

- It is an effective way to reduce the number of micro-organisms, especially endospores that cause tetanus, on soiled instruments and equipment
- Neither sterilisation nor high-level disinfection is effective without prior cleaning

METHOD OF CLEANING

The process for cleaning includes protocols for disassembly, sorting and soaking, physical removal of organic material, rinsing, drying, physical inspection and wrapping.

DISASSEMBLY

- Unless otherwise recommended by the manufacturer, equipment/devices should be disassembled prior to cleaning
- The manufacturer's recommendations shall be followed when disassembling medical equipment/ devices prior to washing.

SORTING AND SOAKING

- Sort equipment/devices into groups like products requiring the same processes of sterilisation
- Segregate sharps and/or delicate equipment/devices to prevent injury to personnel and damage to the equipment/devices
- Soak equipment/devices in a hospital approved instrument soaking solution to prevent drying of soil, making cleaning easier. Wear appropriate PPE
- Saline should not be used as a soaking solution as it damages some medical equipment/devices
- Detergent-based products, including those containing enzymes, may be used as part of the soaking process
- Ensure that detergents (including enzymatic detergents) are appropriate to the equipment/device being cleaned.

PHYSICAL REMOVAL OF ORGANIC MATERIAL

- Completely submerge immiscible items during the cleaning process to minimise aerosolisation of micro-organisms and assist in cleaning
- Remove gross soil using tools such as brushes and clothes
- Employ manual or mechanical cleaning, such as an ultrasonic cleaning, after gross soil has been removed
- Ultrasonic cleaners are recommended for medical equipment/devices that can withstand mechanical cleaning, to achieve the required exposure for cleaning and to reduce potential risk to personnel
- If manual cleaning is performed, physical removal of soil should occur under the water level to minimise splashing
- Tools used to assist in cleaning, such as brushes, should be cleaned and disinfected after use.

RINSING

Rinsing, following cleaning is necessary as residual detergent may neutralise the disinfectant.

- Rinse all equipment/devices thoroughly after cleaning with water to remove residues which might react with the disinfectant/sterilant. Avoid use of untreated well and bore well water, use safe drinking water for this purpose.

DRYING

- Drying is an important step that prevents dilution of chemical disinfectants which may render them ineffective and prevents microbial growth
- Follow the manufacturer's instructions for drying of the equipment/devices
- Equipment/devices may be air-dried or dried by hand with a clean, lint-free towel. Lumens should be adequately flushed with air to ensure drying
- Dry stainless steel equipment/devices immediately after rinsing to prevent spotting.

INSPECTION

- Visually inspect all equipment/devices once the cleaning process has been completed and prior to terminal disinfection/sterilisation to ensure cleanliness and integrity of the equipment/devices (e.g. cracks, defects, adhesive failures)
- Repeat the cleaning on any item that is not clean
- Follow the manufacturer's guidelines for lubrication
- Do not reassemble equipment/devices prior to disinfection/sterilisation.

Monitoring of the cleaning activities should be done to justify the method and materials for cleaning. Monitoring should be done by physical observations.

PACKAGING

Packaging is a necessary step before sterilisation of the instruments is carried out by the hospital.

It has to be ensured that packaging for sterilisation needs to be suitable for the sterilisation method used to ensure that the packaging material can be penetrated by the sterilisation agent (e.g. steam). The packaging also provides protection during transport and storage. Proper packaging protects the sterilised goods from micro bacterial recontamination during transport and storage. The packaging units are to be kept as small as possible.

After sterilisation the packaged material needs to be provided with labels indicating the contents, date of sterilisation, use-by date, batch number and sterilisation indicator.

The recommended practices for packaging activity are as follows:

- ✓ Packaging systems should be compatible with the specific sterilisation process for which it is designed
- ✓ Packaging materials needs to be stored and processed to maintain the qualities required for sterilisation
- ✓ Package contents needs to be assembled, handled and wrapped in a manner that provides for an aseptic presentation of package contents
- ✓ Paper-plastic pouch packages should be used according to manufacturer's written instructions
- ✓ Packages to be sterilised should be labelled
- ✓ Sterilised packages should be considered sterile until an event occurs to compromise the package barrier integrity
- ✓ A chemical indicator/integrator should be placed inside each package and external chemical indicator affixed outside each package to be processed.

Packaging system of the sterile items should:

- ✓ Provide adequate seal integrity and be tamperproof

- ✓ Provide an adequate barrier to particulate matter
- ✓ Withstand physical conditions of the sterilisation process
- ✓ Provide an adequate barrier to fluids
- ✓ Permit adequate air removal
- ✓ Allow penetration and removal of sterilant
- ✓ Protect package content from physical damage
- ✓ Resist tears and punctures
- ✓ Be free of holes
- ✓ Be free of toxic ingredients
- ✓ Have a low lint content
- ✓ Be used according to the manufacturers' written instructions.

DISINFECTION OF INSTRUMENTS

Disinfection removes micro-organisms without complete sterilisation. Disinfection is used to destroy organisms present on delicate or heat-sensitive instruments which cannot be sterilised or when single use items are not available.

Disinfection is not a sterilising process and should not be used as a convenient substitute for sterilisation. Thermal disinfection is not appropriate for instruments that will be used in critical sites and these must be sterile.

Certain products and processes are providing different level of disinfections. They fall into three major categories:

- Low-level disinfection
- Intermediate level disinfection
- High-level disinfection

LOW-LEVEL DISINFECTION

It kills most bacteria, some viruses and some fungi, but may not be reliable to kill more resistant bacteria such as M.tuberculosis or bacterial spores.

INTERMEDIATE LEVEL DISINFECTION

Inactivates Mycobacterium tuberculosis vegetative bacteria, most viruses and most fungi, but does not always kill bacteria spores.

HIGH-LEVEL DISINFECTION (HLD)

Destroy all micro-organisms except some bacterial spores (especially if there is heavy contamination).

This is an alternative to sterilisation when either sterilisation equipment is not available or it is not feasible to carry out sterilisation.

High-level Disinfection of instruments can be performed through:

- Pasteurisation (Boiling in water)
- Chemical disinfectants

Pasteurisation

If an instrument is able to withstand the process of heat and moisture and is not required to be sterile, then thermal disinfection is appropriate. By using heat and water at temperature that destroys pathogenic, vegetative agents, this is a very effective method of disinfection.

The level of disinfection depends on the water temperature and the duration of instrument exposed to this temperature.

Table 18: Minimum surface temperature and time required for thermal disinfection*

Surface temperature (°C)	Minimum disinfection time required (In minutes)
90	1
80	10
75	30
70	100

**Source - Practical guidelines for infection control in healthcare facilities - WHO*

Semi-critical medical equipment/devices suitable for pasteurisation include equipment for respiratory therapy and anaesthesia. Equipment/devices require thorough cleaning and rinsing prior to pasteurisation.

Advantages of pasteurisation include rapid disinfection cycle and moderate cost of machinery but it has a major disadvantage that it is hard to validate the effectiveness of the process.

While performing HLD using pasteurisation it has to be ensured that:

- The process should be monitored with mechanical temperature gauges and timing mechanisms for each load
- Cycle time of disinfection should be verified manually and recorded for each cycle
- Calibration of pasteurisation equipment should be performed according to the manufacturer's recommendations
- Daily cleaning of pasteurising equipment is required to be done.

Following pasteurisation, medical equipment/devices need to be handled in a manner that prevents contamination. Equipment/devices need to be transported directly from the pasteuriser to a clean area for drying, assembly and packaging.

HLD using Chemicals

The performance of chemical disinfectants is dependent on the following factors:

- Temperature
- Contact time
- Concentration and pH
- Presence of organic or inorganic matter
- Resistance of the initial bioburden on a surface.

Steps of HLD using Chemicals

Glutaraldehyde is recommended to use, as it is the most appropriate chemical disinfectant to provide HLD. The following steps should be taken:

- First and foremost requirement is to clean the contaminated instruments thoroughly as per instructions. The instruments are then dried thoroughly before placing them in the disinfectant solution
- Completely immerse all items in the HLD
- Record the time and soak the instruments for at least 20 minutes
- Remove the items using sterile forceps or gloves
- Rinse well with boiled and filtered water three times and use immediately or dry with sterile cloth.

During HLD it has to be ensured that:

- Prepared solutions shall not be topped up with fresh solution
- During manual disinfection it is to be ensured that the container used for disinfection is kept covered during use and washed, rinsed and dried when the solution is changed
- Each device shall be thoroughly rinsed following chemical HLD, according to the chemical manufacturer's instructions
- Unless a device is to be used immediately, it shall be thoroughly dried
- Drying of non-critical devices may be done by air-drying or other methods.

Note:

1. ***There is no single ideal disinfectant. Different grades of disinfectants are used for different purposes***
2. ***Only instruments grade disinfectants are suitable for medical instruments and equipment***
3. ***Hospital grade or household grade disinfectant must not be used on instruments; they are only suitable for environmental purposes.***