## CONTENTS

<table>
<thead>
<tr>
<th>S. No</th>
<th>Chapters</th>
<th>Page No</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Management of Biomedical Waste</td>
<td>4 - 9</td>
</tr>
<tr>
<td>2</td>
<td>Central Sterile Supply Department</td>
<td>10 - 19</td>
</tr>
<tr>
<td>3</td>
<td>Cleaning, Disinfection and Sterilization</td>
<td>20 - 47</td>
</tr>
<tr>
<td>4</td>
<td>Laundry Services</td>
<td>48 - 51</td>
</tr>
<tr>
<td>5</td>
<td>Food services</td>
<td>52 - 54</td>
</tr>
<tr>
<td>6</td>
<td>Prevention and Management of Blood Stream Infections</td>
<td>55 - 61</td>
</tr>
<tr>
<td>7</td>
<td>Prevention of Urinary Tract Infections</td>
<td>62 - 66</td>
</tr>
<tr>
<td>8</td>
<td>Care of patients on Ventilator and prevention of VAP</td>
<td>67 - 71</td>
</tr>
<tr>
<td>9</td>
<td>Prevention and management of Occupational exposures</td>
<td>72 - 74</td>
</tr>
<tr>
<td>10</td>
<td>Infection Control Practices in Operating rooms</td>
<td>75 - 81</td>
</tr>
<tr>
<td>11</td>
<td>Standard Precautions</td>
<td>82 – 91</td>
</tr>
<tr>
<td>12</td>
<td>Surveillance</td>
<td>92 - 101</td>
</tr>
</tbody>
</table>
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MANAGEMENT OF BIOMEDICAL WASTE

Objectives

- To ensure that all statutory provisions with regard to Biomedical waste (BMW) management are complied with.
- All patient areas in the hospital & Bio-medical waste handling units are monitored by infection control nurses as per the institutional guidelines.

Protocol

- BMW should be segregated AT SOURCE, BY THE GENERATORS
- Following are the different categories of BMW:

<table>
<thead>
<tr>
<th>Category</th>
<th>Waste</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Human Anatomical waste</td>
</tr>
<tr>
<td>2</td>
<td>Animal waste</td>
</tr>
<tr>
<td>3</td>
<td>Microbiology &amp; Biotechnology waste and other laboratory waste</td>
</tr>
<tr>
<td>4</td>
<td>Waste sharps</td>
</tr>
<tr>
<td>5</td>
<td>Discarded Medicines &amp; Cytotoxic Drugs</td>
</tr>
<tr>
<td>6</td>
<td>Soiled waste</td>
</tr>
<tr>
<td>7</td>
<td>Infectious solid waste</td>
</tr>
<tr>
<td>8</td>
<td>Chemical waste</td>
</tr>
</tbody>
</table>

- Discarding BMW: Segregate according to above categories
- Place in colour coded bags/bins according to following colour codes.
<table>
<thead>
<tr>
<th>BLACK</th>
<th>BLUE</th>
<th>YELLOW</th>
<th>SHARPS (Separately in Puncture Proof containers)</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Waste</td>
<td>Infected plastics &amp; rubber materials</td>
<td>Anatomical waste</td>
<td>Needles</td>
</tr>
<tr>
<td>Kitchen waste</td>
<td>Gloves</td>
<td>Dressings</td>
<td>Metal styllets</td>
</tr>
<tr>
<td>Non infected plastics</td>
<td>Urobags</td>
<td>Non plastic waste infected with blood &amp; body fluids</td>
<td>Blades</td>
</tr>
<tr>
<td>Discarded medicines</td>
<td>Disposable plastic drapes</td>
<td>PPE infected with blood &amp; body fluids</td>
<td>Lancets</td>
</tr>
<tr>
<td></td>
<td>Infected glass drainage bottles</td>
<td>Culture plates</td>
<td>Pre-filled syringes</td>
</tr>
<tr>
<td></td>
<td>Vaccutainers, Blood culture bottles</td>
<td>Soiled plaster casts</td>
<td>Insulin syringes</td>
</tr>
<tr>
<td></td>
<td>Puncture proof containers</td>
<td>Infected surgical masks and caps</td>
<td>Broken ampoules (Separately)</td>
</tr>
<tr>
<td></td>
<td>Plastic aprons</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>All Rubber &amp; Plastic catheters</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>IV tubings &amp; bottles (after mutilation)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Syringes</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
PROTOCOL

- Appropriate personal protective measures should be used by all housekeeping staff who handle bio-medical waste
  - Personal Protective Equipments (PPE):
    - Heavy duty Hand gloves
    - Gum boots
    - Mask
- Garbage is temporarily stored in the respective bin as per above color coding.

Role of sanitary attendants in BMW management

- Garbage bins in public areas/lab/blood bank/ ICUs and wards/OTs are emptied at the end of each shift or whenever they are 2/3 rd full.
- Bags should be tied up and transferred to the dirty utility room carefully without any spillage.
- At the end of every shift, garbage from every area to be transported by designated trolley to garbage central collection area.
- Garbage movement to be done through utility lift/ramp at the end of every shift.
- In case any bag is torn, ensure that double bagging is done before moving it from dirty utility room.
- There is a Bio medical garbage collection room with compartments made to store black, yellow and blue bags. This garbage room is present in the outer area. All biomedical garbage from various areas in the hospital is stored in this garbage room.
- Biomedical waste is taken for treatment by outsourced vendors.
- On completion of garbage disposal process removal of personal protective equipment (PPE) should be followed by hand washing as per the standard protocol.
SEGREGATION AND STORAGE OF BMW WASTE
MUTILATION AND DISPOSAL OF NEEDLE AND SYRINGE
DISPOSAL OF SHARPS AND NEEDLES IN THE PUNCTURE-PROOF CONTAINERS

Needles and sharps should be immediately cut/destroyed.

Syringes & needles should be put in puncture-proof container.
CENTRAL STERILE SUPPLY DEPARTMENT

Objectives
- Making sterilized articles available in the hospital at the required time and place.
- Ensuring that all items receive the same degree of cleaning and sterilization.
- Ultimately contributing in the reduction of hospital infections which might occur due to usage of contaminated devices.
- Maintaining records of effectiveness of cleaning, disinfection and sterilization processes.

Workflow
The division of the CSSD should be into four areas:

- Decontamination area
- Clean packaging area
- Sterilizer area
- Sterile storage area

Physical barriers should separate the decontamination areas from other areas to contain contamination. A unidirectional work flow should be maintained for optimum functioning.

A manual must be maintained

Transport and reception of non-sterile items
- Used, dirty goods are to be received in the dirty area of the department.
- Personnel handling contaminated items should wear gloves, gowns and masks.
- Dedicated trolleys (preferably covered) should be used for transportation of articles to the department.
- The items must also be sent from the OR’s via dedicated elevators, especially designed for this purpose.

Cleaning of devices and items
- In the decontamination area, all reusable contaminated supplies are sorted and decontaminated.
- The CSSD workers in the decontamination area should wear household-cleaning-type rubber or plastic gloves when handling contaminated instruments and items.
- Face mask, eye protection such as eye shields/goggles, appropriate gowns should be worn when exposure to blood or body fluid may occur.
- Sharps should never be retrieved from trays with gloved hands. Forceps may be used for this purpose.
- At least six air changes per hour and a negative pressure is recommended in the decontamination area.
• The ceilings and walls should be constructed of a non-shedding material and the floors should be able to withstand the chemicals and disinfectants used in cleaning.
• Daily cleaning and maintenance of the facility is needed.
• The instruments may be manually cleaned (scrubbed using detergents and appropriate brushes) or cleaned using automated washers or disinfectors.
• All instruments with dried secretions should be first soaked in detergent water to loosen up the debris. Ensure the instrument is free of any debris or proteinacious deposits as this affects the efficiency of the sterilization process.
• After washing, each device should be inspected for cleanliness, functionality, breakage or defects and then appropriately assembled.
  • All items should be properly dried after washing should be properly dried and moisture-free as moisture impairs many sterilization processes. Drying may be done manually or using automated dryers.

**Assembling and packaging**

• Packaging area is used for inspecting, assembling and packaging of clean, non-sterile articles.
• Wrapping of the articles before sterilization should be done in such a manner that tenting and gapping should be avoided.
• Workers should wear gloves, gowns and masks while packing.
• The packaging procedure and material should be validated for the type of sterilization.
• Double wrapping may be done sequentially or non-sequentially.
• Each pack should be marked with the name and contents of the pack, the initials of the person who packed it and the date and initials of the person who carried out the sterilization.

**Sterilization**

• The sterilizer should be loaded in accordance to the manufacturers’ recommendations.
• Ensure that all the physical and chemical parameters are checked before and during the sterilization cycle.
• Maintain complete records of each sterilization cycle.
• Following sterilization, all sterile items should be moved aseptically to the sterile area for the storage of items.
• The sterile area should be a limited access area with controlled temperatures ($\leq 75^\circ F$) and relative humidity (30-60%).
• A record of the date of sterilization, physical parameters of sterilization cycle and microbiological tests reports should be maintained for each batch.
• All sterile items should be kept in the sterile area till they are supplied to the clinical areas.
• Positive pressure and minimum of ten air changes per hour is recommended in the sterilizer equipment room.
Issuing sterile items
- Clean packaged, sterile goods are sent to the respective clinical areas from the sterile area of the CSSD.
- The personnel delivering the goods should wear caps, gowns, masks and gloves while transporting the items to the clinical areas and should use clean covered dedicated trolleys.
- The trolleys should be clean, covered and preferably lined with a clean cloth.
- The articles can be transported to the OR’s via dedicated elevators directly into the OR’s.

Validation and communication
- Procedures being carried out in the CSSD should be continuously validated.
- This should include all activities including wrapping methods, sterilization methods and sterilization conditions (all physical and chemical parameters).
- The in-charge should ensure proper maintenance of all the equipment according to the manufacturer’s recommendations. Any failure or defect of the physical/chemical/biological indicators should be reported to the administration, maintenance, infection control and other appropriate clinical units or personnel.
- All outdated sterile units should be removed at regular intervals.

STERILIZATION PROCEDURES

Steam under pressure (Autoclaves)
  - **Essential parameters:** Steam (dry, saturated), time, temperature and pressure.
  - **Time to sterilize:** usual cycles: 121 °C x 30 minutes, 132 °C x 4 minutes.

Precautions:
- Follow the manufacturer’s instructions.
- Arrange items in a way that allows the steam to circulate freely.
- Keep the loads at the sterilizing temperature for the recommended holding time.
- Exercise care during opening (potential for steam injuries).

Uses:
- It is the most efficient and reliable method of sterilization (wide margin of safety).
- Use for sterilization of all critical and semi-critical items that are heat and moisture resistant (surgical instruments, surgical drapes, some respiratory and anesthetic equipments, microbiological waste and sharps).

Monitoring of steam sterilization process:
Residual air detection for vacuum sterilizers (Bowie- Dick test): Test daily.

Procedure:
- A commercially available Bowie- Dick type test sheet should be placed in the centre of the pack.
- The test pack should be placed horizontally in the front, bottom section of sterilizer rack, near the door and over the drain in an otherwise empty chamber and run at 134 °C x 3.5 minutes.
- Residual air in the chamber will interfere with steam contact (the entrapped air will cause a spot to appear on the test sheet due to inability of steam to reach the chemical indicator).
- If the sterilizer fails the test, do not use until remedied.

a) **Mechanical monitoring**: Each cycle

b) **Chemical monitoring**: Each cycle

c) **Biological monitoring**: *Geobacillus stercorarius* spores $10^5$.
   - Use at least weekly (preferably daily) and with each load of implantable devices.
   - Loads containing implantable devices should ideally be quarantined until the results of biological indicators are available.

**Hot air sterilizer**

- **Essential parameters**: Temperature and time

- **Precautions**:
  - Follow the manufacturer’s instructions.
  - Arrange items in such a way that, the hot air circulates freely.
  - Keep the load at sterilizing temperature for the recommended holding time
  - Exercise care during opening (potential for thermal injuries).
  - Take out the sterile items with sterile pick-ups, after they have reached room temperature.

- **Uses**: Should be used only for heat tolerant materials that may be damaged by/impermeable to moist heat. Examples: powders, petroleum products, sharp instruments, glass wares.

- **Time to sterilize**: 170 °C x 60 minutes/ 160 °C x 120 minutes/ 150 °C x 150 minutes.
Monitoring of cycle processes:

a) Mechanical: Each cycle

b) Chemical: Each cycle

c) Biological monitor:

- *B. atrophaeus* spores (106): Use at least weekly (preferably daily) and with each load of implantable devices.
- Loads containing implantable devices should ideally be quarantined until the results of biological indicators are available.

Low temperature sterilization

1. Ethylene Oxide (EtO)

Ethylene oxide is gaseous, low temperature sterilant.

**Essential parameters:** Gas concentration (450-1200 mg/L), temperature (37-63°C), relative humidity (40-80%), vacuum, pressure and exposure time (1-6 hours; aeration requires an additional 8-12 hours).

**Precautions**

- EtO gas must penetrate the entire load
- Must be handled according to strict guidelines
- Manufacturer’s instructions must be followed for packaging, sterilizing, validation and aeration.
- Items must undergo aeration to remove residual EtO
- Most occupational exposures to EtO are covered by OSHA standards. OSHA has established a PEL of 1 ppm airborne EtO in work place.
- Ensure regular environmental monitoring, employee information, training and medical examination. Warning signs must be posted near EtO plants. Only authorized persons should enter the area.
- Effectiveness altered by lumen length, lumen diameter, inorganic and organic contamination.

**Time to sterilize:** 12-24 hours

**Uses**

- Appropriate for sterilization of heat and moisture labile critical and semi-critical items.
- Sterilization of devices containing electronic components.
Monitoring of process

a. **Mechanical: Each cycle** (time, temperature, pressure). The essential components of gas concentration and humidity cannot be monitored.

b. **Chemical: Each cycle**

c. **Biological monitor:**

   - *B. atrophaeus* spores (10^6): Use at least weekly (preferably daily) and with each load of implantable devices. Loads containing implantable devices should ideally be quarantined until the results of biological indicators are available.

2. **Hydrogen peroxide (H_2O_2) Gas plasma**

**Principle**

- Gas plasmas are referred to as the fourth state of matter.
- They are generated by exciting a chemical precursor (H_2O_2) under a deep vacuum in an enclosed chamber using radiofrequency/microwave energy.
- This produces highly reactive and biocidal charged particles, many of which are free radicals.
- The free radicals react and inactivate essential cellular components (enzymes, nucleic acids) of microbes.

**Precautions**

- Items should be totally dried before loading.
- H_2O_2 may be toxic at levels greater than 1 ppm TWA (time weighted average)

**Time to sterilize:** 47-75 minutes

**Monitoring of procedure:**

- **Physical and Chemical monitoring:** is inbuilt with each cycle (it records the concentration of active ingredients).
- **Biological monitor:** Spores of *G. stearothermophilus* (read at 48 hours): The system has its own monitor in plastic vials, which should be incorporated at least weekly (preferably daily).

**Uses:**

- Sterilization of devices which are heat and moisture sensitive (plastic, electronic devices, corrosion sensitive metals).
- Examples: Arthroscope & its instruments, micro instruments, vascular instruments, spine sets, pneumatic drills, dermatomes, micro and mini drill, implants, urethroscope & its instruments, laproscope & its instruments, thoroscope & its instruments, laprotomy set, nephrectomy set, microvascular instruments, dental implants, craniotomy sets, tracheostomy set, image intensifying cover, retractors, bone nibblers, ophthalmic instruments.
Sterilizing Practices

- Ensuring sterilization depends not only on the effectiveness of the sterilization process but also on the pre-cleaning, disassembling and packaging of the device, loading the sterilizer, monitoring of sterilization, sterilant quality and quantity, assessing the appropriateness of the cycle for the load contents, and other aspects of device reprocessing.
- The cleaning, disinfection and sterilization of medical and surgical equipments should preferably be done at a central processing area by trained personnel.
- Must comply with the manufacturer’s recommendations. The daily operation of the sterilization must be documented by personnel performing the process.

1. Cleaning.
   - All items MUST be cleaned using water with detergents or enzymatic cleaners before processing.
   - Pre-cleaning in patient-care areas may be needed on items that are heavily soiled with feces, sputum, blood, or other material.

2. Packaging
   - Once items are cleaned, dried, and inspected, those requiring sterilization must be wrapped or placed in rigid containers and should be arranged in instrument trays/baskets.
   - Surgical items may be kept in rigid containers, peel-open pouches, roll stock or reels and sterilization wraps (woven or nonwoven).
   - The packaging material must allow penetration of the sterilant, provide protection against contamination during handling, provide an effective barrier to microbial penetration, and maintain the sterility of the processed item after sterilization.

3. Loading
   - All items to be sterilized should be arranged so that all surfaces will be directly exposed to the sterilizing agent.
   - Allow for proper sterilant circulation; perforated trays should be placed so that the tray is parallel to the shelf; non-perforated containers should be placed on their edge (e.g., basins); small items should be loosely placed in wire baskets and peel packs should be placed on edge in perforated or mesh bottom racks or baskets.

4. Storage
   - Wrapped surgical trays remain sterile for varying periods depending on the type of material used to wrap the trays.
   - Safe storage times for sterile packs vary with the porosity of the wrapper and storage conditions (e.g. open versus closed cabinets).
   - Items that have been sterilized should not be used after the expiration date or if the sterilized package is wet, torn, or punctured.
- Following the sterilization process, medical and surgical devices must be handled using aseptic technique in order to prevent contamination.
- Sterile supplies should be stored far enough from the floor (8 to 10 inches), the ceiling (5 inches unless near a sprinkler head [18 inches from sprinkler head]), and the outside walls (2 inches) to allow for adequate air circulation, ease of cleaning, and compliance with local fire codes.
- Medical and surgical supplies should not be stored under sinks or in other locations where they can become wet.
- Sterile items that become wet are considered contaminated because moisture brings with it microorganisms from the air and surfaces.
- Closed or covered cabinets are ideal but open shelving may be used for storage.
- Any package that has fallen or been dropped on the floor must be inspected for damage to the packaging and contents (if the items are breakable).

5. **Monitoring**

The sterilization procedure must be regularly monitored to evaluate the sterilizing conditions and microbiologic status of the processed items. Monitoring is done by mechanical, chemical and biological means.

*Mechanical indicators*: include the daily assessment of cycle time, temperature and pressure (maintain a record/print-outs of temperature chart and pressure).

*Chemical indicators*:

- Should be used in conjunction with biological indicators, but should not replace them.
- Chemical indicators are affixed on the outside of each pack to show that the package has been processed through a sterilization cycle, but they do not prove that sterilization has been achieved.
- Preferably, a chemical indicator should also be placed on the inside of each pack to verify sterilant penetration.
- Chemical indicators usually are either heat-or chemical-sensitive inks that change color when one or more sterilization parameters (e.g., steam-time, temperature, and/or saturated steam; ETO-time, temperature, relative humidity and/or ETO concentration) are present.
- If the internal and/or external indicator suggests inadequate processing, the item should not be used.

*Biological indicators*:

- These are ideal monitors of sterilization process, because they measure the sterilization process directly by using the most resistant microorganisms (i.e., *Bacillus* spores),
- The manufacturer’s instructions should be followed for use of all commercially prepared biologic monitoring system.
- Apart from routine testing, biological indicators are also required to be used in the following situation: Installation of a new sterilizer, after relocation of an existing sterilizer, after a sterilizer malfunction, after major repairs to a sterilizer that are outside the scope of routine or preventive maintenance and after repairs to the steam generator/delivery system.

- The CDC recommends that "objects, other than implantable objects, do not need to be recalled because of a single positive spore test unless the steam sterilizer or the sterilization procedure is defective." If the mechanical and chemical indicators suggest that the sterilizer was functioning properly, a single positive spore test probably does not indicate sterilizer malfunction but the spore test should be repeated immediately. If the spore tests remain positive, use of the sterilizer should be discontinued until it is serviced. For EtO and H\textsubscript{2}O\textsubscript{2} gas plasma, a single positive spore test may be considered significant. All loads should be retrieved for re-processing.

- The details of the biological indicators for sterilization are given below: Biological Indicators of sterilization procedures

<table>
<thead>
<tr>
<th>Spore Strain</th>
<th>Bacillus atrophaeus</th>
<th>Geobacillus stearothermophilus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monitors</td>
<td>Ethylene oxide, dry heat</td>
<td>Steam, Hydrogen peroxide gas plasma, liquid peracetic acid</td>
</tr>
<tr>
<td>Number of spores</td>
<td>10\textsuperscript{6} spores</td>
<td>10\textsuperscript{6} spores/10\textsuperscript{5} spores</td>
</tr>
<tr>
<td>Method of use</td>
<td>Place strip in centre of one or more packs of chamber; transfer strips into a recommended broth</td>
<td>Place strip in centre of one or more packs of chamber; transfer strips into a recommended broth.</td>
</tr>
<tr>
<td>Incubation</td>
<td>35-37\textdegree C x 14 days. Examine for turbidity. Incubate an unexposed spore strip simultaneously</td>
<td>55-56\textdegree C for upto 14 days anaerobically. Incubate an unexposed strip simultaneously.</td>
</tr>
</tbody>
</table>
Receiving and loading unsterile items for steam sterilization (autoclaves)
CLEANING, STERILIZATION AND DISINFECTION

Important definitions:

Sterilization is defined as the process where all the living microorganisms, including bacterial spores are killed. Sterilization can be achieved by physical, chemical and physiochemical means.

Disinfection is the process of elimination of most pathogenic microorganisms (excluding bacterial spores) on inanimate objects. Disinfection can be achieved by physical or chemical methods. Chemicals used in disinfection are called disinfectants. Sterilization is an absolute condition while disinfection is not. The two are not synonymous.

Decontamination is the process of removal of contaminating pathogenic microorganisms from the articles by a process of sterilization or disinfection. It is the use of physical or chemical means to remove, inactivate, or destroy living organisms on a surface so that the organisms are no longer infectious.

Sanitization is the process of chemical or mechanical cleansing, applicable in public health systems. Usually used by the food industry. It reduces microbes on eating utensils to safe, acceptable levels for public health.

Asepsis is the employment of techniques (such as usage of gloves, air filters, UV rays etc) to achieve microbe-free environment.

Disinfection and sterilization are essential for ensuring that medical and surgical instruments do not transmit infectious pathogens to patients.

<table>
<thead>
<tr>
<th>Patient Contact</th>
<th>Examples</th>
<th>Device Classification</th>
<th>Minimum Inactivation Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intact skin</td>
<td></td>
<td>Non-Critical</td>
<td>Cleaning and/or Low/Intermediate Level Disinfection</td>
</tr>
<tr>
<td>Mucous membranes or non-intact skin</td>
<td></td>
<td>Semi-Critical</td>
<td>High Level Disinfection</td>
</tr>
<tr>
<td>Sterile areas of the body, including blood contact</td>
<td></td>
<td>Critical</td>
<td>Sterilization</td>
</tr>
</tbody>
</table>
The approach to disinfection or sterilization is based on the classification which categorizes instruments or items into critical, semi-critical or non critical based on the intended use and the potential for risk of transmission of infection if the instrument was microbiologically contaminated before use. Table below shows the Spaulding’s classification of medical devices.

<table>
<thead>
<tr>
<th>Item/Device</th>
<th>Definition/Intended use</th>
<th>Risk of infection</th>
<th>Reprocessing required</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Critical</td>
<td>Medical device which is intended to enter a normally sterile tissue or vasculature</td>
<td>High</td>
<td>Sterilization</td>
<td>Cardiac catheter, Surgical - instrument, Implants, Needle</td>
</tr>
<tr>
<td>Semi critical</td>
<td>Devices that are intended to come in contact with mucous membrane or non-intact skin</td>
<td>High/Intermediate</td>
<td>Sterilization desirable, HLD acceptable</td>
<td>Respiratory therapy equipment, Some endoscopes, Manometry probes, Diaphragm fitting rings</td>
</tr>
<tr>
<td>Non critical</td>
<td>Devices that come in contact with intact skin</td>
<td>Low</td>
<td>Intermediate or LLD</td>
<td>BP cuff, stethoscope</td>
</tr>
</tbody>
</table>
Cleaning of hospital surfaces

The frequency of cleaning and disinfecting the environmental surfaces may vary according to the type of patient care area (high risk/ post-operative/ ICUs, OTs), the type of surfaces, the amount of people’s movement and soiling.

The following protocol may be followed:

- The staff must be properly trained on the practices of cleaning & decontamination of hospital surfaces.
- Appropriate personal prophylactic equipments (PPE; gloves, masks, and boots) must be worn at all times and a proper log of all cleaning procedures must be maintained.
- The house keeping surfaces (floors/ table- tops/ counters) should be cleaned on a regular basis, when visibly soiled and when spills occur.
- Cleaning may be done with detergent and hot water or an EPA registered hospital disinfectant for housekeeping surfaces.
- Use of a low/ intermediate level disinfectant is advocated in specific high risk areas or when there is suspected spills of blood/ body substances/ MDR organisms).
- Do not use disinfectants in offices.
- High level disinfectants must not be used for environmental surfaces in any area of the hospital.
- Prepare fresh detergent/disinfectant solutions every day, according to manufacturer’s instructions and replace with fresh solution frequently.
- Hospitals may select one EPA- registered disinfectant for all the wards, considering its activity, cost, safety and material compatibility.
- Follow the manufacturer’s instructions for use of disinfectants, its storage and disposal.
- Diluted disinfectants may become contaminated with resistant pathogen, therefore, avoid application of contaminated cleaning solution from spray bottles/equipments which generate aerosols.
- Discard the remaining solutions after day’s use and dry the containers.
- The methods of cleaning non- porous floors include vacuum cleaning, wet mopping, dry dusting with electrostatic material and spray buffing.
- Avoid dry mopping with brooms, which generate dust aerosols.
- Ensure thorough physical wiping and scrubbing which is as effective as the use of disinfectant in reducing the bio-burden.
- Wet dust horizontal surfaces daily with a clean cloth moistened with an EPA registered hospital disinfectant (or detergent).
- Minimize contamination of cleaning solution and cleaning tools.
- For wet mopping, use a two bucket system. When a single bucket is used, change the solutions more frequently. Discard used cleaning solutions in the sluice. Clean the buckets with detergent and warm water and store inverted to assist drying.
- Worn and damaged cleaning equipment should be replaced. Preferably use disposable mop heads, if cost permits; otherwise, change mop heads after cleaning spills and at the beginning of the day. Decontaminate mop head and cleaning cloths regularly to prevent
contamination. This may be done by laundering (heat disinfection) with detergent and drying at 80°C for 2 hours daily or immersing the cloth in hypochlorite solution (4000 ppm) for 2 minutes. Alternatively, dust attracting mops (microfiber material) may be used, especially for critical care areas.

- Clean the walls, blinds and window curtains when they are visibly contaminated or soiled. Curtains in the vicinity of a disperser of epidemic MRSA strain may be changed if the area is to be reoccupied by a susceptible person within 24 hours.
- Clean and disinfect high touch surfaces more frequently than minimal touch surfaces.
- Appropriate barrier protective coverings may be used for difficult to clean high touch non-critical equipment surfaces that are likely to become contaminated with blood or body fluids (e.g. computer key boards).
- Surfaces should be left dry after cleaning.
- Disinfectant fogging is not recommended for routine patient care areas.
MANAGEMENT OF SPILLS OF BLOOD AND BODY SUBSTANCES

- All blood and body fluid spills in health set ups must be managed according to the recommendations of OSHA, WHO and CDC.
- All equipment and surfaces contaminated with blood and other potentially infectious material (OPIM) must be decontaminated with an appropriate disinfectant.
- PPE (gloves, face masks, fluid resistant gowns) must be used for cleaning blood spills. For large spills, protective shoe covers/ boots must be worn.
- Small spills should be cleaned and disinfected using an intermediate level germicide having a tuberculocidal claim. In 1997, OSHA amended the policy to include, EPA registered disinfectants whose label includes inactivation claims for HBV and HIV provided that such surfaces have not become contaminated with agent(s) or volumes of or concentration of agents for which a higher level of disinfection is recommended. These agents are tested in EPA’S list D & E. EPA encourages the use of registered products because the agency reviews them for safety and performance when the product is used according to label instructions. For blood borne pathogens other than HBV or HIV, OSHA recommends the use of EPA registered tuberculocidal disinfectants.
- For decontamination of small spills (< 10 ml), if sodium hypochlorite solution is selected, use a 1:100 dilution (a 1:100 dilution of 5.25-6.15% sodium hypochlorite provide, 525-615 ppm of available chlorine). If spills involve large amounts (eg >10ml) of blood or OPIM, or involves a culture spill in the laboratory, a 1:10 dilution of hypochlorite solution for first application (before cleaning) reduce the risk of infection during cleaning. After the first application, remove the visible organic matter with absorbent material (eg disposable paper towels discarded into leak-proof, labeled container), then terminal disinfection with 1:100 sodium hypochlorite may be done.
**Sharps containing spillage**

- Nominate a member of staff to keep the public well clear of the area.
- If possible exclude the public from the area until the hazard has been removed.
- Do not touch any needles or syringes.
- Call a suitably trained member of staff to deal with the spillage.
- Put on strong, protective gloves, overalls, stout shoes, and, if necessary goggles which are located the unit
- Use a pair of tongs or forceps to return the used equipment to a sharps container. These items are located in the unit
- Clear away the equipment as quickly and safely as possible.
- Check the area thoroughly for loose sharps.
- Return sharps container to its storage place.
- Clean the affected area thoroughly with a disinfectant.
- Remove gloves, overalls and shoes and return to their storage place.

**Loose sharps**

- **NEVER** attempt to re-sheath a needle – this is the most common cause of needle stick injuries.
- If a needle or syringe is left on the counter or accidentally dropped, do not touch it or attempt to move it.
- Keep the public well away from the area.
- The pharmacist or trained member of staff should deal with the needle.
- Put on a pair of strong protective gloves which are located in the unit
- Use a pair of forceps or tongs to place the loose sharps into the sharps container. These items are located in the unit
- Clean the affected area thoroughly with a disinfectant.

**Spillage kit**

- Biohazard infectious yellow disposable bag
- Disposable single use sterile gloves
- Face mask
- Disposable gown
- Disposable goggles
- Paper towels
- Hypochlorite powder/ Sodium dichloro isocyanurate (Na DCC) granules
- Clean up scoop and scraper
- SPILLAGE SLIDES (2)
**Cleaning of special care areas**

- Housekeeping areas in high risk wards need special attention for routine cleaning.
- Wet dust horizontal surfaces daily with clean cloths moistened with freshly prepared detergent or EPA-registered hospital disinfectant.
- Avoid use of cleaning equipments that produce mist or aerosols or produce dispersion of dust.
- Preferably perform vacuum cleaning.
- Equip vacuums with HEPA filters, especially for the exhaust.
- Ensure regular cleaning and maintenance of equipment to ensure efficient particle removal.
- Keep the doors closed when near -by areas are being cleaned.
- Filters in cleaning equipment/air handling unit should be cleaned and replaced as per the manufacturer’s recommendation.

**Cleaning of bedding, mattresses and pillows**

- Keep the mattress and pillow covers dry. Discard them if they become wet, damaged or stained, especially in burns/ other high risk wards.
- Cover the mattress with protective water-proof plastic material, which should be replaced if torn.
- Sheets should be changed at least twice weekly, if soiled, wrinkled, stained or contaminated with potentially infectious material.
- Mattress and pillows with plastic covers should be wiped over with a neutral detergent and dried. Avoid excessive wetting during cleaning. If disinfection is required, use a chlorine releasing agent and rinse well.
- Mattresses without plastic covers should be steam cleaned if they have been contaminated with body fluids. If this is not possible, contamination should be removed by manual washing, ensuring personnel and environmental protection.
- Avoid the practice of sticking needles into mattresses.
- Wash pillows and bed sheets in a hot water laundry cycle.

**Disinfection in hemodialysis unit**

- The hemodialysis system includes the hemodialysis machine, water supply & treatment system and distribution system.
- Hemodialysis systems usually are disinfected by chlorine based disinfectant, heat pasteurization, ozone, or per acetic acid.
- The non-critical surfaces in hemodialysis systems include the dialysis bed/ chair, counter tops, external surface of dialysis machines and equipments (scissors, hemostats, clamps, BP cuffs, stethoscopes). These should be disinfected with an EPA registered low level disinfectant.
Cleaning of medical equipment

Thorough cleaning, preferably done at the point of use must precede any disinfection or sterilization process. Cleaning alone (physical scrubbing with detergents and surfactants followed by rinsing with water) effectively removes a large number of microorganisms from contaminated equipments and surfaces. For effective cleaning:

- The staff must be properly trained and required to wear PPE appropriate to the task.

- The manufacturers of equipment should provide instructions regarding its cleaning and disinfection, with specific information regarding germicide and water compatibility.

- Utmost care should be taken to prevent drying/baking of soiled material on the surface. Therefore, immediately after use, surgical equipments/soiled devices must be disassembled, rinsed or soaked in water with or without detergent to prevent drying of blood and to facilitate removal of soil and blood.

- Cleaning can be done manually or by automated methods. Manual cleaning is done by scrubbing/rubbing with friction using a brush and employing water under pressure. Care should be taken to remove all visible soil and to reach all channels and bores of the instruments. Items composed of more than one removable part should be disassembled and cleaned.

- The automated methods currently available include ultrasonic cleaners, washer decontaminators, washer disinfectors and washer sterilizers. These equipments must be used according to the manufacturer’s instructions. Special precautions should be taken in loading these automated systems: hinged instruments should be opened fully to allow adequate contact with the detergent solution, stacking of instruments should be avoided and instruments should be disassembled as much as possible.

- Delicate and intricate objects and heat- or moisture-sensitive articles may require careful cleaning by hand.

- Cleaning should be usually done using a detergent or soap and water. A neutral/near neutral pH detergent solution is commonly used because such solutions generally have the best material compatibility and good soil removal. Enzymes (usually proteases) are sometimes added to assist in removing organic material. Enzymatic cleaners must be used in accordance with manufacturer’s instructions.
Disinfection of HBV, HCV, HIV or TB contaminated devices

Equipment, devices and surfaces should be managed in the same way regardless of whether the patient is known to be infected with HBV, HCV, HIV or M. tuberculosis. Sterilization or high level disinfection with EPA registered chemicals should be done.

Reprocessing Single-Use or Disposable Items

Items or devices that cannot be cleaned and sterilized or disinfected without altering their physical integrity and function should not be reprocessed. Reprocessing procedures that result in residual toxicity or compromise the overall safety or effectiveness of the items or devices should be avoided.

Sterilization and Disinfection

Sterilization: can be achieved by either physical or chemical methods.
- Pre-cleaning to remove all the organic soil must be done for all instruments undergoing sterilization.
- Equipment which can withstand heat and moisture must be sterilized by autoclaving.

Chemical/Liquid sterilization:
- Consider the use of chemical sterilization only if single use is not cost effective and other sterilization methods (mentioned in CSSD protocols) cannot be used.
- The choice of disinfectants should be primarily based on material compatibility, time, use-conditions and cost. Strictly follow the manufacturer’s instructions of use.
- The FDA has approved a few high level disinfectants which can be used for chemical sterilization if the exposure time is prolonged. These chemicals must be used strictly according to the manufacturer’s instructions regarding use-concentration, contact time, temperature, product compatibility and shelf life.
- A disadvantage of chemical sterilization is that items can not be packed and therefore, must be used immediately. The disinfectants also need to be rinsed off thoroughly to prevent toxicity.
- There are no reliable biological indicators for monitoring chemical sterilization.

Disinfection
- Disinfection is used to destroy organisms present on delicate or heat sensitive instruments which cannot be sterilized or when single use items are not available.
- The level of disinfection varies with the intended use and level of risk of infection associated with its use.

Disinfection can be achieved by thermal (pasteurization) or chemical means.

Thermal disinfection (Pasteurization)
• If an instrument is able to withstand heat and moisture and is not required to be sterile, thermal disinfection is appropriate.
• Semi-critical items suitable for pasteurization include equipment for respiratory therapy and anesthesia.
• The items to be pasteurized must be thoroughly cleaned with detergent and water prior to disinfection.
• They must be totally immersed in water during the pasteurization cycle. After pasteurization, special care must be taken to dry (residual water tends to collect) and prevent re-contamination of the equipment during storage and transport.

Chemical disinfection:
Numerous disinfectants are used alone, or in combination for disinfection. Commercial formulations of these germicides are unique products, which must be registered with EPA or cleared by FDA.
• In general, the activity of a disinfectant depends on the temperature, contact time, pH, presence of organic or inorganic matter and number and resistance of the bio-burden on a surface, therefore, while using the product, the users must comply with the manufacturer’s label instructions of use-concentration, contact time, temperature, product compatibility, specific purpose of germicide, exposure hazard and methods of disposal.
• HCW must exercise due precautions and use appropriate PPE while using disinfectants.
• Use only instrument grade disinfectants for equipments and instruments.
• Household/ hospital grade chemicals should be reserved for non critical surfaces.
• Pre-cleaning of instruments must be done to ensure appropriate disinfectant activity.
• An increase in pH improves the activity of some disinfectants (glutaraldehyde, quaternary ammonium compounds) but decreases the activity of others (phenols, hypochlorite, iodine). Many disinfectants require dilution prior to use.
• It is mandatory to follow the manufacturer’s instructions exactly as per label regarding use, its dilution and mixing (higher dilution will reduce activity and high concentration can damage instruments or cause toxic effects to the users).
• Use diluted preparations only till recommended shelf life. During use, the minimum effective concentration (MEC) must be regularly monitored depending on the frequency of use.

ALCOHOLS:

Available compounds: Ethyl alcohol, Isopropyl alcohol (IPA), N-propanol

Optimal Concentration: 60-90 % in water (v/v); 100 % concentration not effective.

Uses: Intermediate/ low level disinfectant
• Alcohols/ alcohol impregnated wipes are used for disinfection of small, smooth, clean surfaces (eg trolley tops).
• Disinfection of rubbers stoppers of medication vials, thermometers, stethoscopes, scissors, manual ventilation bags, manikins, ultrasound instrument, and external surface of ventilators, electrical / electronic equipments, which can not be immersed in disinfectants and medication preparation areas.
• Skin antiseptic
• Comment: No product cleared by FDA for HLD/sterilization

GLUTARALDEHYDE

• **Optimal Concentration**: 2-3.2%; generally used as a 2 % activated alkaline solution at room temperature
• **Method of use**: Aqueous solutions are acidic and not sporicidal. They are activated by alkanizing to pH 7.5-8.5 for sporicidal effect. Activity depends on pH, temperature, use concentration, presence of inorganic ions and age of solution.
• **Shelf life**: Shelf life of the activated chemical is approximately 14 days. Solutions may become diluted on repeated use, especially in automated endoscope reprocessors, if wet instruments are immersed.
• **Quality control (Q/C) procedures**: Chemical test strips/ liquid chemicals should be used at recommended frequency to ensure use concentration of > 1-1.5% (Minimum effective concentration; MEC) while high level disinfecting semi-critical items. If solutions are used daily, test MEC daily.

Do not use test strips to extend use life beyond expiration date.

**Disposal**: Neutralize with sodium bisulfate.

**Uses: Liquid chemical sterilant/ High level disinfectant**

• Low temperature disinfection/ sterilization of medical equipments like endoscopes, spirometry tubings, dialyzers, transducers, anesthetic & respiratory equipments, hemodialysis proportioning and dialysate delivery systems etc.
• Should not be used for cleaning non-critical surfaces (toxic & expensive).

**Measures to minimize exposure**:

• Cover the immersion baths with tight lids
• Use only in areas with adequate provisions for exhaustion of toxic vapors (ducted exhaust hood/ ductless fume hoods with vapor absorbents).
• Ensure appropriate ventilation (7-15 air changes/ hour)
• Use of appropriate PPE (gloves, fluid resistant gowns, face masks, goggles)
• Use of appropriate automated machines.
Modified formulations (have reuse life of 28-30 days):

- Activated dialdehyde solutions containing 2.4-3.5% glutaraldehyde
- Glutaraldehyde phenate
- Potentiated acid glutaraldehyde
- Phenol + 2% glutaraldehyde
- Stabilized alkaline glutaraldehyde

However, alkaline glutaraldehyde are superior microbicidals, sporidical and have better anticorrosive properties

**ORTHOPHTHALALDEHYDE**

**Available compounds:** 0.55% 1,2-benzenedicarboxaldehyde

**Disposal:** Must be disposed off in accordance with state regulations. If disposed through sanitary sewers, glycine (25 gms/ gallon) can be used to neutralize OPA.

**Uses:** Chemical sterilant/ High level disinfectant

- Low temperature disinfection/ sterilization of medical equipments.
- Probably more useful for washer disinfectors where glutaraldehyde resistant strains have emerged.

**Precautions:** Handle the chemical with care. Use appropriate PPE (gloves, fluid resistant gowns, face masks, eye protection). Store in containers with tight fitting lids.

**FORMALDEHYDE**

**Available compounds:** 37% formaldehyde by weight (formalin)

**Uses:**

- Preservative of tissues and anatomic specimens
- Preparation of some viral vaccines
- Embalming agent
- Occasionally used to disinfect disposable hemodialyzers reused on the same patient & used to disinfect internal fluid pathways. The equipment must be thoroughly rinsed and tested for residual formaldehyde after disinfection.
- Decontamination of laminar flow biologic safety cabinets

**PARAFORMALDEHYDE**

A solid polymer of formaldehyde, may be vaporized by heat for decontamination of biological safety cabinets.
HYDROGEN PEROXIDE \((H_2O_2)\)

**Available compound:** Commercially available 3-25 % \(H_2O_2\) formulations, 7.5 % \(H_2O_2\) with 0.85% phosphoric acid (to maintain a low pH) is marketed as a sterilant.

- A new, rapid acting, 13.4% \(H_2O_2\) formulation (not FDA cleared) has demonstrated sporicidal, myco bactericidal, fungicidal and virucidal efficacy.

**Uses:** Chemical sterilant/ High level disinfectant

- FDA approved commercial products containing \(H_2O_2\) alone or in combination with peracetic acid is used for disinfection/ sterilization of semi-critical/ critical medical or dental equipments.
- Commercially available 3-7.5% \(H_2O_2\) is used for disinfecting, ventilators, fabrics, endoscopes, foot care equipment. Vaporized \(H_2O_2\) is also used for gas plasma sterilization.

**Precautions:** Check the MEC (6-7.5%) regularly to ensure effective disinfection

PERACETIC ACID/ PEROXYACETIC ACID (PAA)

**Available compounds:** Effective at low (<0.3%) concentrations

**Uses:** Chemical sterilant/ High level disinfectant (See table 7 for FDA approved products)

- Low temperature sterilant for endoscopes, dental equipments.
- In combination with \(H_2O_2\) it is used for disinfection of hemodialyzer.

0.2 % PAA is approved by FDA for use with an automated endoscope reprocessor (AER) at elevated temperature.

**Precautions:** Proper training and appropriate channel connectors must be used with AERs.

CHLORINE RELEASING AGENTS

**Available compounds:**

1. Hypochlorites (most commonly used): available as a liquid (sodium hypochlorite, \(NaOCl\)) or solid (calcium hypochlorite) formulation.
2. Chlorine dioxide
3. Sodium dichloroisocyanurate (NaDCC)
4. Monochloramine
5. Chloramine T
**Use dilution**: Aqueous solution of 5.25-6.15 % sodium hypochlorite is called household bleach.
- A 1:10 dilution of bleach gives 5250-6150 available chlorine. Dilutions may be made according to intended use.
- Preferably make fresh solutions daily for environmental disinfection since diluted solutions of hypochlorite are unstable (there is a 50% reduction in the level of free available chlorine at the end of one month).
- Loss of free chlorine can be minimized if diluted solutions are kept at room temperature in closed, opaque plastic containers at pH 8.

**Uses**: High/ intermediate/ low level disinfectant depending on concentration of free available chlorine and contact time

- Disinfection of blood/ body fluid spills
- Decontamination of laboratory spills
- HLD for selected semicritical devices: dental equipments, CPR mannequins (500 ppm available chlorine x 10 minutes), disinfection of syringes used by drug addicts if sterile disposable needles unavailable (full strength bleach)
- Spot disinfection of counter tops and floors
- Intermediate level disinfection of hemodialysis equipments and hydrotherapy tanks
- Disinfection of water
- Disinfectant in laundry
- LLD for environmental surfaces and hydrotherapy tanks, baby feeding bottles, disinfection of table tops, food preparation areas, toilets
- Disinfection of equipments used for home health care
- Irrigating agent in endodontic treatment
- Disinfection of regulated medical waste
- Disinfection of water distribution system in hemodialysis machines

**Precautions**: Disinfection efficacy reduces at alkaline pH. However, do not mix chlorine releasing agents with acids (including acidic fluids like urine) as toxic chlorine gas is released.

**PHENOLS**

**Available compounds and use concentrations**: Ortho-phenyl phenol, Ortho- benzyl para chlorophenol, p-tert-amylphenol.

Follow manufacturer’s instructions for use dilution; general concentrations range from 0.5-2% aqueous solutions.
Uses: Intermediate/low level disinfectant depending on concentration of active compound

- Many phenolic germicides are EPA registered as disinfectants for environmental surfaces (bedside tables, bed rails, laboratory surfaces, floors, furnishings and non-critical medical devices).
- Especially useful if surface is contaminated with sputum/feces
- Not FDA cleared as HLD for use with semicritical items but could be used to pre-clean or decontaminate critical & semi-critical devices before terminal sterilization/high level disinfection
- Commercially available with added detergents to provide one-step cleaning and disinfection.

Precautions
- Avoid use to clean infant incubators and in nurseries due to serious reported adverse effects (hyperbilirubinemia).
- If used for terminal disinfection, the surfaces should be thoroughly rinsed with water and dried before use. Not recommended for use on food contact surfaces.

IODINE & IODOPHORS

Available compounds:
- Iodine tinctures are aqueous solutions of iodine in alcohol (0.5-10% iodine).
- Iodophors are iodine releasing agents, consisting of combinations of iodine and a carrier (Povidone-iodine & Poloxamer iodine).
- Iodophors have the same antimicrobial activity but are less toxic and non-staining.
- Must be diluted according to manufacturer’s direction since dilution increases the activity of povidone/iodine (due to higher availability of active free iodine molecules).

Uses: Intermediate/low level disinfectants
- ILD for some equipment like thermometers and hydrotherapy tanks. Sometimes used for disinfection of blood culture bottles
- LLD for hard surfaces and non-critical surfaces (I.V poles, wheel chairs, beds, call bells etc.
- Iodine solutions (tinctures): antiseptics on skin/tissues
- Iodophors: antiseptics and disinfectants
- FDA has not cleared any liquid sterilant/HLD having iodophors as active ingredient.

Precautions: Antiseptic Iodophors are not suitable for hard surface disinfection. These should not be used on silicone catheters.
QUATERNARY AMMONIUM COMPOUNDS

Available compounds:

- Benzalkonium chloride
- Ethyl benzyl chloride
- Dimethyl benzyl ammonium chloride
- Dodecyl dimethyl ammonium chloride

Uses: Low level disinfectant

- Good cleaning agent.
- Only to be used for environmental sanitation of non-critical surfaces (floors, furniture, walls, food preparation areas, keyboards).
- EPA registered compounds can be used for non-critical items like BP cuffs & cleansing dirty wounds.

Precautions: Discard left over solution. Do not top up stock bottles. Use screw capped bottles for storage.

CHOROHEXIDINE

Chlorhexidine as chlorhexidine gluconate is dissolved in 70% alcohol.

- Use as antiseptic. Apply alcoholic chlorhexidine to the skin in the event of accidental contamination.
- Effective against Gram-positive organisms and HIV.
- Not recommended as a general disinfectant.
- Not active against sporulating bacteria or non-lipid-containing viruses.
- Active in pH range 5.5 - 8.0.
- Incompatible with soap and anionic detergents.
### DILUTIONS OF CHLORINE RELEASING AGENTS AND THEIR USES

<table>
<thead>
<tr>
<th>Agent</th>
<th>Dilution</th>
<th>Available chlorine</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>House hold bleach</td>
<td>1:10</td>
<td>5000 ppm or 0.5%</td>
<td>Cleaning of Blood spills</td>
</tr>
<tr>
<td>(5.25%)NaOCl with 50,000ppm available Cl₂.</td>
<td>1:50</td>
<td>1000 ppm/0.1%</td>
<td>Cleaning of blood spills</td>
</tr>
<tr>
<td>Surface disinfection (if grossly soiled)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Food surfaces in gastroenteritis outbreaks</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diluted solution loose 50% activity in 30 days.</td>
<td>1:100</td>
<td>500 ppm/0.05%</td>
<td>Cleaning of small blood spills</td>
</tr>
<tr>
<td>Surface disinfection</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Laundry</td>
<td>1:500</td>
<td>100 ppm/0.01%</td>
<td>Decontamination of clean surfaces.</td>
</tr>
<tr>
<td>Decontamination of food surface</td>
<td>1:200</td>
<td>0.025%</td>
<td>Decontamination of food surface</td>
</tr>
<tr>
<td>1:1 or undiluted</td>
<td>2.5-5%</td>
<td>20000-50000ppm</td>
<td>Instruments/Surface contaminated with tissues infected with prions</td>
</tr>
<tr>
<td>1: 50,000 diluted</td>
<td>1 ppm</td>
<td></td>
<td>Disinfection of water</td>
</tr>
<tr>
<td>NaDCC powder with 60% available Cl₂</td>
<td>Dissolve 8.5gm 1 litre of water</td>
<td>0.85% or 5000ppm</td>
<td>Cleaning of blood spills/ surfaces</td>
</tr>
<tr>
<td>Chlorine T with 25% available Cl₂</td>
<td>Dissolve 20gm in 1 litre water</td>
<td>2% or 5000ppm</td>
<td>Cleaning of blood spills/ surfaces</td>
</tr>
</tbody>
</table>

### TYPES OF DISINFECTANTS

#### Low Level Disinfectants

- Low level disinfectants kill most vegetative bacteria and some fungi as well as enveloped (lipid) viruses (e.g., hepatitis B, C, HIV etc.).
- Low level disinfectants do not kill mycobacterium or bacterial spores.
- Low level disinfectants are typically used to clean environmental surfaces.

#### Examples:

- Phenolic germicides
- Quatenery ammonium compounds
Intermediate Level Disinfectants
- Intermediate level disinfectants kill vegetative bacteria, most viruses and fungi but not resistant bacterial spores

Examples:
- Ethyl /Isopropyl Alcohol(70%-90%)
- Sodium Hypochlorite
- Idophor Germicide

High Level Disinfectants
- High level disinfectants can destroy vegetative bacteria, mycobacteria, fungi, enveloped (lipid) and non-enveloped (non-lipid) viruses, but not necessarily bacterial spores.

- High level disinfectant chemicals (also called chemical sterilants) must be capable of sterilization when contact time is extended. Items must be thoroughly cleaned prior to high level disinfection.

Examples:
- Glutaraldehyde
- Ortho- phthalaldehyde
- Per acetic acid
Liquid sterilants and high level disinfectants approved by FDA for processing of medical and dental devices

<table>
<thead>
<tr>
<th>Disinfectants</th>
<th>Use-Dilution</th>
<th>Exposure time/ comment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Chemical Sterilant (sporicidal)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Glutaraldehyde</td>
<td>≥ 2.4%</td>
<td>Sterilization claim</td>
</tr>
<tr>
<td>Ortho-phthalaldehyde (OPA)</td>
<td>0.55%</td>
<td>10 hours at 20-25 °C</td>
</tr>
<tr>
<td>Glutaraldehyde with phenol/phenate</td>
<td>1.12%/1.93%</td>
<td>7.5 hours at 35 °C</td>
</tr>
<tr>
<td></td>
<td>0.95%/1.64%</td>
<td>Data not available</td>
</tr>
<tr>
<td>Hydrogen peroxide with peracetic acid</td>
<td>7.35%/0.23%</td>
<td>12 hours at 25 0 C</td>
</tr>
<tr>
<td></td>
<td>1.0%/0.08%</td>
<td>3 hours at 20 °C</td>
</tr>
<tr>
<td></td>
<td>8.3%/7%</td>
<td>5 hours at 25 0C</td>
</tr>
<tr>
<td>Hydrogen peroxide</td>
<td>7.5%</td>
<td>6 hours at 20 °C</td>
</tr>
<tr>
<td>Peracetic acid</td>
<td>(0.2%)</td>
<td>Only cleared for use with STERIS system</td>
</tr>
<tr>
<td><strong>High level disinfectants</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Glutaraldehyde (different formulations cleared by FDA)</td>
<td>&gt;/= 2.0%</td>
<td>5 minutes at 35/37.8 °C to 90 minutes at 25 0 C</td>
</tr>
<tr>
<td>Ortho-phthalaldehyde</td>
<td>0.55%</td>
<td>12 minutes at 20 0C</td>
</tr>
<tr>
<td>Hydrogen peroxide</td>
<td>0.6%</td>
<td>5 minute at 20 °C in AER</td>
</tr>
<tr>
<td>Hydrogen peroxide and peracetic acid*</td>
<td>1.0%/ 0.08%</td>
<td>12 minutes at 20 0 C</td>
</tr>
<tr>
<td></td>
<td>7.35%/ 0.23%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>8.3%/ 7%</td>
<td></td>
</tr>
<tr>
<td>Hypochlorite and hypochlorous acid</td>
<td>650-675 ppm</td>
<td>30 minutes at 20 0 C</td>
</tr>
<tr>
<td></td>
<td>400-450 ppm</td>
<td>25 minutes at 20 0 C</td>
</tr>
<tr>
<td>Glutaraldehyde and phenol/phenate</td>
<td>1.121%/1.93%</td>
<td>15 minutes at 20 0 C</td>
</tr>
<tr>
<td>Glutaraldehyde + isopropyl alcohol</td>
<td>3.4%/26%</td>
<td>5 minutes at 25 0 C</td>
</tr>
<tr>
<td><strong>Intermediate level disinfectants</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethyl/ Isopropyl alcohol</td>
<td>70-90%</td>
<td>1-10 minutes</td>
</tr>
<tr>
<td>Sodium hypochlorite</td>
<td>100-1000 ppm available chlorine</td>
<td>30 seconds- 5 minutes</td>
</tr>
<tr>
<td>Phenolic germicide</td>
<td>Manufacturer’s product label instruction</td>
<td>~10 minutes</td>
</tr>
<tr>
<td>Iodophor germicide</td>
<td>Manufacturer’s product label</td>
<td>~10 minutes</td>
</tr>
<tr>
<td><strong>Low level disinfectants</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethyl/ Isopropyl alcohol</td>
<td>70-90%</td>
<td>&gt;/= 1 minute</td>
</tr>
<tr>
<td>Sodium hypochlorite</td>
<td>100-1000 ppm available chlorine</td>
<td>&gt;/= 1 minute</td>
</tr>
<tr>
<td>Phenolic germicide</td>
<td>Manufacturer’s product label</td>
<td>&gt;/= 1 minute</td>
</tr>
<tr>
<td>Iodophor germicide</td>
<td>Manufacturer’s product label</td>
<td>&gt;/= 1 minute</td>
</tr>
<tr>
<td>Quaternary ammonium compounds</td>
<td>Manufacturer’s product label</td>
<td>&gt;/= 1 minute</td>
</tr>
</tbody>
</table>
Dilution of Glutaraldehyde solutions

1. Korsolex: for 15 days
2. Korsolex Rapid: for 7 days

Preparation & Usage

To prepare 5% solution, add 500 ml of Korsolex / Korsolex Rapid to 9.5 L of water.

<table>
<thead>
<tr>
<th>KORSOLEX</th>
<th>KORSOLEX RAPID</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Strength of solution</strong></td>
<td><strong>Immersion Time</strong></td>
</tr>
<tr>
<td>Standard Disinfection</td>
<td>5% 15 minutes</td>
</tr>
<tr>
<td>Life</td>
<td>14 days</td>
</tr>
<tr>
<td><strong>Strength of solution</strong></td>
<td><strong>Immersion Time</strong></td>
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<tr>
<td>Standard Disinfection</td>
<td>5% 15 minutes</td>
</tr>
<tr>
<td>Life</td>
<td>7 days</td>
</tr>
</tbody>
</table>

Method for storage and handling of disinfectants & other precautions

- All disinfectants and housekeeping chemicals are transported in trolleys.
- All chemicals should be kept in store in the chemicals cupboard. No other cleaning equipment should be stored along with the chemicals.
- No over stocking of chemicals should be done. Maximum of one month stock may be kept in the housekeeping store.
- The cans caps should be closed properly to avoid spillage.
- No two chemicals are mixed as this may lead to the chemical becoming ineffective.
- A disinfectant record book should be kept to show the number of containers, the names of disinfectants and their concentration in use.
- Ensure that the optimum dilution is used. Written Instruction for preparing solution should be posted in all areas where this work is done.
- Use diluted preparations only till recommended shelf life.
- Do not mix disinfectants with detergents. They may be incompatible with each other.
- Disinfectant containers should not be filled to the brim.
- Disinfectants must be periodically checked. For in use testing. Collect aseptically about 2ml of disinfectant from containers into sterile bottles, label them and send promptly to the microbiology laboratory.

Education to be given to housekeeping staff:

- Correct chemical to be used for a particular task.
- Correct usage of chemical to be done during the cleaning procedure.
- Right dilution to be done as mentioned on the can.
- Mixing of two or more chemicals should not be done.
- PPE to be used while handling chemicals.
- In case of irritation to eyes, skin - flush thoroughly with fresh water. Get medical attention.
Cleaning and sterilization of endoscopes

In general, endoscope disinfection or sterilization with a liquid chemical sterilant involves following steps after leak testing:

- **Clean**: mechanically clean internal and external surfaces, including brushing internal channels and flushing each internal channel with water and a detergent or enzymatic cleaners (leak testing is recommended for endoscopes before immersion).
- **Disinfect**: immerse endoscope in high-level disinfectant (or chemical sterilant) and perfuse (eliminates air pockets and ensures contact of the germicide with the internal channels) disinfectant into all accessible channels, such as the suction/biopsy channel and air/water channel and expose for a time recommended for specific products.
- **Flush and brush**: all accessible channels to remove all organic (e.g., blood, tissue) and other residue. Clean the external surfaces and accessories of the devices by using a soft cloth or sponge or brushes. Continue brushing until no debris appears on the brush.
  - Use cleaning brushes appropriate for the size of the endoscope channel or port (e.g., bristles should contact surfaces).
Cleaning items (e.g., brushes, cloth) should be disposable or, if they are not disposable, they should be thoroughly cleaned and either high-level disinfected or sterilized after each use.
- Discard enzymatic cleaners (or detergents) after each use because they are not microbicidal and, therefore, will not retard microbial growth.

- **Rinse**: rinse the endoscope and all channels with sterile water or filtered water.
- **Dry**: rinse the insertion tube and inner channels with alcohol, and dry with forced air after disinfection and before storage.
- **Store**: store the endoscope in a way that prevents recontamination and promotes drying (e.g., hung vertically). Drying the endoscope is essential to greatly reduce the chance of recontamination of the endoscope by microorganisms that can be present in the rinse water.
- Check the solution each day of use (or more frequently) using the appropriate chemical indicator (e.g., glutaraldehyde chemical indicator to test minimal effective concentration of glutaraldehyde) and document the results of this testing.
- Discard the solution if the chemical indicator shows the concentration is less than the minimum effective concentration.
- Do not use the liquid sterilant/high-level disinfectant beyond the reuse-life recommended by the manufacturer (e.g., 14 days for ortho-phthalaldehyde).
- Make PPE (e.g., gloves, gowns, eyewear, face mask or shields, respiratory protection devices) available and use these items appropriately to protect workers from exposure to both chemicals and microorganisms (e.g., HBV).

**Reprocessing of Respiratory apparatus**

1. **Ventilators**
   Respiratory, anesthetic, resuscitation and similar apparatus and ventilators are classed for use in mucosal (semi critical) sites and therefore, should be sterilized when possible. If items cannot withstand sterilization, they must receive high level disinfection.

**Maintenance of ventilators:**
The manufacturers must provide complete information regarding cleaning and decontamination, which should be followed. All reusable equipments must be cleaned and disinfected as per manufacturer’s recommendations.

- All equipments should be covered when not in use.
- Use appropriate PPE and respiratory protection. Perform hand hygiene after handling these equipments
- All disposable devices must be discarded between patients or more frequently if indicated.
- Select an internal filter which has high microbial and water retention property.
- Regular cleaning or replacement of all internal parts (as identified by manufacturers) must be done.
- Clean the ventilators to remove all organic soil.
- Preferably use disposable circuits and filters, which should be changed after every patient.
Reusable circuits should be replaced for decontamination every 48 hours. The disinfection process must include the entire breathing circuits (mask or tube and connection, CO₂ absorber and valves, reservoir hose and bags and any monitoring devices within the breathing circuit).

Dismantle the circuits, wash thoroughly and sterilize by autoclaving/low temperature sterilization.

Alternatively, they may be sterilized by vaporized H₂O₂. Infant ventilators may be sterilized by EtO. However, all toxic residues should be removed by flushing air and oxygen before reuse.

Replace the external filters and tubing, if they are visibly soiled and when needed to assure proper ventilator function.

Place labels in a conspicuous place on the breathing circuit, noting the date and time the system was changed.

Breathing circuits should be monitored and changed when excess of blood or mucus etc. is noted in the circuit.

While assembling the circuit, don’t allow the circuit to dangle close to the floor.

During use, the machine and all its parts (support arm, electric cord, high pressure hoses, alarm and wheels) should be wiped with hospital approved disinfectant when visibly soiled.

Ventilator accessories, such as spacers for metered dose inhalers may be kept at bedside between treatments in clean plastic bags.

Do not allow the tubing condensate to drain into patient’s trachea or back into humidifiers. Condensate must be periodically removed from tubing using aseptic techniques to empty the trap device.

2. **Humidifiers**

   - For humidification, either a heat moisture exchanger (which produces less condensation & contamination) or water bath may be used.
   - The humidifier should be cleaned and disinfected (by heat disinfection in a washing machine or 70-90% alcohol) before refilling with sterile water.
   - Do not add antiseptics to humidifier water. Change the entire humidifier system when indicated or empty.
   - If water humidifiers are used, change circuits every 48 hours and in between patients.
   - Moisture traps should be incorporated to protect filters.
   - If heat-moisture exchangers are used, circuits may be changed weekly and in between patients.

3. **Nebulizers**

   - Should be heat disinfected daily.
   - Water should be replaced, not topped up.
   - Empty the residual medication from nebulizer cup after each treatment and dry before filling water (if drying is not possible, flush with 70-90% alcohol).
   - Rinse the mouthpiece/mask with warm water and dry it with clean tissue paper.
4. **Oxygen Hoods**
   - Dispose oxygen hood every 48 hours and after each patient.
   - Oxygen masks and tubings should be disposed.
   - Replace the entire oxygen hood delivery system every 7 days.
   - Piped gases do not become contaminated with bacteria, provided the lines remain dry.

5. **Bed side pulmonary screening devices**
   - Discard all pulmonary screening devices (inspiratory force manometer, tidal volume /vital capacity devices and peak flow meters) after single patient use.
   - Wipe all non disposable spirometers and manometers with a hospital approved disinfectant between patients.

6. **Anesthetic equipment**
   - The external surface of the machine should be kept clean and dry.
   - Tubings, reservoirs, ambubag, face masks, endotracheal tubes and airways, if not single use, should be cleaned and thermally disinfected (preferrably at the CSSD).
   - Disposable face masks, tubings and reservoir bags may be given to patients suffering from suspected tuberculosis.

7. **Laryngoscope blade**
   Clean with detergent, followed by disinfection with 70-90% alcohol for 10 minutes and drying.

8. **Suction equipment**
   - If piped suction is not available, use separate machine for each patient. After use, discard the contents in sluice, wash with detergent and water and dry the bottle.
   - Use a fresh catheter for every suction.
   - An antifoaming agent may be added to the bottle contents to protect the filters.
   - The filters should be changed if they become moist or discolored.
   - Disinfectants (chlorine releasing agents at a concentration for dirty situations) needs to be added only if contents are considered hazardous.
   - The machine should be periodically returned to CSSD where pumps can be checked, filters changed and the tubings, lid, non return valve and bottles autoclaved.

9. **Infant incubators**
   - Preferably send to CSSD. Clean the inner surfaces with detergent and moist paper and dry.
   - If disinfection is required, use chlorine releasing solution (125 ppm available chlorine) or 70-90% alcohol, rinse and dry.
   - Avoid use of phenolic germicide.
REMOVAL, CLEANING AND DISINFECTION OF VENTILATOR TUBINGS
CLEANING AND DISINFECTING OF VENTILATOR TUBINGS
PEST CONTROL

Pests like cockroaches, flies, mosquitoes etc can serve as agents for transmission of microbes or may serve as biological vectors of disease. They typically thrive in moist, warm conditions and feed on food scraps, human and medical waste, dressings and solid waste and are found mainly in kitchens, laundry, sink traps and drains. The pest control programme should aim at their eradication from all indoor hospital areas.

- Develop pest control strategies (with emphasis on kitchens, cafeterias, laundry, CSSD, operating rooms, ICUs, laboratories, stores, toilets, loading docks, construction activities and other areas prone to infestation) to eliminate the food sources and indoor habitats of pests.
- Seal windows by installing screens and keep them in good repair.
- Apply pesticides as needed.
- Pest control service may be outsourced to a specialist, who can use approved chemical/physical methods.
- Place laboratory specimens in covered containers for over-night storage.
- Avoid water pooling in and around hospital area.
LAUNDRY FACILITY

The facility should be designed for efficiency in providing hygienically clean textiles, fabrics, and apparel for patients and staff. All laundry areas must have impermeable floor surfaces. It should be designed, equipped and ventilated to reduce the dissemination of microorganisms onto finished textiles. The ventilation should include adequate filtration, air exchange rate (5 - 10 per hour) and exhaust. The laundry is usually partitioned into two separate areas – a “dirty” area for receiving and handling the soiled laundry and a “clean” area for processing the worked items and textile storage. Functional separation may be achieved by physical barriers, negative air pressure systems in the soiled linen area, or positive air flow from the clean area to the soiled linen area. The laundry areas must have adequate hand washing facility. Use and maintain laundry equipment according to manufacturers’ instructions. Damp textiles should not be left in machines overnight.

Staff training and protection

All laundry workers should be properly immunized. They should wear appropriate personal protective equipment (e.g., gloves and protective garments) while sorting soiled fabrics and textiles. Specific procedures be followed by workers handling textiles “contaminated” with blood or other potentially infectious body fluids. These requirements include special precautions for bagging and handling of contaminated textiles and use of protective apparel to reduce the risk of employee exposure and sharp disposal device accessibility. The gloves used for sorting should be of sufficient thickness to minimize sharps injury. If fabrics are heavily soiled with blood or body fluids, protective gowns may also be worn. The staff must practice frequent hand washing. The linen should not be sluiced by hand. There should be careful removal of sharp objects, along with contaminant, labeling and hazard communication.

Collection, sorting and transportation of soiled textiles

Sorting or rinsing contaminated laundry in patient care areas is prohibited. All personnel involved in collection, transport, sorting, and washing of soiled health-care textiles should be appropriately trained, have adequate access to hand washing facilities, use appropriate PPE, and be supervised to assure compliance with protective procedures. Soiled textiles should be collected in a manner that minimizes agitation to prevent aerosolization and contamination of the environment and personnel. The linen should be appropriately bagged at the site of use. Bags should not be over-filled as this may prevent closure. Label the bags properly for easy identification.

Transport contaminated laundry by cart. Clean and soiled textiles should be transported separately and in a manner that will minimize microbial contamination. The hampers or carts to transport soiled textiles should be appropriately cleaned before use in transporting clean textiles. Carts that are going to be used to store textiles on the floors (hallways) should have covers on them during the transportation and storage to minimize exposure to common traffic.
Laundry process

Sorting: Soiled linen may or may not be sorted in the laundry before being loaded into washer/extractor units.

Washing: The duration of time that soiled textiles may be stored before processing is related to practical issues such as stain removal and aesthetics rather than infection control concerns. Soiled linen awaiting wash cycle must be stored in disposable bags.

Hot-water washing

160°F for 25 minutes to process textiles destroys nearly all bacterial forms except spore formers. If hot water is used, linen should be washed with a detergent in water at 71°C (160°F) for 25 minutes. Water of this temperature can be provided by steam jet or separate booster heaters. Wash woolen blankets in warm water and dry.

Low-Temperature Water Washing

The newly developed synthetic detergents and enzymes in the past 10 years do not require high temperature laundering. If low temperature (<70°C) laundry cycles are used, chemicals suitable for low-temperature washing at proper use concentration should be used.

Disinfection: A chlorine releasing agent to give a final concentration of 150 ppm available chlorine can be introduced in the penultimate rinse (bleach cycle). Chlorine compounds should not be used on fabrics treated for fire retardance. Other agents like hydrogen peroxide may be used for disinfection in such cases. Oxygen based laundry detergents may also be an alternative to chlorine bleach; however, they should be EPA registered. Rinse again to wash off chlorine.

Drying: The temperature during drying cycles of washers and ironing provides an additional antimicrobial activity. Dryer temperatures and cycle times are dictated by the materials in the fabrics. Man-made fibers (i.e., polyester and polyester blends) require shorter times and lower temperatures. Dry the linen, preferably in a drier or sun (heavy duty washers/driers are recommended).

Processing of linen from infected patients
Clothings of patients infected with MRSA or having gastroenteritis must be washed separately and not in a communal wash. The temperatures should reach 65°C for at least 10 minutes or 70°C for 3 minutes. Soiled linen does not require a sluice cycle, but does need a hot cycle. Do not sluice by hand as this may spray bacteria onto surfaces, uniforms and staff. Foul/infected items which cannot be laundered on a hot wash can be disinfected by adding hypochlorite (bleach) at 150 parts per million to the final rinse.

Washing of linen contaminated with agents of bioterrorism
Handle textiles and fabrics with minimum agitation. They should be bagged or contained without sorting at the point of use. Most forms of containment used for routine laundry are acceptable for containing textiles and fabrics from smallpox patients. Wet textiles should be bagged first and then placed in a leak-proof container. Reusable fabric laundry bags commonly used for laundry transport can be laundered along with the clothing and other fabrics. If no other wash cycle other than cold water are available, use detergents and laundry additives that are specially formulated for cold-water washing and dry using a hot air cycle for the dryer.

Storage and transportation
After washing, cleaned and dried textiles care pressed folded and packaged for transport, distribution and storage by methods that ensure their cleanliness until use. There should be a separate area for drying, ironing and storage of clean linen, away from used linen, to prevent contamination. Clean linen should be stored in a dry area above the floor.
level. It must not be stored in bathrooms or sluices. Staff with unhealed lesions, rashes or exfoliative skin conditions should not handle clean laundry unless lesions are covered with an impermeable dressing.

**Monitoring** The efficiency of the disinfection cycle should be checked when commissioning new machines, at regular intervals (every 6 weeks) and during outbreaks. Microbiological methods (application of heat resistant Enterococci to linen) may be used during major outbreaks.

Sampling may be used as part of an outbreak investigation if epidemiologic evidence suggests that textiles, fabrics, or clothings are a suspected vehicle for disease transmission. Sampling techniques include aseptically macerating the fabric into pieces and adding these to broth media or using contact plates for direct surface sampling. When evaluating the disinfecting properties of the laundering process specifically, placing pieces of fabric between two membrane filters may help to minimize the contribution of the physical removal of microorganisms.
FOOD SERVICES

Food services chain consists of:
- Receiving raw food
- Storing
- Food preparation (cutting/ sorting, cooking)
- Direct serving/ chilling/ heat holding/ reheating before serving.
- Strict standards pertaining to hygiene should be maintained during all the stages.

KITCHEN STAFF:
- Should be trained about personal hygiene, food safety and food-borne diseases.
- Should wear clean clothes and change work clothes at least once daily. They should wear protective aprons and keep their hair covered while preparing food.
- They should clean their hands, face and hair and trim their nails.
- Staff should be instructed not to touch their nose, lips and hair while preparing food.
- Must wash hands before handling food, after going to the toilet, after handling raw food and after coming in contact with unclean equipment/ work surfaces.
- They must use hot water with soap (preferably liquid) and dry hands with clean dry cloth towels, fresh paper towels or by air drying. They may use an antibacterial soap during an outbreak.
- Food should be handled using preferably disposable gloves. All injuries and cuts should be covered with a waterproof tape.
- Workers suffering from acute diarrhea, enteric fever, draining abscess or skin infections should not handle food and such episodes should be brought to the notice of the medical officer.
- Frequent training of the staff and inspection of the kitchen hygiene should be carried out by the infection control team.

KITCHEN INFRASTRUCTURE
- Proper maintenance of refrigerators and freezers is needed with checking and recording of their temperatures daily.
- Adequate supply of clean and portable water to the kitchen should be ensured along with adequate hand washing facility. Preparation area should have the provision of sink with running hot and cold water, working drainage system and windows with screens.
- Kitchen should be a no-smoking area.
- There should be adequate storage area with adequate fire protection and sufficient ventilation.
- Entry to the food preparation area should be limited.
PREPARATION OF FOOD

- Serving to be done as soon as possible after preparation.
- Preparation of raw and cooked food should have different designated areas to prevent cross contamination.
- Never process cooked and uncooked meat using the same machines.
- Maintain the temperature and refrigeration requirements for both raw and cooked foods for food protection.
- Serve cooked perishable food within two hours of preparation and dispose of thereafter.

FOOD STORAGE AND DISTRIBUTION

- After cooking, all the food to be stored should be immediately cooled.
- All food items should be kept in covered containers and labelled with date and content.
- All food items should be within the expiration dates.
- Storage of all food items should be away from the walls and at least 6 inches above the floor level.
- No storage of food items to be done with contaminated materials, clinical specimens or medical products such as drugs, vaccines and blood.
- Only trained staffs should distribute food in dedicated, clean trolleys.
- Protect food from vectors using nets, clean cloth or covers.
- Maintain and wash trolleys daily or more frequently if soiled.

CLEANING, INSPECTION AND SUPERVISION

- Strict protocols regarding cleaning and maintenance should be made and followed.
- The entire kitchen area should be dust-free and the work areas and food storage areas clean and well maintained.
- Clean and disinfect the working areas and all utensils after each use. All equipment to be cleaned daily and kept in a way that the area around them can be cleaned daily.
- Walls and ceiling should have smooth and impermeable surfaces.
- Detergent and hot water can be used for cleaning. A clean cloth should be used and changed daily.

PEST CONTROL

- Special emphasis should be laid on pest control by covering all food items.
- Discard wastes promptly and avoid accumulation of stagnant water.
- Adequate maintenance of all structures should be done to prevent formation of cracks.
- Use suitable pesticides or other methods to control pests and rodents.
- Place screens on kitchen windows and ensure proper maintenance of these.
WASTE MANAGEMENT

- Ensure availability of washable, leakage proof garbage containers with tight-fitting lids.
- All wastes to be disposed into the waste bins immediately and these bins should be kept outdoors after use.
PREVENTION AND MANAGEMENT OF BLOOD STREAM INFECTIONS

Identification of blood stream infections (BSIs)

- The infection control nurses work in collaboration with other units in identifying the BSIs.
- All patients in the clinical area are monitored with their devices such as Central lines, Arterial lines, Peripheral venous catheters for identify the development of catheter related blood stream infections.
- The catheter related blood stream infections that are identified are notified to the Consultants, Senior residents and staff responsible for looking after those patients by the HICNs.
- The blood culture positivity is daily reported from the lab and the patients with such positivity are monitored for primary or secondary infections.
- The secondary blood stream infections are those related to any secondary source such as pneumonia, urinary tract, wound and surgical site etc.
- Paired blood samples (one from central line and one from peripheral vein) are collected from suspected blood stream infection cases.

Prevention and management of Blood Stream Infection

- The recommendation of CDC is considered as a reference for the management of blood stream infections. The major recommendations of CDC is given below

Selection of Catheters and Sites

Peripheral Catheters and Midline Catheters

- In adults, use an upper-extremity site for catheter insertion. Replace a catheter inserted in a lower extremity site to an upper extremity site as soon as possible
- Select catheters on the basis of the intended purpose and duration of use, known infectious and non infectious complications.
- In pediatric patients, the upper or lower extremities or the scalp (in neonates or young infants) can be used as the catheter insertion site.
- Use a midline catheter or peripherally inserted central catheter (PICC), instead of a short peripheral catheter, when the duration of IV therapy will likely exceed six days.
- Evaluate the catheter insertion site daily.
- Remove peripheral venous catheters if the patients develop signs of phlebitis, infection, or a malfunctioning catheter.
Central Venous Catheters

- Weigh the risks and benefits of placing a central venous device at a recommended site to reduce infectious complications against the risk for mechanical complications.
- Avoid using the femoral vein for central venous access in adult patients.
- Use a subclavian site, rather than a jugular or a femoral site, in adult patients to minimize infection risk for non tunneled CVC placement.
- Avoid the subclavian site in hemodialysis patients and patients with advanced kidney disease, to avoid subclavian vein stenosis.
- Use a fistula or graft in patients with chronic renal failure instead of a CVC for permanent access for dialysis.
- Use ultrasound guidance to place central venous catheters (if this technology is available) to reduce the number of cannulation attempts and mechanical complications.
- Promptly remove any intravascular catheter that is no longer essential.
- When adherence to aseptic technique cannot be ensured (i.e. catheters inserted during a medical emergency), replace the catheter as soon as possible, i.e, within 48 hours.

Hand Hygiene and Aseptic Technique

- Perform hand hygiene procedures, either by washing hands with conventional soap and water or with alcohol-based hand rubs (ABHR). Hand hygiene should be performed before and after palpating catheter insertion sites as well as before and after inserting, replacing, accessing, repairing, or dressing an intravascular catheter.
- Maintain aseptic technique for the insertion and care of intravascular catheters.
- Sterile gloves should be worn for the insertion of arterial, central, and midline catheters.
- Use new sterile gloves before handling the new catheter when guidewire exchanges are performed.
- Wear either clean or sterile gloves when changing the dressing on intravascular catheters.
- Use maximal sterile barrier precautions, including the use of a cap, mask, sterile gown, sterile gloves, and a sterile full body drape, for the insertion of CVCs, PICCs, or guide wire exchange.
- Prepare clean skin with a >0.5% chlorhexidine preparation with alcohol before central venous catheter and peripheral arterial catheter insertion and during dressing changes. If there is a contraindication to chlorhexidine, tincture of iodine, an iodophor, or 70% alcohol can be used as alternatives.
- Antiseptics should be allowed to dry according to the manufacturer’s recommendation prior to placing the catheter.

Catheter Site Dressing Regimens

- Use either sterile gauze or sterile, transparent, semipermeable dressing to cover the catheter site. If the patient is diaphoretic or if the site is bleeding or oozing, use a gauze dressing until this is resolved.
- Replace catheter site dressing if the dressing becomes damp, loosened, or visibly soiled.
• Do not use topical antibiotic ointment or creams on insertion sites, except for dialysis catheters, because of their potential to promote fungal infections and antimicrobial resistance.
• Do not submerge the catheter or catheter site in water. Showering should be permitted if precautions can be taken to reduce the likelihood of introducing organisms into the catheter.
• Replace dressings used on short-term CVC sites every 2 days for gauze dressings.
• Replace dressings used on short-term CVC sites at least every 7 days for transparent dressings, except in those pediatric patients in which the risk for dislodging the catheter may outweigh the benefit of changing the dressing.
• Replace transparent dressings used on tunneled or implanted CVC sites no more than once per week.
• Ensure that catheter site care is compatible with the catheter material.
• Monitor the catheter sites visually when changing the dressing or by palpation through an intact dressing on a regular basis, depending on the clinical situation of the individual patient.
• Encourage patients to report any changes in their catheter site or any new discomfort to their provider.

Systemic Antibiotic Prophylaxis
• Do not administer systemic antimicrobial prophylaxis routinely before insertion or during use of an intravascular catheter to prevent catheter colonization.

Antibiotic/Antiseptic Ointments
• Use povidone iodine antiseptic ointment or bacitracin/gramicidin/polymyxin B ointment at the hemodialysis catheter exit site after catheter insertion and at the end of each dialysis session only if this ointment does not interact with the material of the hemodialysis catheter per manufacturer’s recommendation.

Antibiotic Lock Prophylaxis, Antimicrobial Catheter Flush and Catheter Lock Prophylaxis
• Use prophylactic antimicrobial lock solution in patients with long term catheters who have a history of multiple CRBSI despite optimal maximal adherence to aseptic technique.

Anticoagulants
• Do not routinely use anticoagulant therapy to reduce the risk of catheter-related infection in general patient population.

Replacement of Peripheral and Midline Catheters
• There is no need to replace peripheral catheters more frequently than every 72-96 hours to reduce risk of infection and phlebitis in adults.
• No recommendation is made regarding replacement of peripheral catheters in adults only when clinically indicated.
• Replace peripheral catheters in children only when clinically indicated.
• Replace midline catheters only when there is a specific indication.

Replacement of CVCs, Including PICCs and Hemodialysis Catheters

• Do not routinely replace CVCs, PICCs, hemodialysis catheters, or pulmonary artery catheters to prevent catheter-related infections.
• Do not remove CVCs or PICCs on the basis of fever alone.
• Do not use guidewire exchanges routinely for non-tunneled catheters to prevent infection.
• Use a guidewire exchange to replace a malfunctioning non-tunneled catheter if no evidence of infection is present.
• Use new sterile gloves before handling the new catheter when guidewire exchanges are performed.
• In patients not receiving blood, blood products or fat emulsions, replace administration sets that are continuously used, including secondary sets and add-on devices, no more frequently than at 96-hour intervals, but at least every 7 days.
• Replace tubing used to administer blood, blood products, or fat emulsions (those combined with amino acids and glucose in a 3-in-1 admixture or infused separately) within 24 hours of initiating the infusion.
• Replace tubing used to administer propofol infusions every 6 or 12 hours, when the vial is changed, per the manufacturer’s recommendation.

Peripheral Arterial Catheters and Pressure Monitoring Devices for Adult and Pediatric Patients

• In adults, use of the radial, brachial or dorsalis pedis sites is preferred over the femoral or axillary sites of insertion to reduce the risk of infection.
• In children, the brachial site should not be used. The radial, dorsalis pedis, and posterior tibial sites are preferred over the femoral or axillary sites of insertion.
• A minimum of a cap, mask, sterile gloves and a small sterile fenestrated drape should be used during peripheral arterial catheter insertion.
• During axillary or femoral artery catheter insertion, maximal sterile barriers precautions should be used.
• Replace arterial catheters only when there is a clinical indication and remove the arterial catheter as soon as it is no longer needed.
• Use disposable, rather than reusable, transducer assemblies when possible.
• Do not routinely replace arterial catheters to prevent catheter-related infections.
• Replace disposable or reusable transducers at 96-hour intervals. Replace other components of the system (including the tubing, continuous-flush device, and flush solution) at the time the transducer is replaced.
• Keep all components of the pressure monitoring system (including calibration devices and flush solution) sterile.
• Minimize the number of manipulations of and entries into the pressure monitoring system. Use a closed flush system (i.e. continuous flush), rather than an open system (i.e. one that requires a syringe and stopcock), to maintain the patency of the pressure monitoring.

Replacement of Administration Sets
• In patients not receiving blood, blood products or fat emulsions, replace administration sets that are continuously used, including secondary sets and add-on devices, no more frequently than at 96-hour intervals but at least every 7 days.
• No recommendation can be made regarding the frequency for replacing intermittently used administration sets.
• No recommendation can be made regarding the frequency for replacing needles to access implantable ports.
• Replace tubing used to administer blood, blood products, or fat emulsions (those combined with amino acids and glucose in a 3-in-1 admixture or infused separately) within 24 hours of initiating the infusion.
• Replace tubing used to administer propofol infusions every 6 or 12 hours, when the vial is changed, per the manufacturer’s recommendation.
• Complete the infusion of lipid emulsions alone within 12 hours of hanging the emulsion. If volume considerations require more time, the infusion should be completed within 24 hours.
• Complete infusions of blood or other blood products within 4 hours of hanging the blood.
• Clean injection ports with 70% alcohol or an iodophor before accessing the system.
• Do not use any container of parenteral fluid that has visible turbidity, leaks, cracks, or particulate matter or if the manufacturer’s expiration date has passed.
• Use single-dose vials for parenteral additives or medications when possible.
PREVENTIVE BUNDLES FOR CATHETER RELATED BLOOD STREAM INFECTIONS

CENTRAL LINE BUNDLE AT JPNATC

- Hand Hygiene
- Maximal barrier Precautions upon insertion/Manipulation
- PI/Alcohol/Chlorhexidine Skin Antisepsis
- Optimal Catheter site selection, with avoidance of the Femoral Vein for central venous access in adult patients
- Daily review of line necessity with prompt removal of unnecessary lines

Surveillance

- Monitor the catheter sites visually or by palpation through the intact dressing on a regular basis.
- If patients have tenderness at the insertion site, fever without obvious source, or other manifestations suggesting local infections or BSI, the dressing should be removed to allow thorough examination of the site

Hand hygiene

- Observe proper hand-hygiene procedures either by washing hands with conventional antiseptic containing soap and water or with waterless alcohol-based gels or foams.
- Observe hand hygiene before and after palpating catheter insertion sites, as well as before and after inserting, replacing, accessing, repairing, or dressing an intravascular catheter.

Catheter site care

Cutaneous antisepsis

- Disinfect clean skin with an appropriate antiseptic before catheter insertion and during dressing changes.
- Although a 2% chlorhexidine based preparation is preferred, tincture of iodine, an iodophor, or 70% alcohol can be used.
- Allow the antiseptic to remain on the insertion site and to air dry before catheter insertion. Allow povidone iodine to remain on the skin for at least 2 minutes, or longer if it is not yet dry.
PROPERLY INSERTED CENTRAL VASCULAR CATHETER
Prevention of Urinary Tract Infection

Definition
Urinary tract infections (UTIs) are the infections of the urethra, bladder, ureters, or the kidneys, which comprise the urinary tract. When it affects the lower urinary tract it is known as a simple cystitis (a bladder infection) and when it affects the upper urinary tract it is known as pyelonephritis (a kidney infection).

Indications for insertion of urinary catheter
1. Patient has acute urinary retention of bladder outlet obstruction
2. Need for accurate measurements of urinary output in critically ill patients
3. Preoperative use for selected surgical procedures:
   - Patients undergoing urologic surgery or other surgery on contiguous structures of the genitourinary tract
   - Anticipated prolonged duration of surgery (catheters inserted for this reason should be removed in the post anesthetic care unit itself)
   - Patients anticipated to receive large-volume infusions or diuretics during surgery
   - Need for intraoperative monitoring of urinary output
4. To assist in healing of open sacral or perineal wounds in incontinent patients
5. Patient requiring prolonged immobilization (e.g., potentially unstable thoracic or lumbar spine, multiple traumatic injuries such as pelvic fractures)
6. To improve comfort for end of life care if needed

Prevention of CA-UTI

Avoid indwelling catheters
- As a substitute for nursing care of the patient with incontinence.
- As a means of obtaining urine for culture or other diagnostic tests when the patient can voluntarily void
- For prolonged postoperative duration without appropriate indications (e.g. structural repair of urethra or contiguous structures, prolonged effect of epidural anesthesia, etc.)

Proper insertion techniques
- Perform hand hygiene immediately before and after insertion or any manipulation of the catheter device or site.
- Ensure that only properly trained persons who know the correct techniques of aseptic catheter insertion and maintenance are given this responsibility.
- In the acute care hospital setting, insert urinary catheters using aseptic technique and sterile equipment using sterile gloves, drape, sponges, an appropriate antiseptic or sterile solution for periurethral cleaning, and a single-use packet of lubricant jelly for insertion.
In the non-acute care setting, clean (i.e., non-sterile) techniques for intermittent catheterization is an acceptable and more practical alternative to sterile technique for patient requiring chronic intermittent catheterization.

- Properly secure indwelling catheters after insertion to prevent movement and urethral traction.
- Unless otherwise clinically indicated, consider using the smallest bore catheter possible, consistent with good drainage, to minimize bladder neck and urethral trauma.
- If intermittent catheterization is used, perform it at regular intervals to prevent bladder over distension.
- Consider using a portable ultrasound device to assess urine volume in patients undergoing intermittent catheterization to assess urine volume and reduce unnecessary catheter insertions.

**Proper maintenance techniques**

- Following aseptic insertion of the urinary catheter, maintain a closed drainage system.
  - If breaks in aseptic technique, disconnection, or leakage occur, replace the catheter and collection system using aseptic technique and sterile equipment.
- Consider using urinary catheter systems with preconnected, sealed catheter-tubing junctions.
- Maintain unobstructed urine flow.
  - Keep the catheter and collecting tube free from kinking.
  - Keep the collecting bag below the level of the bladder at all times. Do not rest the bag on the floor.
  - Empty the collecting bag regularly using a separate, clean collecting container for each patient; avoid splashing, and prevent contact of the drainage spigot with the nonsterile collecting container.
- Use Standard Precautions, including the use of gloves as appropriate, during any manipulation of the catheter of collecting systems.
- At the Trauma Center, indwelling catheters are taken out at 72 hours and external catheterization is done subsequently.
- Unless clinical indications exist do not use systemic antimicrobials routinely to prevent CAUTI in patients requiring either short or long-term catheterization.
  - Do not clean the peri-urethral area with antiseptics to prevent CAUTI while the catheter is in place. Routine hygiene (e.g. cleansing of the meatal surface during daily bathing or showering) is appropriate.
  - Unless obstruction is anticipated (e.g. as might occur with bleeding after prostatic or bladder surgery) bladder irrigation is not recommended.
  - Routine irrigation of the bladder with antimicrobials is not recommended
  - Routine instillation of antiseptic or antimicrobial solutions into urinary drainage bags is not recommended.
• Clamping indwelling catheters prior to removal is not necessary however in certain condition intermittent clamping of catheters may be practiced as per the physicians orders
• Hydrophilic catheters might be preferable to standard catheters for patients requiring intermittent catheterization.
• Silicone might be preferable to other catheter materials to reduce the risk of encrustation in long-term catheterized patients who have frequent obstruction.

Specimen collection
• Prevention of contamination by normal vaginal, perineal and anterior urethral flora is very vital.
• Collect sample in wide-mouthed glass or plastic, jars, beakers of other suitable receptacles which should have tight-fitting lids.
• Mid-stream urine or clean catch urine is collected. Whenever possible, urine specimen should be collected in the morning, before the patient has voided urine.

Specimen collection from catheter
• Wash hands and prepare equipments
• Clamp the catheter for few minutes (approximately for 2 minutes)
• Clean the aspiration port with antiseptic solution
• Insert the needle and aspirate required amount of sample
• Unclamp the catheter
• However if the catheter is made of silicone material the sample should be taken from the catheter opening and the catheter should not be pricked.

PREVENTIVE STRATEGIES FOR URINARY CATHETER RELATED INFECTIONS
• Catheterize only if absolutely necessary
• Reduce the duration of catheterization
• Closed drainage
• Intermittent catheterization
• External collection devices
• Ensure dependent drainage
• Use of systemic antimicrobials: Only if patient is symptomatic and culture suggests UTI
• Compared with latex catheters, silastic catheter has a decreased incidence of urethritis and possibly urethral strictures. However, because of its lower cost and similar long term outcomes, latex is preferably used for long term catheterization.
• Remove catheters as early as possible
PREVENTIVE BUNDLE FOR CA-UTI AT JPNA TC

- Aseptic insertion and proper maintenance.
- Dependent drainage
- Condom or intermittent catheterization in appropriate patients
- Catheter required (daily assessment)

NURSES RESPONSIBILITY IN PREVENTION OF UTI

- Nurses should encourage ongoing hydration to reduce urinary stasis and flush the urinary tract.
- The drainage bag should be emptied at least every 8 hour or when the bag is 2/3rd full whichever is earlier provided there are no standing orders otherwise.
- In order to avoid cross-contamination, staff should wear gloves and use proper hand washing when handling catheters.
- If a patient has multiple drainage bags, the bags should be isolated on opposite sides of the bed.
- The practice and promotion of hand hygiene is very essential and forms the core of prevention of CAUTI.
- Use if standard precautions with consistent use of aseptic techniques during manipulation of catheters are strongly advised and the catheters should be secured properly.
- The urine collection bag should always be kept below the bed level and if at all it is to be raised in some unavoidable instances (e.g. shifting of patient, positioning of patient) make sure it is clamped and the lid of the collection bag should always be kept closed.
- Patient education plays an important role in making the patient aware of the importance of continuing with safe practices even at home.
- Removal of unnecessary catheters
- Use of bundle strategies for infection prevention
DRAINAGE OF URINE FROM UROBAGS
CARE OF PATIENTS ON VENTILATOR AND PREVENTION OF VAP

Intubation procedure:

- Preoxygenate with 100% oxygen to provide apneic or distressed patient with reserve while attempting to intubate.
  - Do not allow more than 30 seconds to any intubation attempt.
  - If intubation is unsuccessful, ventilate with 100% oxygen for 3-5 minutes before a reattempt.

Volume and pressure ventilation

- **Volume ventilation**: Volume is constant and pressure will vary with patient’s lung compliance.
- **Pressure ventilation**: Pressure is constant and volume will vary with patient’s lung compliance.

Initial settings:

- Select your mode of ventilation
- Set sensitivity at Flow trigger mode
- Set Tidal Volume
- Set Rate
- Set Inspiratory Flow (if necessary)
- Set PEEP
- Set Pressure Limit

Humidification

Post initial settings:

- Obtain an ABG (arterial blood gas) about 30 minutes after you set your patient up on the ventilator.
- Goal:

  Keep patient’s acid/base balance within normal range:
  - pH 7.35 – 7.45
  - PCO2 35-45 mmHg
  - PO2 80-100 mmHg
PREVENTION OF VAP

- Avoid cross-contamination by FREQUENT HANDWASHING
- Decrease risk of aspiration (cuff occlusion of trachea, positioning, use of small-bore NG tubes)
- SUCTION only when clinically indicated, using STERILE TECHNIQUE
- Maintain closed system setup on ventilator circuitry and avoid pooling of condensation in the tubings.
- Ensure adequate nutrition
- Neutralization of gastric contents with antacids and H2 blockers

Plan of care for the ventilated patient

- Patient Goals:
  - Patient will have effective breathing pattern.
  - Patient will have adequate gas exchange.
  - Patient’s nutritional status will be maintained to meet body needs
  - Patient will not develop a pulmonary infection.
  - Patient will not develop problems related to immobility.
  - Patient and/or family will indicate understanding of the purpose for mechanical ventilation.

Role of a nurse:

- Observe changes in respiratory rate and depth; observe for SOB and use of accessory muscles.
  An increase in the work of breathing will add to fatigue; may indicate patient fighting ventilator.
- Observe for tube misplacement- note and post cm. Marking at lip/teeth/nares after x-ray confirmation and q. 2 h.
  Indicates correct position to provide adequate ventilation.
- Prevent accidental extubation by taping tube securely, checking q.2h. restraining/sedating as needed.
  Avoid trauma from accidental extubation, prevent inadequate ventilation and potential respiratory arrest.
- Inspect thorax for symmetry of movement. Determines adequacy of breathing pattern; asymmetry may indicate hemothorax or pneumothorax.
- Measure tidal volume and vital capacity. Indicates volume of air moving in and out of lungs.
- Asses for pain. Pain may prevent patient from coughing and deep breathing.
- Monitor chest x-rays Shows extent and location of fluid or infiltrates in lungs.
• Maintain ventilator settings as ordered. Ventilator provides adequate ventilator pattern for the patient.
• Elevate head of bed 60-90 degrees. This position moves the abdominal contents away from the diaphragm, which facilitates its contraction.
• Impaired gas exchange r/t alveolar-capillary membrane changes Monitor ABG’s. Determines acid-base balance and need for oxygen.
• Assess LOC, listlessness, and irritability. These signs may indicate hypoxia.
• Observe skin color and capillary refill. Determine adequacy of blood flow needed to carry oxygen to tissues.
• Monitor CBC. Indicates the oxygen carrying capacity available.
• Administer oxygen as ordered. Decreases work of breathing and supplies supplemental oxygen.
• Observe for tube obstruction; suction prn; ensure adequate humidification. May result in inadequate ventilation or mucous plug.
• Reposition patient q. 1-2 h. Repositioning helps all lobes of the lung to be adequately perfused and ventilated.
• Provide nutrition as ordered, e.g. TPN, lipids or enteral feedings. Calories, minerals, vitamins, and protein are needed for energy and tissue repair. Obtain nutrition consult.
• Provides guidance and continued surveillance.
• Potential for pulmonary infection r/t compromised tissue integrity.
• Secure airway and support ventilator tubing.
• Prevent mucosal damage.
• Provide good oral care q. 4 h.; suction when need indicated using sterile technique; hand washing with antimicrobial for 30 seconds before and after patient contact. Measures aimed at prevention of nosocomial infections.
• Ensure ventilator tubing changed q. 7 days, in-line suction changed q. 24 h.; ambu bags changes between patients and whenever become soiled.
• Assess for GI problems. Preventative measures include relieving anxiety, antacids or H2 receptor antagonist therapy, adequate sleep cycles, adequate communication system. Most serious is stress ulcer. May develop constipation.
• Observe skin integrity for pressure ulcers; preventative measures include turning patient at least q2 h.; use pressure relief mattress or turning bed if indicated; follow prevention of pressure ulcers plan of care;
• Patient is at high risk for developing pressure ulcers due to immobility and decreased tissue perfusion.
• Maintain muscle strength with active/active-assistive/passive ROM and prevent contractures with use of span-aids or splints.
• Patient is at risk for developing contractures due to immobility, use of paralytics and ventilator related deficiencies.
• Encourage patient to relax and breath with the ventilator; explain alarms; teach importance of deep breathing; provide alternate method of communication; keep call bell within reach;
Reduce anxiety, gain cooperation and participation in plan of care

Anxious Patient
- Can be due to a malfunction of the ventilator
- Patient may need to be suctioned
- Frequently the patient needs medication for anxiety or sedation to help them relax
  - Attempt to fix the problem
  - Call your DOCTOR

Anytime you have concerns, alarms, ventilator changes or any other problem with your ventilated patient.
- Call your DOCTOR
- NEVER hit the silence button!

Recommended elements of Preventive Bundle for VAP

- Avoid unnecessary antibiotics
- Avoid unnecessary stress ulcer prophylaxis
- Sucralfate for stress ulcer prophylaxis
- Oral intubation
- Chlorhexidine oral rinse
- Selective digestive decontamination
- Short-course parenteral antibiotics
- Appropriate hand disinfection
- Appropriate staffing
- Avoid tracheal intubation
- Shorten duration of mechanical ventilation
- Semirecumbent positioning
- Avoid gastric overdistention
- Subglottic suctioning
- Avoid ventilator circuit changes/manipulation
- Drain ventilator circuit condensate
- Prevent accidental extubation
VENTILATOR CARE BUNDLE AT JPNATC

- HOB > 30 degree
- Oral care once in each shift
- Sedation vacations to check readiness to extubate
- DVT prophylaxis
- Peptic ulcer disease prophylaxis

CARE OF VENTILATORS, TUBINGS & SUCTION APPARATUS
PREVENTION AND MANAGEMENT OF OCCUPATIONAL EXPOSURES

- Ensure that standard precautions are followed and protective equipment(s) is/are always used during patient care.
- The following standard precautions should be followed whenever an exposure occurs.

Immediate action following an exposure

- All persons following an injury/exposure to blood spills/body fluids should:
  - Wash the affected body area with running water and soap; flush mouth and eyes, if contaminated with water or saline for a minimum of 30 seconds.
  - In case of penetrating wound, wash with soap and water and remove any foreign material if it’s an immediate necessity.
  - If clothing is contaminated, remove contaminated clothing if possible. Clothing that is removed must be either:
    - Secured and labelled in a clear plastic bag and stored in a secure location if it’s required as evidence; or
    - Disposed off safely.
  - Immediately notify the section-in-charge/ Hospital Infection Control staff (Phone no – 011-26731244 or Room No. 204, Phone no – 011-26731268, II floor, Laboratory Medicine). During evening/night, the Labs are open, so the duty Technician in Lab Medicine may be contacted for needful.
  - Following the exposure, the health care worker must as soon as practicable proceed Room-204/212, Laboratory Medicine Department, Phone no – 011-26731268)
  - Samples of the HCW and the patients should be given for testing of viral markers.
  - Health care workers have a right to seek for medical attention outside of these procedures from the physician of their choice.
  - Health care worker needs to complete a needle stick or spillage report form as soon as practicable following the injury/exposure, which is available either with the Hospital Infection Control Section or the Microbiology Senior Resident in charge.

1) In-charges/Managers must report the incident and ensure that reporting and notifications are completed in accordance with the Incident Reporting and Recording.
### TABLE 1. Recommended HIV postexposure prophylaxis (PEP) for percutaneous injuries

<table>
<thead>
<tr>
<th>Exposure type</th>
<th>HIV-positive, class 1*</th>
<th>HIV-positive, class 2*</th>
<th>Source of unknown HIV status†</th>
<th>Unknown source§</th>
<th>HIV-negative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less severe†</td>
<td>Recommend basic 2-drug PEP</td>
<td>Recommend expanded ≥3-drug PEP</td>
<td>Generally, no PEP warranted; however, consider basic 2-drug PEP** for source with HIV risk factors††</td>
<td>Generally, no PEP warranted</td>
<td>No PEP warranted</td>
</tr>
<tr>
<td>More severe§</td>
<td>Recommend expanded 3-drug PEP</td>
<td>Recommend expanded ≥3-drug PEP</td>
<td>Generally, no PEP warranted; however, consider basic 2-drug PEP** for source with HIV risk factors††</td>
<td>Generally, no PEP warranted</td>
<td>No PEP warranted</td>
</tr>
</tbody>
</table>

* HIV-positive, class 1 — asymptomatic HIV infection or known low viral load (e.g., <1,500 ribonucleic acid copies/mL). HIV-positive, class 2 — symptomatic HIV infection, acquired immunodeficiency syndrome, acute seroconversion, or known high viral load. If drug resistance is a concern, obtain expert consultation. Initiation of PEP should not be delayed pending expert consultation, and, because expert consultation alone cannot substitute for face-to-face counseling, resources should be available to provide immediate evaluation and follow-up care for all exposures.
† For example, deceased source person with no samples available for HIV testing.
‡ For example, a needle from a sharps disposal container.
§ For example, solid needle or superficial injury.
** For example, solid needle or superficial injury.
†† If PEP is offered and administered and the source is later determined to be HIV-negative, PEP should be discontinued.
§§ For example, large-bore hollow needle, deep puncture, visible blood on device, or needle used in patient's artery or vein.

### TABLE 2. Recommended HIV postexposure prophylaxis (PEP) for mucous membrane exposures and nonintact skin* exposures

<table>
<thead>
<tr>
<th>Exposure type</th>
<th>HIV-positive, class 1†</th>
<th>HIV-positive, class 2†</th>
<th>Source of unknown HIV status§</th>
<th>Unknown source‖</th>
<th>HIV-negative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small volume**</td>
<td>Consider basic 2-drug PEP††</td>
<td>Recommend basic 2-drug PEP</td>
<td>Generally, no PEP warranted‖</td>
<td>Generally, no PEP warranted</td>
<td>No PEP warranted</td>
</tr>
<tr>
<td>Large volume‖†</td>
<td>Recommend basic 2-drug PEP</td>
<td>Recommend expanded ≥3-drug PEP</td>
<td>Generally, no PEP warranted; however, consider basic 2-drug PEP** for source with HIV risk factors‖</td>
<td>Generally, no PEP warranted</td>
<td>No PEP warranted</td>
</tr>
</tbody>
</table>

* For skin exposures, follow-up is indicated only if evidence exists of compromised skin integrity (e.g., dermatis, abrasion, or open wound).
†† For example, a needle from a sharps disposal container.
‡‡ For example, solid needle or superficial injury.
§§ For example, large-bore hollow needle, deep puncture, visible blood on device, or needle used in patient's artery or vein.
‖ For example, splash from inappropriately disposed blood.
** For example, a few drops.
‖‖ The recommendation "consider PEP" indicates that PEP is optional; a decision to initiate PEP should be based on a discussion between the exposed person and the treating clinician regarding the risks versus benefits of PEP.
§§§ If PEP is offered and administered and the source is later determined to be HIV-negative, PEP should be discontinued.
‖‖‖ For example, a major blood splash.
### TABLE 3. Recommended postexposure prophylaxis for exposure to hepatitis B virus

<table>
<thead>
<tr>
<th>Vaccination and antibody response status of exposed workers*</th>
<th>Source HBsAg (^\dagger) positive</th>
<th>Source HBsAg (^\dagger) negative</th>
<th>Source unknown or not available for testing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unvaccinated</td>
<td>HBIG (^\dagger) x 1 and initiate HB vaccine series(^\dagger)</td>
<td>Initiate HB vaccine series</td>
<td>Initiate HB vaccine series</td>
</tr>
<tr>
<td>Previously vaccinated</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Known responder**</td>
<td>No treatment</td>
<td>No treatment</td>
<td>No treatment</td>
</tr>
<tr>
<td>Known nonresponder**</td>
<td>HBIG (^\dagger) x 1 and initiate revaccination or HBIG (^\dagger) x 2(^\ast)</td>
<td>No treatment</td>
<td>If known high risk source, treat as if source were HBsAg positive</td>
</tr>
<tr>
<td>Antibody response unknown</td>
<td>Test exposed person for anti-HBs(^\ast) 1. If adequate,(^\ast) no treatment is necessary 2. If inadequate,(^\ast) administer HBIG (^\dagger) x 1 and vaccine booster</td>
<td>No treatment</td>
<td>Test exposed person for anti-HBs 1. If adequate,(^\ast) no treatment is necessary 2. If inadequate,(^\ast) administer vaccine booster and recheck titer in 1–2 months</td>
</tr>
</tbody>
</table>

* Persons who have previously been infected with HBV are immune to reinfection and do not require postexposure prophylaxis.

\(^\dagger\) Hepatitis B surface antigen.

\(^\ast\) Hepatitis B immune globulin; dose is 0.06 mL/kg intramuscularly.

\(^\ast\) Hepatitis B vaccine.

** A responder is a person with adequate levels of serum antibody to HBsAg (i.e., anti-HBs \(>10 \text{ mIU/mL}\)).

\(^\ast\) A nonresponder is a person with inadequate response to vaccination (i.e., serum anti-HBs \(<10 \text{ mIU/mL}\)).

\(^\ast\) The option of giving one dose of HBIG and reinitiating the vaccine series is preferred for nonresponders who have not completed a second 3-dose vaccine series. For persons who previously completed a second vaccine series but failed to respond, two doses of HBIG are preferred.

\(^\ast\) Antibody to HBsAg.
INFECTION-CONTROL AND VENTILATION REQUIREMENTS FOR OPERATING ROOMS

Air change rate:
- An air change is defined as occurring when a volume of air equivalent to the volume of the room has been supplied to or removed from that room. (which ever airflow is greater).
- The rate of air change is usually given in terms of air change per hour (ACH) and is derived from the volume of a room and the ventilation rate.
  \[
  \text{Air change rate} = \frac{\text{Air supply rate}}{\text{Room volume}}
  \]
- Clean areas (operation room and preparation room): 20ACH/ hour
- Preparation room used for laying up sterile instrument : 37 ACH/ hour since the main route of entry of air borne contamination is via instruments
- If preparation rooms are used only as sterile pack stores: 11ACH/ hour.

Pressure differentials
- Pressure differentials are essential to prevent backflow of air from dirty to clean areas. The differentials are small and need to be measured by special electronic micro manometer or inclined fluid manometer. The desired pressure differentials vary from 9-30 Pascal
- Air leaving the final filter should contain no more than 0.5 CFU/m³ of air. If air filters have been tested by particle penetration test, this test is not necessary.
- The filters should be checked to prevent passage of particles through it and the clean zone should resist particle ingress from outside.

AHU: The humidifier and cooling coil in AHU should be disinfected at least six monthly.
- Maintain positive-pressure ventilation with respect to corridors and adjacent areas.
- Do not use ultraviolet (UV) lights to prevent surgical-site infections.
- Keep operating room doors closed except for the passage of equipment, personnel, and patients.
- Strictly limit entry to essential personnel. Only people absolutely needed for an assigned work should be present. People present in theatre should curtail unnecessary movements in and out of theatres, which will greatly reduce bacterial count.
- Trolleys entering theatre should be designated for use in that theatre only and cleaned after each patient.
Precautionary procedures for infectious TB patients who also require emergency surgery

- Use an N95 respirator approved by the Hospital, without exhalation valves in the operating room.
- Incubate the patient in either the AII (airborne infection isolation) room or the operating room; if incubating the patient in the operating room, do not allow the doors to open until 99% of the airborne contaminants are removed.
- When anesthetizing a patient with confirmed or suspected TB, place a bacterial filter between the anesthesia circuit and patient's airway to prevent contamination of anesthesia equipment or discharge of tubercle bacilli into the ambient air.
- Extubate and allow the patient to recover in an AII room. If the patient has to be extubated in the operating room, allow adequate time for ACH to clean 99% of airborne particles from the air, because extubation is a cough-producing procedure.
- Whenever possible, patients with suspected tuberculosis should be taken as the last case.

Recommendations for pre operative surgical scrub

- An approved antiseptic agent should be used for hand washing.
- ‘Surgical scrub’ hand wash should be for a minimum of 2 minutes.

Skin preparation & use of antiseptic agents:

- Alcohol solutions are more effective than and preferable to aqueous solutions for skin preparation. They should be allowed to dry thoroughly.

- **Chlorhexidine gluconate 0.5% w/w in spirit 70%**.

- **Povidone iodine 7.5%**.

- Multi-use bottles of antiseptics - if used:
  - Label with date first opened
  - Use within the ‘Use by Date’ or discard once ‘use by date’ reached
  - Never refill or ‘top up’; discard container and dispenser after use or when use by date has been reached

- **Sharps use and disposal**
  - Ensure removable blades can be easily detached using an appropriate device.
  - Use an appropriate size and type of ‘sharps’ bin/box for the area and anticipated volume of usage
  - Do not place ‘sharps’ bins/boxes in areas where there may be an obstacle to environmental cleaning.
  - Avoid overfilling: the sharps containers must be closed securely when three-quarters full.
  - Used needles must not be recapped
Gloves
- Scrub team members should wear sterile surgical gloves donned after the sterile gown.
- A fresh pair of sterile gloves should be worn for each procedure.

Face Masks
- A mask (with a filter size <1.1 microns) may be worn over the mouth and nose by all members of the ‘scrub’ team; a visor or goggles should also be worn for added protection where risk of aerosol.
- If worn, a fresh mask should be worn for each operation.
- The mask should be changed if deemed to have become contaminated or saturated.

Theatre Caps
- Scrubbed staff should wear disposable headgear because of their proximity to the operating field, particularly in a laminar flow field.
- Caps must be worn in laminar flow theatre during prosthetic implant operations.
- After use dispose of headgear and do not wear outside theatre

Theatre footwear
- Special well-fitting footwear with impervious soles should be worn in the operating department.
- Footwear should be regularly cleaned to remove splashes of blood and body fluid.
- All footwear should be cleaned after every use, and procedures should be in place to ensure that this is undertaken at the end of every session.

Jewellery and accessories
- Necklaces, ear-rings and rings with stones should be removed;
- Wedding rings may continue to be worn by ‘scrub’ and non-‘scrub’ staff although surgeons may be advised to remove these, particularly if working with metal prostheses.

Visitors
- Visitors attending the anesthetic room do not need to wear special protective wear or footwear and may wear ordinary outdoor clothes.
- If a visitor is to enter any of the main operating theatres, then they should change into theatre suits.

Dress when leaving theatre
- Theatre staff should wear a clean white coat over theatre suit, if leaving the department and especially in public areas.
- Surgical masks must be removed before leaving theatre; masks should never be left tied around neck.
- Caps must be removed when leaving theatre.
SURGICAL SCRUB BEFORE DONNING OF STERILE GOWN AND GLOVES
Patients with MRSA
Put last on list if:
- Patient has extensive eczema or other exfoliative skin disorder colonised with MRSA
- Patient with MRSA is undergoing orthopaedic or joint replacement surgery
- Patient has tissue infection with MRSA and/or where aerosol-dispersing power tools are used on infected tissue.

Patients with blood-borne virus: Hepatitis B, C or HIV
- Treat in the same way as any other patient, with universal blood precautions.
- Take due care with sharps and ensure that all measures are in place to minimise risk of needlestick injury or contamination with blood: the operating/scrub team should be experienced and the procedure should be unhurried; the scrub team may wish to double-glove; risk assessment should determine whether water impermeable gowns should be worn.
- Scrub team should know the correct procedure to follow in the event of an inoculation or ‘sharps’ incident if there has been exposure to HIV.

STEPS FOR DONNING OF SURGICAL GOWN (Unassisted)
STEPS FOR DONNING OF SURGICAL GOWN (Assisted)
Cleaning of operative rooms

Schedule

- Beginning of the day
- During a procedure
- Between procedures
- End of the day
- Weekly/monthly

Prior to first case

- The furniture, equipment, lights are to be damp dusted with detergent germicide with cloth. Particular attention should be paid to horizontal surfaces.

During the procedure

- Spills / blood splashes in vicinity of sterile field should be absorbed with a cloth/disposable paper towel and cleaned with hypochlorite solution (Appropriate dilution).
- All instruments opened for a procedure whether used or not used are treated as contaminated

In between case

- Furniture, operating lights, suction canisters and other equipment used to be wiped with a detergent germicide.
- Patient transport vehicles are to be wiped with a detergent germicide
- 3-4 feet area of the floor around the table should be cleaned by wet mopping with a detergent germicide/ low level disinfectant.
- Walls, doors and other areas that have come in contact with the patient’s blood and body fluids are to be cleaned with hypochlorite using disposable cloth

Day’s End

- OR, Scrub utility Corridor, Furnishings and equipment to be cleaned
- Wet mopping should be done with single use mop (preferable)
- Fogging with hydrogen peroxide based disinfectants
- Clean all the table tops, sinks, door handles with detergent followed by low level disinfectant.
- Clean the floors with detergents mixed with warm water. Finally mop with disinfectant.
- Keep the operation theatre dry for the next day’s work

Theatre trolleys must be free of dust and without dirt or spillage; the fabric of the trolley should be in good condition.

Grossly infected cases (gas gangrene/ suspected tetanus/ hepatitis/ HIV)

- Scupulous cleaning with disinfectants: Glutaraldehyde/ hydrogen peroxide/ Orthophthalaldehyde.
- Fogging with hydrogen peroxide disinfectants
STANDARD PRECAUTIONS

Assume that every person is potentially infected or colonized with an organism that could be transmitted in the healthcare setting and apply the following infection control practices during the delivery of health care.

**Hand hygiene**

- Hand hygiene has been cited frequently as the single most important practice to reduce the transmission of infectious agents in healthcare settings and is an essential element of Standard Precautions.
- The term “hand hygiene” includes both hand washing with either plain or antiseptic-containing soap and water, and use of alcohol-based products (gels, rinses, foams) that do not require the use of water.
- In the absence of visible soiling of hands, approved alcohol-based products for hand disinfection are preferred over antimicrobial or plain soap and water because of their superior microbiocidal activity, reduced drying of the skin, and convenience.
- Improved hand hygiene practices have been associated with a sustained decrease in the incidence of MRSA and VRE infections primarily in the ICU.

**Hand hygiene must be performed**

- During the delivery of healthcare, avoid unnecessary touching of surfaces in close proximity to the patient to prevent both contamination of clean hands from environmental surfaces and transmission of pathogens from contaminated hands to surfaces.
- When hands are visibly dirty, contaminated with proteinaceous material, or visibly soiled with blood or body fluids, wash hands with either a non antimicrobial soap and water or an antimicrobial soap and water.
- If hands are not visibly soiled, or after removing visible material with non antimicrobial soap and water, decontaminate hands. The preferred method of hand decontamination is with an alcohol-based hand rub. Alternatively, hands may be washed with an antimicrobial soap and water. Frequent use of alcohol-based hand rub immediately following hand washing with non antimicrobial soap may increase the frequency of dermatitis.
STEPS FOR PERFORMING HAND HYGIENE USING HAND RUBS/ HAND WASH
(Each step should be repeated for both the hands)

Wash hands:
- Before having direct contact with patients
- After contact with blood, body fluids or excretions, mucous membranes, nonintact skin, or wound dressings.
- After contact with a patient’s intact skin (e.g., when taking a pulse or blood pressure or lifting a patient).
- If hands will be moving from a contaminated-body site to a clean-body site during patient care.
- After contact with inanimate objects (including medical equipment) in the immediate vicinity of the patient.
- After removing gloves: Wash hands with non-antimicrobial soap and water or with antimicrobial soap and water if contact with spores (e.g., C. difficile or Bacillus anthracis) is likely to have occurred. The physical action of washing and rinsing hands
under such circumstances is recommended because alcohols, chlorhexidine, iodophors, and other antiseptic agents have poor activity against spores.

**Personal protective equipment (PPE) for healthcare personnel**

- PPE refers to a variety of barriers and respirators used alone or in combination to protect mucous membranes, airways, skin, and clothing from contact with infectious agents.
- The selection of PPE is based on the nature of the patient interaction and/or the likely mode(s) of transmission.
- Designated containers for used disposable or reusable PPE should be placed in a location that is convenient to the site of removal to facilitate disposal and containment of contaminated materials.
- Hand hygiene is always the final step after removing and disposing of PPE. The following sections highlight the primary uses and methods for selecting this equipment.

**Gloves:**

- Gloves are used to prevent contamination of healthcare personnel hands when
  - anticipating direct contact with blood or body fluids, mucous membranes, non-intact skin and other potentially infectious material;
  - having direct contact with patients who are colonized or infected with pathogens transmitted by the contact route e.g., VRE, MRSA, RSV or
  - handling or touching visibly or potentially contaminated patient care equipment and environmental surfaces.

- Gloves can protect both patients and healthcare personnel from exposure to infectious material that may be carried on hands.
- The extent to which gloves will protect healthcare personnel from transmission of blood borne pathogens (e.g., HIV, HBV and HCV) following a needle stick or other puncture that penetrates the glove barrier has not been determined.
- During patient care, transmission of infectious organisms can be reduced by adhering to the principles of working from “clean” to “dirty”, and confining or limiting contamination to surfaces that are directly needed for patient care. It may be necessary to change gloves during the care of a single patient to prevent cross-contamination of body sites.
- It also may be necessary to change gloves if the patient interaction also involves touching portable computer keyboards or other mobile equipment that is transported from room to room.
- Discarding gloves between patients is necessary to prevent transmission of infectious material. Gloves must not be washed for subsequent reuse because microorganisms cannot be removed reliably from glove surfaces and continued glove integrity cannot be ensured.
- Glove reuse has been associated with transmission of MRSA and gram-negative bacilli.
- When gloves are worn in combination with other PPE, they are put on last. Gloves that fit snugly around the wrist are preferred for use with an isolation gown because they will cover the gown cuff and provide a more reliable continuous barrier for the arms, wrists, and hands.
• Gloves that are removed properly will prevent hand contamination. Hand hygiene following glove removal further ensures that the hands will not carry potentially infectious material that might have penetrated through unrecognized tears or that could contaminate the hands during glove removal.

DONNING OF GLOVES

REMOVAL OF GLOVES
Isolation gowns

- Isolation gowns are used as specified by standard and Transmission-Based Precautions, to protect the HCW’s arms and exposed body areas and prevent contamination of clothing with blood, body fluids, and other potentially infectious material.

- The need for and type of isolation gown selected is based on the nature of the patient interaction, including the anticipated degree of contact with infectious material and potential for blood and body fluid penetration of the barrier.

- When applying Standard Precautions, an isolation gown is worn only if contact with blood or body fluid is anticipated. However, when Contact Precautions are used (i.e., to prevent transmission of an infectious agent that is not interrupted by Standard Precautions alone and that is associated with environmental contamination), donning of both gown and gloves upon room entry is indicated to address unintentional contact with contaminated environmental surfaces.

- The routine donning of isolation gowns upon entry into an intensive care unit or other high-risk area does not prevent or influence potential colonization or infection of patients in those areas.

- Isolation gowns are always worn in combination with gloves, and with other PPE when indicated.

- Gowns are usually the first piece of PPE to be donned. Full coverage of the arms and body front, from neck to the mid-thigh or below will ensure that clothing and exposed upper body areas are protected.

- Several gown sizes should be available in a healthcare facility to ensure appropriate coverage for staff members.

- Isolation gowns should be removed before leaving the patient care area to prevent possible contamination of the environment outside the patient’s room.

- Isolation gowns should be removed in a manner that prevents contamination of clothing or skin.

- The outer, “contaminated”, side of the gown is turned inward and rolled into a bundle, and then discarded into a designated container for waste or linen to contain contamination.
Face protection: masks, goggles, face shields

**Masks:**
- Masks are used for three primary purposes in healthcare settings:
  - Placed on healthcare personnel to protect them from contact with infectious material from patients e.g., respiratory secretions and sprays of blood or body fluids, consistent with Standard Precautions and Droplet Precautions;
  - Placed on healthcare personnel when engaged in procedures requiring sterile technique to protect patients from exposure to infectious agents carried in a healthcare worker’s mouth or nose, and
  - Placed on coughing patients to limit potential dissemination of infectious respiratory secretions from the patient to others (i.e., Respiratory Hygiene / Cough Etiquette).
- Masks may be used in combination with goggles to protect the mouth, nose and eyes, or a face shield may be used instead of a mask and goggles, to provide more complete protection for the face.
- Masks should not be confused with particulate respirators that are used to prevent inhalation of small particles that may contain infectious agents transmitted via the airborne route.
- The mucous membranes of the mouth, nose, and eyes are susceptible portals of entry for infectious agents. Therefore, use of PPE to protect these body sites is an important component of Standard Precautions.
- The wearing of masks, eye protection, and face shields in specified circumstances when blood or body fluid exposures are likely to occur is mandated by the OSHA Blood borne Pathogens Standard.
- Appropriate PPE should be selected based on the anticipated level of exposure.
- Two mask types are available for use in healthcare settings: surgical masks that are cleared by the FDA and required to have fluid-resistant properties, and procedure or isolation masks.
- No studies have been published that compare mask types to determine whether one mask type provides better protection than another. Since procedure/isolation masks are not regulated by the FDA, there may be more variability in quality and performance than with surgical masks.
- Masks come in various shapes (e.g., molded and non-molded), sizes, filtration efficiency, and method of attachment (e.g., ties, elastic, ear loops).
- Healthcare facilities may find that different types of masks are needed to meet individual healthcare personnel needs.
**Goggles:**

- The eye protection chosen for specific work situations (e.g., goggles or face shield) depends upon the circumstances of exposure, other PPE used, and personal vision needs.

- Personal eyeglasses and contact lenses are NOT considered adequate eye protection. Indirectly-vented goggles with a manufacturer’s anti-fog coating may provide the most reliable practical eye protection from splashes, sprays, and respiratory droplets from multiple angles.

**Respiratory protection**

- Respiratory protection currently requires the use of a respirator with N95 or higher filtration to prevent inhalation of infectious particles.

- CDC currently recommends N95 or higher level respirators for personnel exposed to patients with suspected or confirmed tuberculosis.

- Currently this is also true for other diseases that could be transmitted through the airborne route, including SARS and smallpox.

- Respirators are also currently recommended to be worn during the performance of aerosol-generating procedures (e.g., intubation, bronchoscopy, suctioning) on patients with SARS Co-V infection, avian influenza and pandemic influenza.

**Respiratory Hygiene/Cough Etiquette**

- Educate healthcare personnel on the importance of source control measures to contain respiratory secretions to prevent droplet and fomite transmission of respiratory pathogens.

- Implement the following measures to contain respiratory secretions in patients and accompanying individuals who have signs and symptoms of a respiratory infection, beginning at the point of initial encounter in a healthcare setting (e.g., triage, reception and waiting areas in emergency departments, outpatient clinics and physician offices.
  
  - Post signs at entrances and in strategic places (e.g., elevators, cafeterias) with instructions to patients and other persons with symptoms of a respiratory infection to cover their mouths/noses when coughing or sneezing, use and dispose of tissues, and perform hand hygiene after hands have been in contact with respiratory secretions.
  
  - Provide tissues and no-touch receptacles (e.g., foot-pedal operated lid or open, plastic-lined waste basket) for disposal of tissues.
  
  - Provide resources and instructions for performing hand hygiene in or near waiting areas in ambulatory and inpatient settings; provide conveniently-located dispensers of alcohol-based hand rubs and, where sinks are available, supplies for hand washing.
DONNING OF CAP AND SHOE COVERS
WEARING THE SURGICAL MASK

Patient placement

- Include the potential for transmission of infectious agents in patient-placement decisions.
- Place patients who pose a risk for transmission to others (e.g., uncontained secretions, excretions or wound drainage, monitor air pressure daily with visual indicators (e.g., smoke tubes, flutter strips), regardless of the presence of differential pressure sensing.

Safe injection practices

- The following recommendations apply to the use of needles, cannulas that replace needles, and, where applicable intravenous delivery systems:
- Use aseptic technique to avoid contamination of sterile injection equipment.
- Do not administer medications from a syringe to multiple patients, even if the needle or cannula on the syringe is changed. Needles, cannula and syringes are sterile, single-use items; they should not be reused for another patient or for accessing a medication or solution that might be used for a subsequent patient.
- Use fluid infusion and administration sets (i.e., intravenous bags, tubing and connectors) for one patient only and dispose appropriately after use. Consider a syringe or needle/cannula contaminated once it has been used to enter or connect to a patient’s intravenous infusion bag or administration set.
- Use single-dose vials for parenteral medications whenever possible.
- Do not administer medications from single-dose vials or ampules to multiple patients or combine leftover contents for later.
• If multi dose vials must be used, both the needle or cannula and syringe used to access the multi dose vial must be sterile.
• Do not keep multi dose vials in the immediate patient treatment area and store in accordance with the manufacturer’s recommendations; discard if sterility is compromised or questionable.
• Do not use bags or bottles of intravenous solution as a common source of supply for multiple patients.
• Infection control practices for special lumbar puncture procedures: Wear a surgical mask when placing a catheter or injecting material into the spinal canal or subdural space (i.e., during myelograms, lumbar puncture and spinal or epidural anesthesia).
Surveillance Work at JPNA Trauma Centre

### JPNA TRAUMA CENTRE – HIFCOM

<table>
<thead>
<tr>
<th>Name</th>
<th>TC No</th>
<th>Date of Admission</th>
<th>Age/Sex</th>
<th>Diagnosis</th>
<th>Surgery</th>
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#### Type of Trauma
- Abdominal
- Head
- Thoracic
- Multiple
- Long Bones
- Spine
- Vascular

#### FINAL ICU OUTCOME
- Discharge
- Transfer out
- Transferred to another unit
- Died

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<th>Date</th>
<th>Temperature</th>
<th>Blood Pressure (Systolic)</th>
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#### INVASIVE DEVICES
- CVC (with site of change of dressing)
- Arterial
- PVC
- Ventilatory support
- Foley’s catheter

### ANTIBIOTICS DAYS

<table>
<thead>
<tr>
<th>Name (Dosage / Route / Frequency)</th>
<th>Date / Month</th>
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### VAP CHECK LIST

1) Base line chest X Ray-Date/Month

2) Chest X-Ray After 48 Hours
   a) New/Progressive & Persistent infiltrates
   b) Consolidation
   c) Cavitation

3) Fever

4) WBC Count
   - Leukopenia (<1000 WBC/mm³)
   - Leukocytosis (>10,000 WBC/mm³)

5) Sputum characteristics
   - Patient Sputum
   - Color of sputum

6) Respiratory Rate

7) Worsening gas exchange
   - ABG
     - $P_{O_2}$
     - $P_{CO_2}$

8) Increased O2 requirements & ventilator demand
   - $F_{IO_2}$

9) Microbiological Culture

### CENTRAL LINE BUNDLE

- Hand Hygiene
- Maximal barrier precautions upon insertion / Manipulation
- P/I (Alcohol/Chlorhexidine Skin Antiseptics)
- Optimal Catheter Site Selection, with Avoidance of the Femoral Vein for Central Venous Access in Adult Patients
- Daily Review of Line Necessity with Prompt Removal of Unnecessary Lines

### VENTILATOR BUNDLE

- Elevation of the Head of the Bed
- Daily “Sedation Vacations” and Assessment of Readiness to Extubate
- Peptic Ulcer Disease Prophylaxis
- Deep Venous Thrombosis Prophylaxis

### BLADDER BUNDLE

- Aseptic insertion and proper maintenance
- Dependent Drainage
- Condom or intermittent catheterization in appropriate patients (Third Day)
- Catheter required (Daily Assessment)
### Laboratory-confirmed bloodstream infection

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Present</th>
<th>Absent</th>
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<tbody>
<tr>
<td>Fever (≥38°C)</td>
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<td>Chills</td>
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<td>Hypotension</td>
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<td>Hypothermia</td>
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<td>Apnea</td>
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<td>Bradycardia</td>
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<td>Tip Culture Report</td>
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### Clinical Sepsis

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<thead>
<tr>
<th>Symptom</th>
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<tbody>
<tr>
<td>Fever (≥38°C)</td>
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<td>Hypotension (systolic pressure &lt;90 mm Hg)</td>
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<td>oliguria (&lt;20 cm3/hr)</td>
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<td>Blood culture not done</td>
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<td>Organism not or detected in blood</td>
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<td>No apparent infection at another site</td>
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<td>Physician institutes treatment for sepsis</td>
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### Urinary Tract Infection

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### SSI Surveillance

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<tr>
<td>Date of Trauma: 2.03.20</td>
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<tr>
<td>Duration between Trauma &amp; Surgery: 3 days</td>
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<td>Type of Surgery: Emergency</td>
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<td>Blood Transfusion: Yes</td>
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<tr>
<th>Date</th>
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**Notes:**
- Patient developed a fever on 4.03.20, which was 37.6°C.
- Patient was treated with 500 mg Cefuroxime on 3.03.20.
- Patient was discharged on 12.03.20.
- Patient was reviewed on 12.03.20 with a negative swab.

**Diagnosis:**
- Head injury
- Multiple fractures
- Pelvic fracture

**Surgery:**
- Laparotomy
- Exploratory laparotomy
- Laparotomy with washout
- Exploratory laparotomy

**Pathology:**
- Abdominal abscess
- Blunt trauma

**Treatment:**
- Antimicrobial therapy
- Supportive care

**Outcome:**
- Patient recovered and was discharged on 12.03.20.
| First wound dressing General appearance of the wound Pus/semisolid/ dry |
| Second wound dressing General appearance of the wound Pus/semisolid/ dry / C/S send. |
| Third wound dressing General appearance of the wound Pus/semisolid/ dry / C/S send. Initiation of Antibiotics course |

**Clinical Evidence of SSI**

- Redness with tenderness
- Swelling
- Purulent discharge
- Positive wound culture
- Rise in antibiotic usage
- Clinical & microbiological response - Repeat sample

**Wound Condition at discharge**

<table>
<thead>
<tr>
<th>Date</th>
<th>Type</th>
<th>Organism isolated</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### BS Surveillance

<table>
<thead>
<tr>
<th>Date</th>
<th>Type</th>
<th>Organism Located</th>
<th>Date</th>
<th>Type</th>
<th>Organism Located</th>
</tr>
</thead>
<tbody>
<tr>
<td>22/12/2011</td>
<td>Left</td>
<td>Sterile</td>
<td>22/12/2011</td>
<td>Right</td>
<td>Sterile</td>
</tr>
<tr>
<td>24/12/2011</td>
<td>Left</td>
<td>Sterile</td>
<td>24/12/2011</td>
<td>Right</td>
<td>Sterile</td>
</tr>
</tbody>
</table>

### Clinical Evidence of BS

- **Date**: 22/12/2011
- **Culture Positive (from one or more local sites)**
- **Organism cultured from blood is not related to infection at another site**
- **Fever (> 38 °C)**
- **Blood**
- **Wound**
- **Urinary Tract**
- **Respiratory Tract**
- **Abscess**
- **Brain / Spinal Cord**
- **Line insertion & maintenance in appropriate**
- **Is BS Significant?**
- **Any other infection diagnosed?**

- **Culture Reports**
  - **Date**: 22/12/2011
  - **Type**: Left
  - **Organism Located**: Sterile
  - **Date**: 23/12/2011
  - **Type**: Right
  - **Organism Located**: Sterile
### Hand Hygiene Compliance Checklist

**Department of ICU**

**Name of the Observer:**

**Time of observation:**

**Healthcare Professional Observed:**
- **Nurse:**
- **Physician:**
- **Physiotherapist:**
- **Infection Control:**
- **OT/AA:**

**Indications for Hand Hygiene for a Healthcare Worker During Patient Care:**

<table>
<thead>
<tr>
<th>No.</th>
<th>Indication</th>
<th>Criterion</th>
<th>Friction</th>
<th>Handrub</th>
<th>Handspray</th>
<th>Handwash</th>
<th>Hand Dry</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>BEFORE TRACTION</td>
<td>a. Positioning the patient</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Cloth Gown, Gloves, Surgical Cap, Face Mask</td>
</tr>
<tr>
<td></td>
<td></td>
<td>b. Chest physiotherapy</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Cloth Gown, Gloves, Surgical Cap, Face Mask</td>
</tr>
<tr>
<td></td>
<td></td>
<td>c. Check anesthesia</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Cloth Gown, Gloves, Surgical Cap, Face Mask</td>
</tr>
</tbody>
</table>

**AFTER CLEAN PROCEDURE:**

<table>
<thead>
<tr>
<th>No.</th>
<th>Indication</th>
<th>Criterion</th>
<th>Friction</th>
<th>Handrub</th>
<th>Handspray</th>
<th>Handwash</th>
<th>Hand Dry</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Take item</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Cloth Gown, Gloves, Surgical Cap, Face Mask</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Taking blood sample</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Cloth Gown, Gloves, Surgical Cap, Face Mask</td>
<td></td>
</tr>
<tr>
<td></td>
<td>d. Team coordination</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Cloth Gown, Gloves, Surgical Cap, Face Mask</td>
<td></td>
</tr>
<tr>
<td></td>
<td>e. Syringe needle dressing</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Cloth Gown, Gloves, Surgical Cap, Face Mask</td>
<td></td>
</tr>
<tr>
<td></td>
<td>f. Trolley care</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Cloth Gown, Gloves, Surgical Cap, Face Mask</td>
<td></td>
</tr>
<tr>
<td></td>
<td>g. While changing patient's clothes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Cloth Gown, Gloves, Surgical Cap, Face Mask</td>
<td></td>
</tr>
</tbody>
</table>
5. AFTER BLOOD EXPOSURE

<table>
<thead>
<tr>
<th>Step</th>
<th>Action</th>
<th>Yes</th>
<th>No</th>
<th>CLOTH TOWEL</th>
<th>STERIL TOWEL</th>
<th>PAPER TOWEL</th>
<th>NONE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>After UTI testing</td>
<td>☑</td>
<td>☑</td>
<td>Soap</td>
<td>Liquid antiseptic</td>
<td>CLOTH TOWEL</td>
<td>STERIL TOWEL</td>
</tr>
<tr>
<td>2.</td>
<td>Large wound dressing</td>
<td>☑</td>
<td>☑</td>
<td>Soap</td>
<td>Liquid antiseptic</td>
<td>CLOTH TOWEL</td>
<td>STERIL TOWEL</td>
</tr>
<tr>
<td>3.</td>
<td>Sample collection (source, blood, specimen etc.)</td>
<td>☑</td>
<td>☑</td>
<td>Soap</td>
<td>Liquid antiseptic</td>
<td>CLOTH TOWEL</td>
<td>STERIL TOWEL</td>
</tr>
<tr>
<td>4.</td>
<td>Preparation of new suture material etc.</td>
<td>☑</td>
<td>☑</td>
<td>Soap</td>
<td>Liquid antiseptic</td>
<td>CLOTH TOWEL</td>
<td>STERIL TOWEL</td>
</tr>
</tbody>
</table>

6. AFTER TOUCHING PATIENT'S SURROUNDINGS

<table>
<thead>
<tr>
<th>Step</th>
<th>Action</th>
<th>Yes</th>
<th>No</th>
<th>CLOTH TOWEL</th>
<th>STERIL TOWEL</th>
<th>PAPER TOWEL</th>
<th>NONE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Handling (hands, bedsheet, IV stand etc.)</td>
<td>☑</td>
<td>☑</td>
<td>Soap</td>
<td>Liquid antiseptic</td>
<td>CLOTH TOWEL</td>
<td>STERIL TOWEL</td>
</tr>
<tr>
<td>2.</td>
<td>After cleaning hands etc. (undernourished etc.)</td>
<td>☑</td>
<td>☑</td>
<td>Soap</td>
<td>Liquid antiseptic</td>
<td>CLOTH TOWEL</td>
<td>STERIL TOWEL</td>
</tr>
<tr>
<td>3.</td>
<td>After using computer etc. of touching patient etc.</td>
<td>☑</td>
<td>☑</td>
<td>Soap</td>
<td>Liquid antiseptic</td>
<td>CLOTH TOWEL</td>
<td>STERIL TOWEL</td>
</tr>
</tbody>
</table>
Environmental surveillance