Review Article

# Cleaning and Sterilisation of Anaesthetic Equipment

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## ABSTRACT

The main purpose of this review article is to bring up what has been known (practiced) about decontamination, disinfection, and sterilisation of anaesthetic equipment. It also discusses how this evidence-based information on infection prevention and control impacts care of patient in routine anaesthesia practice. This review underscores the role played by us, anaesthetists in formulating guidelines, implementing the same, monitoring the outcome and training post-graduate trainees and coworkers in this regard. The article re-emphasises that certain guidelines when followed strictly will go a long way in reducing transmission of hospital acquired infection between patient and anaesthetist or between patients. Anaesthetists do not restrict their work to operating room but are involved in disaster management, interventional radiological procedures and in trauma care. They should ensure that the patients are cared for in clean and safe environment so as to reduce healthcare associated infections (HCAIs) simultaneously taking preventive measures against the various health hazards associated with clinical practice. They should ensure that the coworkers too adopt all the preventive measures while delivering their duties. For this review, we conducted literature searches in Medline (PubMed) and also searched for relevant abstracts and full texts of related articles that we came across. There is much to be learned from the western world where, health care organisations now have legal responsibility to implement changes in accordance with the newer technology to reduce health care associated infection. There is a need to develop evidence-based infection prevention and control programs and set national guidelines for disinfection and sterilisation of anaesthesia equipment which all the institutions should comply with.

**Key words:** Anaesthetic equipment, decontamination, disinfection, sterilisation

## INTRODUCTION

The awareness about transmissibility of certain diseases existed even centuries back when practitioners like Hippocrates, Gallen and many other pioneers used water or wine to either clean wounds or instruments before use. In 19$^{th}$ century, thanks to the work of Pasteur, Lister and many others, for the first time change was seen in infection control. However, it was Waters in 1932, who first associated anaesthesia equipment as a vector for nosocomial pathogens. This has necessitated active role by all the anaesthetists to take precautions against transmission of infection between patient and anaesthetist and between patients as a routine part of safe anaesthesia practice to reduce healthcare associated infections (HCAIs).[1]

There is an increasing trend in the western world toward the use of disposable or single use equipment to tide over this problem but for a country like ours it would not be feasible. The biggest handicaps would be economic burden on the institutions to keep large inventory, the higher costs to the patients and the increasing load on authorities for waste management. We, therefore, have hardly any choice but to continue the use of reusable equipment by sticking to decontamination practices taking appropriate infection control precautions as per the standards and guidelines set by the hospital authorities.

There is a need to ensure that these standards are not just established but are strictly adhered to and monitored as well, in all areas of anaesthetic practice.

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## PRINCIPLES OF DISINFECTION

There are several advances in the development of antimicrobial agents and methods of sterilisation, yet several factors still influence their effectiveness. A thorough knowledge of these agents and methods as well as the response of the microorganisms to them needs to be acquired so that we can choose the one best suited for the purpose.

The recommendations on the preferred methods for cleaning, disinfection, and sterilisation of patient-care medical devices and also for cleaning and disinfecting the operation theatre (OT) are, evidence-based and are available as guidelines for disinfection and sterilisation in healthcare facilities.[2] We should have policies to identify whether cleaning, disinfection, or sterilisation are indicated, primarily on the basis of the items' intended use.

## DEFINITIONS OF TERMS

When we consider anaesthetic equipment, we should know what level of disinfection or sterilisation is required for a particular item. It is therefore imperative that we learn few definitions related to this subject.

Disinfection describes a process that eliminates most disease-producing microorganisms except bacterial spores. In OT environment and for anaesthetic equipment, liquid chemicals or wet pasteurisation are commonly used for disinfection.

Sterilisation describes a process that destroys or eliminates all forms of microbial life including bacterial spores ensuring acceptable level of sterility. Steam under pressure, dry heat, ethylene oxide (ETO) gas and hydrogen peroxide gas plasma are some of the methods available for this purpose.

High Level Disinfection (HLD) is a process that destroys fungi, viruses and vegetative bacteria, but not necessarily bacterial spores. Disinfectants like aldehydes, peracetic acid, and chlorine dioxide are used for this purpose and may produce sterilisation with longer contact time.[3]

Intermediate level disinfection (ILD) eliminates all pathogenic vegetative bacteria including *Mycobacterium Tuberculosis*, fungi and most viruses except some small viruses without envelopes and bacterial spores. Alcohol, sodium hypochlorite, phenols, and iodophors are often used for ILD.

Low Level Disinfection (LLD) kills some fungi, some viruses and most vegetative bacteria except *M. Tuberculosis* and endospores. Disinfectants such as alcohol and quaternary ammonium compounds are commonly used for LLD.

As far as anaesthetic equipment is concerned, only the items used for invasive procedures actually require sterilisation whereas for most others decontamination or disinfection may suffice. For efficient disinfection or sterilisation, the contaminated anaesthetic equipment and devices must be thoroughly cleaned.

## CLEANING

The first step in decontamination is thorough cleaning of equipment which primarily is required to lower the bioburden before they are subjected to disinfection or sterilisation.[4]

Cleaning of dismantled equipment ensures there is no residue left on any of its parts by washing with cool water with an enzymatic cleaner and detergent. One should avoid water temperature to exceed 45°C to prevent coagulation of proteinaceous material as this forms protective layer for micro-organisms during disinfection or sterilisation. Care should be taken in case of articles with lumen to prevent drying of material within it. If an item is not cleaned properly, despite sterilising the item any residue left behind can hamper the smooth functioning of the device or can cause reaction in the patient with subsequent use.[2]

Washing of devices should be undertaken in a special area away from anaesthesia room and can be achieved using manual or automated methods. Developing countries still rely on purely manual reprocessing which consists of rinsing, disinfection, final rinsing, and drying. Washer disinfectors, low temperature steam or ultrasonic baths are available and when used will protect the staff from exposure to both chemicals and microorganisms.

The floor, walls, and ceiling of work place should be regularly washed and cleaned with germicide. Whenever there are fluid spills contaminated with blood, the area should be treated with tuberculocidal germicide. It would be ideal to have negative air pressure in this room and air from this area should be exhausted to outside.

Those involved in cleaning equipment should use gloves to protect themselves from injuries and infection.

Whenever feasible, complete protective clothes consisting of head gear, eyewear, mask, fluid repellent gown, and protective foot wear should be worn.[5] Thorough drying of cleaned items is a must as humidity encourages growth of certain organisms. During sterilisation, water on the wet equipment will dilute the liquid chemical agent decreasing its effectiveness and if sent for gas sterilisation, toxic ethylene glycol which is difficult to remove will be formed as ETO dissolves in water. The cleaned items should be towel dried or air dried and when available hot air ovens or air drying cabinets should be used for this purpose.

Each cleaned item must be inspected and tested for smooth functioning and disassembled again before sending for sterilisation so that all its surfaces can come in contact with the sterilant.

## STERILISATION

A particular medical device can be made sterile using physical or chemical procedures depending on its degree of contact with the patient. The chemical germicides formulated as sterilants and disinfectants should be used rationally.

### Chemical disinfection and sterilisation

This fast and technically easy to carry out method is suitable for equipment likely to get damaged by heat sterilisation. Chemical sterilisation is achieved by completely immersing equipment in disinfectant containing solution for varying period of time depending on the nature of the item to be disinfected or sterilised. The sterilant acts on the exposed surfaces of the item.

This type of sterilisation is commonly used for endoscopes. However, disinfected items should be rinsed well to clear residual chemical which can cause irritation of the tissues. The major disadvantage of this method is inability to monitor the efficacy of the procedure which is done indirectly by surveying the patient outcome after subsequent use. Many changes have taken place in the guidelines as regards the use of this method since 1981.[2]

Few of the most commonly used disinfectants are discussed below [Table 1].

#### *Glutaraldehyde*

Glutaraldehyde based solutions, in a concentration of 1 to 1.5% are widely used to achieve high level of disinfection in 20 to 30 min, however its sporicidal effect may require 3 to 10 h of exposure time.[6] It is non-corrosive and can even act in the presence of organic matter. Activated glutaraldehyde can be used as long as 14 days, whereas its phenol containing formulations have a longer shelf life of

**Table 1: Comparative properties of disinfectants**

| Disinfectant | Activity | Advantages | Disadvantages | Recommendation |
|---|---|---|---|---|
| Glutaraldehyde | Broad spectrum microbicidal and sporicidal | Good compatibility | Requires activation<br>Produces irritant fumes | For fibroscope and respiratory equipment |
| Orthophthaldehyde | Broad spectrum microbicidal and sporicidal | No activation required<br>No fumes | Costly<br>Stains equipment | For scopes<br>Alternative to glutaraldehyde |
| Iodine compounds | Microbicidal spares M Tuberculosis and spores | Rapid action | Corrosive to metals, plastic and rubber<br>Stains items | As an antiseptic |
| Alcohols | Wide microbicidal activity<br>Non sporicidal | Non staining | Flammable | Hand disinfection<br>For endoscopes |
| Phenols | Wide microbicidal activity<br>Non sporicidal | Easily available<br>Low cost | Irritant to skin<br>Depigmentation | As surface disinfectant |
| Quaternary Ammonium compounds | Microbicidal spares<br>M Tuberculosis, Not sporicidal, Not virucidal | Less irritant<br>Good detergent property | Occupational asthma | As surface disinfectant<br>For non-critical items |
| Peracetic acid | Broad spectrum microbicidal and sporicidal | No activation required<br>Wide compatibility | Expensive<br>Irritant to eye and skin | For fibroscopes |
| Chlorines | Wide microbicidal activity<br>Non sporicidal | Low cost<br>Fast acting | Corrosive to metals | Surface disinfectant<br>To clean blood and body fluid spills |
| Hydrogen Peroxide | Broad spectrum microbicidal and sporicidal | No activation required | Serious eye damage<br>Incompatible with some metals | Fogging of operating room<br>For endoscopes |
| Formaldehyde | High level disinfectant | Non corrosive | Pungent odor and irritant fumes<br>Carcinogenic | Withdrawn from use |

28 days. Alkaline glutaraldehyde (pH 7.5 to 8.5) has better microbicidal properties as compared to acid glutaraldehyde.[7] Equipment should be properly rinsed in sterile solution after removing from glutaraldehyde.

Glutaraldehyde evaporates at room temperature and those who are exposed to its fumes can get headache, eye irritation, and asthma like symptoms.[8] However, these are transitory and subside once exposure stops. One can use ductless fume hoods if available to minimise exposure to fumes. A neutraliser, either glycine or sodium bisulfite should be added to the solution during disposal to eliminate vapors produced.

### Orthophthaldehyde

In comparison with glutaraldehyde, orthophthaldehyde can achieve faster high level disinfection at a shorter time and does not require activation.[9] It has fewer side effects and can be discarded through the drain without a neutraliser. However, it is significantly more costly than glutaraldehyde.[10]

### Iodine compounds

Iodine compound or iodophor is a combination of iodine and a solubilising agent that releases free iodine in aqueous solution. Iodophors kill bacteria; do not kill spores and small hydrophilic viruses. Iodophors are mainly used as antiseptics and are no longer used as high-level disinfectants because of their inefficiency against bacterial spores, *M. tuberculosis*, and some fungi.[2] Iodine solution should be freshly prepared every day.

### Alcohols

Alcohols, water soluble compounds refer to ethyl or isopropyl alcohol. These are best used at concentration of 70 to 90% by volume. They require a wet contact for at least 5 min to disinfect. Wiping with alcohol is a low level disinfection. Ethyl alcohol is a potent bactericidal agent and inactivates viruses including hepatitis B (HBV) in 15 min and human immunodeficiency virus (HIV) in 1 min. Isopropyl alcohol is equally effective on bacteria, but lacks effectiveness against non-lipid enteroviruses. They are considered as intermediate or low level disinfectants because of their inability to inactivate bacterial spores and because of the inability of isopropyl alcohol to inactivate hydrophilic viruses. Alcohol is often used to clean external surfaces of fibreoptic cables. As alcohol evaporates rapidly, it is not necessary to rinse the items which are soaked in it.

Use of alcohol-based rub before and after every patient contact is recommended as it reduces bacteria count more rapidly compared to any antimicrobial soaps.[11,12] Alcohols being flammable must be used with care if any heat source is present in the vicinity.

### Phenols

The oldest germicides, phenolic compounds, are derived from carbolic acid and have a bad odor. They are considered to be intermediate to low level disinfectants. They are absorbed by porous materials, may be released even after thorough rinsing causing irritation of tissues.[10] 3% phenolics are ineffective against some fungi, bacterial spores, and *M. tuberculosis*. Their use is restricted to environmental surfaces and non-critical devices.

### Quaternary ammonium compounds

Quaternary ammonium compounds (quats) are in general not sporicidal, tuberculocidal, or virucidal. They are used for low level disinfection.[10] They are adequate for the use on noncritical surfaces and are not recommended for the disinfection of endoscopes. The quats commonly are used in ordinary environmental sanitation of floors, furniture, and walls. They can also be used for disinfecting medical equipment that contacts intact skin (e.g., blood pressure cuffs).

### Peracetic acid

Peracetic, or peroxyacetic acid, characterised by rapid action against all microorganisms is a high level disinfectant being sporicidal even at low temperatures. It does not produce harmful decomposition products.[3] The presence of organic matter does not reduce its efficacy. An automated machine using 35% peracetic acid along with corrosion and degradation inhibitors is available for sterilisation of medical instruments. Another formulation containing approximately 1% hydrogen peroxide and 0.08% peracetic acid can be used upto 14 days. This dilute solution does not cause skin irritation; however, it has corrosive effect on ocular tissue.[10]

### Chlorine compounds

Hypochlorites, available as liquid (e.g., sodium hypochlorite) or solid (e.g., calcium hypochlorite) are the most widely used of the chlorine disinfectants. They are fast acting broad spectrum microbicidals without any toxic residues, and are inexpensive. “The disinfectant power of all chlorine releasing compounds is expressed as available chlorine in ppm (parts per million): 1mg/litre = 1 ppm = 0.0001%. HIV virus

is inactivated at concentration as low as 50 ppm and HBV at 500 ppm in 10 min. It is tuberculocidal at no less than 1000 ppm but does not destroy spores."[13] Dilution of 1 in 10 is recommended for the use in case of blood spills. Sodium hypochlorite at the concentration used in household bleach can produce ocular irritation or oropharyngeal, esophageal, and gastric burns. Another disadvantage of hypochlorites is corrosiveness to metals in high concentrations. Hypochlorites are widely used in hospital settings mainly as environmental disinfectant.[2]

### *Hydrogen peroxide*

Hydrogen peroxide has bactericidal, virucidal, sporicidal, and fungicidal properties. Although most microbial forms are killed in less than 1 h, it takes hours to eliminate spores. It should be stored in a cool place and protected from the light.[2] High level disinfection can be achieved in 30 min using a 7.5% solution, whereas 3% solution is a low level disinfectant that can be used for inanimate surfaces. Higher concentrations are corrosive to metals. It has been currently used with nebulisation system for decontamination of operating room.[14]

### *Formaldehyde*

Formaldehyde, in its liquid and gaseous states was used as a disinfectant as well as sterilant. However, its disagreeable odor and irritant fumes even at very low levels limited its use. Despite being a high level disinfectant, it is no longer used in most hospitals because of its role as a suspected human carcinogen. Water-based solution of formaldehyde is available and is called formalin.[2]

A number of environment friendly products like ammonia, baking soda, borax, and vinegar were evaluated as alternatives for disinfectants but were found to be unacceptable.[14]

### *Ozone*

This new sterilisation process was cleared by Food and Drug Administration (FDA) in August 2003 for processing reusable medical devices.[15] Equipment needing low temperature for sterilisation can be sterilised using ozone. The sterilant is created internally by the steriliser from oxygen, steam-quality water, and electricity. It is converted back to oxygen and water vapor at the end of the cycle. The treated objects are dry. In this less expensive and environment friendly process, there are no toxic emissions.

## PASTEURISATION

Semicritical medical equipment for respiratory therapy and anaesthesia (breathing tubes, face masks, tracheal tubes, stylets, bite blocks etc.) can be sterilised by pasteurisation, a process of hot water disinfection (70°C for 30 min) which is accomplished through the use of automated pasteurisers or washer disinfectors.[16] This method is less damaging to equipment than autoclaving, reliable, nontoxic, and less expensive. Following the pasteurising cycle, medical equipment should be thoroughly dried in a drying cabinet that is preferably equipped with a High-efficiency particulate air (HEPA) filter.[12] However a pre-filter or fine filter can be used as an alternative.

## AUTOCLAVING

Steam sterilisation is done by moist steam in the form of saturated steam under pressure. It is inexpensive and nontoxic method of sterilisation for all items except those which are moisture or heat sensitive. Four parameters of importance in steam sterilisation are steam, pressure, temperature, and time. Increasing the temperature of saturated steam reduces the time needed to bring about sterilisation. The minimum time for sterilisation at 121°C is 15 min and 4 min at 132°C.[2]

The items which are to be sterilised should be packaged in material easily penetrated by steam after thorough cleaning. When loading the autoclave one should take care not to crowd or stuff the items in the chamber so that all the surfaces get adequately exposed to the steam. Among many sterilisers available pre-vacuum sterilisers are preferred.

Sterilisation process can be monitored using mechanical, chemical, or biological indicators. As per U.S. guidelines each pack that undergoes sterilisation cycle should be monitored with chemical indicator (dots, labels, strips or ribbons) which should be placed at a location that is most difficult to sterilise. Biological indicators which are standardised preparations of spores also need to be placed similarly and used at least once a week as well as after major repairs.[17] Though most authorities recognise biological indicators as being closest to the ideal ones to monitor the lethality of a particular sterilisation process; the cost and the time required to detect viable spores do not permit its use routinely.

## ETHYLENE OXIDE

Anaesthesia equipment that cannot be steam sterilised is best sterilised by ETO. ETO is a colorless poisonous gas that is flammable and explosive. Effectiveness of ETO sterilisation is influenced by four essential parameters: Gas concentration, temperature, humidity, and exposure time. The total cycle time is 3 to 6 h, even 12 h at times. The exposure time can be decreased by increasing the temperature.[2]

The cleaned items should be dried in ambient air or towel dried, placed in non ETO absorbing wire baskets or containers, and loosely loaded to allow the gas to reach all the items. Microbes become more susceptible for destruction by ETO in the presence of humidity. In recent times software and microprocessors are integrated so as to have proper control and monitoring of sterilisation. Monitoring should be done by physical and chemical indicators; biological indicators should be used at least once a week.

When ETO comes in contact with the items it is absorbed by some of the items in varying amount. 8 to 12 hours of mechanical aeration at 50 to 60°C will degas the toxic ETO residue from exposed articles. The main disadvantages associated with ETO are the lengthy cycle time, the cost, and exposure hazards.[17] Symptoms associated with ETO exposure are eye pain, sore throat, headache, nausea, vomiting, dyspnea, dermal irritation or burns. It has also been demonstrated to be carcinogenic. One has to follow proper recommendations to reduce exposure.[14,18]

## GAMMA RADIATION

Requirement of protected special environment and the cost of the equipment are the factors that make this technique impractical for everyday use.[18] However, this is a non-polluting, environment friendly process that does not leave any harmful residue on the exposed items. In this method, items are exposed to gamma rays from Cobalt-60 source at normally used dose level. The sterility of the items is retained indefinitely, as long as the packaging is intact. Sterilisation of equipment of any shape can be achieved due to the high penetration ability of gamma rays. Thermo labile items can also be sterilised by this method.

## GAS PLASMA STERILISATION

The factors that limit the use of this procedure are inadequate penetration, inability to sterilise certain equipment and the non-availability in most centers. This system uses a completely new technology applying radio frequency emissions to the hydrogen peroxide substrate. Gas plasmas have been referred to as the fourth state of matter. A gas plasma is created by the electric field. To facilitate maximum dispersion of the hydrogen peroxide vapor around the equipment, a deep vacuum is generated which also helps to avoid using excessive heat. It does not produce any harmful substances; water and oxygen being the end products.[2,18] This method, though effectively used to sterilise glass items, plastics, polyvinyl chloride (PVC), metal items, electric and fiber optic cables as well as rigid endoscopes, is unsuitable for cellulosic material like linen, cotton, and paper. The cycle does not need aeration and equipment can be used immediately.[19] It is less expensive as compared to ETO, but needs special compatible supplies like wraps and trays. No toxic residues remain on the sterilised items after completion of gas plasma sterilisation. The heat and moisture sensitive instruments can be sterilised by this process in about one hour.

Based on the degree of risk of infection likely to be transmitted one can decide if anaesthetic equipment needs to be sterilised or just disinfected.

## MODIFIED CLASSIFICATION SCHEME FOR INSTRUMENTS, EQUIPMENT AND MEDICALLY RELATED SURFACES

In 1968, Spaulding devised a clear and logical classification scheme to identify how medical equipment should be disinfected and sterilised based on the degree of risk of infection. Many countries still use this scheme in their guidelines for disinfection and sterilisation. The following is a modified expanded classification.

### Critical items

The objects introduced in the vascular system or any sterile body cavity, pose a high risk of infection if contaminated and are included in this category. This category includes regional and vascular needles as well as catheters and should be sterilised before reuse.[20]

### Semi-critical items

The items included in this category are those that come in contact with mucous membranes and non-intact skin but do not penetrate either and do not cross the blood barrier.[12] Laryngoscopes, laryngoscope

blades, endoscopes, endotracheal tubes, esophageal stethoscopes, resuscitation bags, face masks, oral and nasal airways, connectors etc., come in this category. Since intact mucous membranes are susceptible to bacteria, bacilli and viruses, these items should be sterile when possible. However, high-level disinfection is acceptable. These items should be properly stored to prevent recontamination.

### Non-critical items

All the items like blood pressure cuffs, arm boards, stethoscopes, pulse oximeter sensors, head straps, electrocardiogram electrodes, all associated cables etc., that come into contact with healthy skin are included in this category. Skin being an effective barrier to most microorganisms, these items should be cleaned and subjected to intermediate or low-level disinfection.[2]

### Environmental surfaces

This category is specially added to include items or surfaces which are likely to harbor organisms transferable by those working in the OT environs. It includes surfaces of medical equipment, laryngoscope handles, infusion pumps, equipment carts, anaesthesia carts, monitor knobs, blood warmers, monitoring cables, and other equipment not in direct patient contact. Intermediate or low level disinfection is the acceptable mode of decontamination for this category.

Each institution should choose a disinfectant that has been approved for use in its setting and follow manufacturer's recommendations regarding its use, exposure time, disposal etc., There should be protocol established for frequency of disinfection and to monitor efficacy and compliance.[17] There should be training, and continuing education of all post-graduate students and personnel involved in this.

## INDIVIDUAL ITEM CONSIDERATION

Operating theatres and associated areas like the one for sterilisation of equipment should be designed and maintained to the standards defined by the set guidelines and the protocols followed to minimise HCAIs.[21]

All patients harbor potential pathogens in their respiratory tract, hence appropriate measures are a must for control of cross infection between patients and between patient and anaesthetist.

Anaesthesia machine and equipment are potential vectors for transmission of nosocomial infection via anaesthetist's hand.[22] Hence, all the surfaces of the anaesthesia machine particularly knobs and the monitor should be cleaned with an appropriate intermediate or low level disinfectant on daily basis usually at the end of working day or immediately if contaminated. Before the next case, items to be used should be placed on clean surfaces.

The patient's respiratory system is in direct communication with the machine via breathing circuit along with the ventilator and $CO_2$ absorber. The breathing circuits are long, corrugated, and difficult to clean. They can be reused provided a filter is placed between the endotracheal tube and the Y piece after sterilising or subjecting to high level disinfection.[23] Ultrasonic cleaning if available is a good option. Filters are more effective in preventing bacterial transmission than viral. Bellows, unidirectional valves and carbon dioxide absorbers however, should be cleaned and disinfected periodically.[24] The canister should be cleaned every time the absorbent is changed. Canister should be disinfected as per instructions provided by the manufacturer.

After each use, contaminated reusable face masks should be soaked in water with detergent, cleaned, thoroughly rinsed, dried and then subjected to sterilisation or high level disinfection taking care not to damage pneumatic cushion.

Endotracheal tubes, connectors, and suction catheters are commonly supplied as sterile and for single patient use. Reusable endotracheal tubes, connectors, suction catheters, and airways should be cleaned after use and sterilised. Suction catheters if properly flushed and stored may be used for up to 24 h on the same patient.

Supraglottic airways, designed for repeated use should be rinsed after removal, soaked in enzymatic detergent and then autoclaved. These should be sterilised no more often than the manufacturer's recommendations. One should not reuse supraglottic airway that is used for tonsillectomy or adenoidectomy.

Reusable gum elastic bougies should be cleaned and subjected to high-level disinfection or sterilisation.

Prevalent practices for decontamination and disinfection of laryngoscope blades between patients are frequently ineffective, leaving residual contaminants around light sources. The blade should be immediately cleaned with enzymatic detergent and then should ideally undergo high level disinfection

or sterilisation. Numerous studies have demonstrated that contamination of laryngoscope blades and handles is common.[25-27] The fact that knurled handles of laryngoscopes also get contaminated is often overlooked by most of us. Handles should be washed, disinfected and if suitable, sterilised after every use. Anaesthetists should always wear gloves during intubation and prevent contamination of surfaces and drapes by segregating contaminated items.

Fibreoptic bronchoscopes and laryngoscopes should be cleaned, rinsed with water and subjected to high level disinfection. These can be best decontaminated in an automated system. Guidelines for care of these instruments if available should be followed.

Transeosophageal echocardiography probes should be cleaned carefully, disinfected, and sterilised in an automated reprocessor if available.

There should be protocols for periodic cleaning and disinfection that are in accordance with manufacturer's recommendations for all the equipment.[28]

## SPECIFIC DISEASE STATES

One should place a bacterial filter, preferably a high-efficiency particulate air (HEPA) filter between the anaesthesia circuit and the patient's airway if patient with confirmed or suspected tuberculosis (TB) is to be anaesthetised. As far as possible elective surgery on a patient with TB should be delayed until the patient is no longer infectious and if unavoidable, single-patient use items should be used.[29] Reusable items that are used for these patients should be subjected to sterilisation or high level disinfection.

Hepatitis B virus (HBV), Hepatitis C virus (HCV), and Human Immunodeficiency virus (HIV) are transmitted through blood and other body fluids to health care providers *via* needle stick injuries, contact with mucous membrane or broken skin. One must take all the standard precautions to prevent needle prick injuries as well as contact with contaminated items or body fluids. Hypochlorite solution should be used as surface disinfectant for blood contaminated spills. The Centers for Disease Control and Prevention (CDC) recommends sterilisation or high-level disinfection of HBV, HCV, or HIV contaminated devices.[30] HCV infection is the most dreaded of the lot as it is more common in us than the general population.[31-33]

Creutzfeldt-Jakob disease (CJD) is caused by infection with a proteinaceous infectious agent (prion) that is resistant to most of the usual methods of reprocessing and decontamination. Hence, devices contaminated with high-risk tissue (i.e., brain, spinal cord, or eye tissue) require special sterilisation using sodium hydroxide followed by autoclaving. Ideally, prion-contaminated medical devices should be discarded.[34,35] Care should be taken to minimise environmental contamination.

## SELF PROTECTION OF ANAESTHESIOLOGIST

It needs to be emphasised that in the anaesthesia setting, hand hygiene is unacceptably low. Therefore, all anaesthetists must practice good hand hygiene as a part of infection control strategy during routine administration of anaesthesia. Waterless, alcohol-based formulations containing chlorhexidine are found to be very effective in reducing bacterial count.[23]

In a country like ours, anaesthetists are exposed to numerous pathogens either airborne example H1N1 virus (swine flu), *M. Tuberculosis* or blood borne example HCV, HIV, HBV. Anaesthetists should use gloves routinely as it is known to help prevent 98% of their contact with patient blood. Fluid-resistant masks (as a protection against infected droplet and airborne infection) and gowns must be used routinely when any contact with blood or body fluids is anticipated. One must use sterile gloves for invasive procedures; non-sterile examination gloves may be worn for all other activities to prevent exposure to microorganisms. Meticulous aseptic technique should always be followed for conduct of neuraxial anaesthesia. Before touching non-contaminated items and before taking the next case, gloves and gowns must be removed. Special footwear should be worn in the operating rooms and cleaned after every use.

One should prevent accidental injuries with used sharps and inoculation with infected blood by avoiding recapping of needles and these must be discarded into puncture resistant sharps container at the point of use.[1,29]

All anaesthetists should receive the HBV immunisation. However, safe handling of sharps and safe injection practices using universal precautions to prevent exposure is the only preventive measure against HCV. As regards to HIV, risk of transmission of infection is estimated at just 0.3 percent after percutaneous exposure.

## SUMMARY

Anaesthetists are involved in the care of patients who harbor potentially pathogenic organisms. In the anaesthesia settings requiring the expeditious performance of multiple and complex tasks and procedures hand hygiene, decontamination, and sterilisation of equipment is often overlooked despite the adequate knowledge of nosocomial infection.

Therefore, there is a need to have national guidelines for disinfection and sterilisation of equipment in operating room environment as well as in intensive care units. The recommendations should be strictly adhered to and monitoring of sterilisation procedures done by anaesthetists along with the hospital authorities, simultaneously protecting themselves by ensuring compliance.

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Announcement

## FAMILY BENEVOLENT FUND OF ISA

Family Benevolent Fund (FBF) is one of the welfare programs of Indian Society of Anaesthesiologists (ISA). It is registered under the Societies Registration Act. Please visit the website www.isafbf.com. Membership is limited only to ISA members and President and Secretary are in the executive body of FBF. ISA member can be a member of FBF by paying the Membership fee depending on the age of members.

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| Up to 35 years | - | 3,000/- |
| Up to 40 years | - | 4,500/- |
| Up to 45 years | - | 6,000/- |
| Up to 50 years | - | 8,000/- |
| Up to 55 years | - | 10,000/- |
| Up to 60 years | - | 15,000/- |

Age proof is required, the membership fee increased from April 2010. Immediate settlement of Fraternity amount to the nominee, in case of death of a member. So far 14 members were supported with an amount of Rs. 18 Lakhs.

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