Chapter 14 Decontamination

Decontamination is a term used to describe a process or treatment that renders a medical device, instrument or environmental surface safe to handle. A decontamination procedure can range from sterilization to simple cleaning with soap and water. Sterilization, disinfection and antisepsis are all forms of decontamination.

Sterilization is the use of a physical or chemical procedure to destroy all microbial life, including highly resistant bacterial endospores.

Disinfection eliminates virtually all pathogenic non-sporeforming microorganisms but not necessarily all microbial forms on inanimate objects (e.g., work surfaces and equipment). Effectiveness is influenced by the kinds and numbers of organisms, the amount of organic matter, the object to be disinfected and chemical exposure time, temperature and concentration.

Antisepsis is the application of a liquid antimicrobial chemical to skin or living tissue to inhibit or destroy microorganisms. It includes swabbing an injection site on a person or animal and hand washing with germicidal solutions. Manufacturer's recommendations for appropriate use of germicides should always be followed.

General Procedures

A. All infectious materials and all contaminated equipment or apparatus should be decontaminated before being washed, stored or discarded. Autoclaving is the preferred method. Each individual working with biohazardous material should be responsible for its

proper handling

B. Biohazardous materials should not be placed in autoclaves overnight in anticipation of autoclaving the next day.

C. Autoclaves should not be operated by untrained personnel.

D. Special precautions should be taken to prevent accidental removal of material from an autoclave before it has been sterilized, or simultaneous opening of both doors on a double door autoclave.

E. Dry hypochlorites, or any other strong oxidizing material, must not be autoclaved with organic materials such as paper, cloth or oil:

Oxidizer + Organic Material + Heat = possible explosion.

F. Liquid, gas or vapor disinfectants, dry heat, ultraviolet or ionizing radiation appropriate for some applications are not universal and may not substitute for autoclaving or incineration before disposal in all situations.

G. Although some chemicals may be utilized as either a disinfectant or an antiseptic, adequacy for one application does not guarantee adequacy for the other.

Methods

There are four main categories of physical and chemical means of decontamination: (1) heat; (2) liquid disinfection; (3) vapors and gases; and (4) radiation. Each category is discussed briefly below.

1. Heat

Wet Heat

Wet heat is the most dependable method of sterilization. Autoclaving (saturated steam under pressure of approximately 15 psi to achieve a chamber temperature of at least 250° F (121° C) for a prescribed time) is the most convenient method of rapidly achieving destruction of all forms of microbial life. In addition to proper temperature and time, prevention of entrapment of air is critical to achieving sterility. Material to be sterilized must come in contact with steam and heat. A chemical indicator (e.g., autoclave tape) must be used with each load placed in the autoclave. The use of autoclave tape alone is not an adequate monitor of efficacy. Autoclave sterility monitoring must be conducted at least

monthly using appropriate biological indicators (Bacillus stearothermophilus spore strips) placed at locations throughout the autoclave. The spores, which can survive 250° F for 5 minutes but are killed at 250° F in 13 minutes, are more resistant to heat than most, thereby providing an adequate safety margin when validating decontamination procedures. Each type of container employed should be spore tested because efficacy varies with the load, fluid volume, etc.

Dry Heat

Dry heat is less efficient than wet heat and requires longer times and/or higher temperatures to achieve sterilization. It is suitable for the destruction of viable organisms on impermeable non-organic surfaces such as glass, but it is not reliable in the presence of shallow layers of organic or inorganic materials which may act as insulation. Sterilization of glassware by dry heat can usually be accomplished at 160-170° C for 2-4 hours. Dry heat sterilizers should be monitored on a regular basis using appropriate biological indicators [spore strips].

Incineration

Incineration is another effective means of decontamination by heat. As a disposal method incineration has the advantage of reducing the volume of the material prior to its final disposal.

2. Liquid Disinfection

The most practical use of liquid disinfectants is for surface decontamination and, when used in sufficient concentration, as a decontaminate for liquid wastes prior to final disposal in the sanitary sewer. If liquid disinfectants are used, they must have been shown to be effective against the target organism(s) present.

Liquid disinfectants are available under a wide variety of trade names. In general, these can be classified as: halogens, acids, alkalis, heavy metal salts, quaternary ammonium compounds, phenolic compounds, aldehydes, ketones, alcohols and amines. The more active a compound is, the more likely it is to have undesirable characteristics such as corrosivity. No liquid disinfectant is equally useful or effective under all conditions and for all viable agents.

Consult the list of recommended disinfectants in Appendix 8.

3. Vapors & Gases

Vapors and gases are primarily used to decontaminate biological safety cabinets and associated systems; bulky or stationary equipment not suited to liquid disinfectants; instruments or optics which might be

damaged by other decontamination methods; and rooms, buildings and associated air-handling systems. Agents included in this category are glutaraldehyde and formaldehyde vapor, ethylene oxide gas, peracetic acid and hydrogen peroxide vapor. When used in closed systems and under controlled conditions of temperature and humidity, excellent disinfection can be obtained. Great care must be taken during use because of the hazardous nature of many of these compounds. Contact RM&S for monitoring requirements if these compounds are to be used.

4. Radiation

Although ionizing radiation will destroy microorganisms, it is not a practical tool for laboratory use. Nonionizing radiation in the form of ultraviolet radiation (UV) is used for inactivating viruses, bacteria and fungi. It will destroy airborne microorganisms and inactivate micro-organisms on exposed surfaces or in the presence of products of unstable composition that cannot be treated by conventional means. Because of the low penetrating power of UV, microorganisms inside dust or soil particles will be protected from its action, limiting its usefulness. UV is used in air locks, animal holding areas, ventilated cabinets and laboratory rooms to reduce levels of airborne microorganisms and maintain good air hygiene. UV can cause burns to the eyes and skin of people exposed for even a short period of time. Therefore, proper shielding should be maintained when it is in use. UV lamps that are used for space decontamination should be interlocked with the general room or cabinet illumination, so that turning on the lights extinguishes the UV.

UV lamps are not recommended for decontamination unless they are properly maintained. Due to the fact that UV lamp intensity or destructive power decreases with time, it should be checked monthly with a UV meter or monitoring strip. Frequent cleaning every few weeks is necessary to prevent accumulation of dust and dirt on the lamp which also reduces its effectiveness drastically. If UV must be used, it should be used when areas are not occupied.