MRAD 240: Specialized Imaging 1

Medical and Surgical Asepsis & Types of Equipment Sterilization Methods

MRT Program

Objectives

- Differentiate between medical and surgical asepsis and their application.
- Explain the principles of surgical asepsis
- Compare the various methods of equipment sterilization

Medical Asepsis

- Medical asepsis is the term used for practices that are meant to confine and limit the growth and transmission of microorganisms.

- Reducing the probability that a susceptible person will become infected by these microorganisms.

- The process of reducing the total number of organisms is called **microbial dilution**.

Microbial Dilution Levels

The 3 levels are:

Simple cleanliness

- Proper cleaning, dusting, linen handling and **hand hygiene**.

Disinfection

- The destruction of pathogens by using chemical materials.

Sterilization

- The third level is also called **surgical asepsis**. This involves treating items with heat, gas or chemicals to make them completely germ-free.

Nosocomial Infections

What is a nosocomial infection?

- Hospital Acquired Infection (HAI)

In the United States it is estimated that approximately 722,000 patients will get an HAI each year

- Clostridium difficile (C.diff), Methicillin-Resistant Staphlococcus Aureus (MRSA), Vancomycin-Resistant Enterococcus (VRE)

75,000 will die as a result

Hand Hygiene

- In 2002 the CDC revised their hand hygiene guidelines to include the use of an alcohol-based hand rub
- They are faster to use than handwashing, more accessible than a sink, as dispensers can be placed throughout the facility
- More effective than soap and water in reducing the incidence of nosocomial infections
- Alcohol-based hand rubs DO NOT replace handwashing with soap and water when hands are visibly soiled or contaminated with blood or other secretions



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Antiseptic vs. Disinfectant

- **Antiseptic** - a substance that tends to inhibit the growth and reproduction of microorganisms, usually on living tissue.
  - Skin prep before injections
  - Pre-surgery skin prep
  - Mouthwash

- **Disinfectant** - liquid chemical applied to objects to eliminate many or all pathogenic microorganisms.

Disinfection

- What is a **fomite**?
- There are items that cannot be sterilized, therefore must be disinfected.
- Used on objects such as x-ray tables, floors, walls, and equipment (x-ray mobiles, stretchers, wheelchairs, etc.)

Surgical Asepsis

- Surgical asepsis requires the complete destruction of all organisms and spores from equipment used to perform invasive patient procedures.

- It is also the process of creating and maintaining and area that is completely free of pathogens

Radiology procedures that require surgical asepsis and sterile equipment include:

- IV insertions
- Femoral Catheterization
- Skeletal injections
- Angiography
- Biopsies
- And more.....

Methods of Sterilization

- Five methods are used:
  - Chemical
  - Dry heat
  - Conventional gas
  - Gas plasma technology
  - Autoclaving (steam)

Chemical Sterilization

- Involves the immersion and soaking of objects in a bath of germicidal solution followed by a sterile water rinse.

- Effectiveness of this process depends on solution strength and temperature, and the immersion time of up to 6-10hrs.

  - Used if objects can't go into autoclave or gas
  - Effective at destroying microorganisms but will not kill spores.

Dry Heat (hot air)

- Works by conduction of heat into the item
- Required to sterilize some sharp instruments, certain powders and greasy substances
- Time varies from 1-6 hours at a temperature range of 165-170 degrees Celsius or 329-338 degrees Fahrenheit.
- Not suitable for plastic or rubber items

Conventional Gas

- Used for items that would be damaged by high temperatures are usually sterilized with a mixture of gases (freon & ethylene oxide).
- Advantage
  - Used primarily for electrical, plastic, rubber items, and optical ware.
  - Used for items from isolation rooms
    - Telephones, stethoscopes, blood pressure cuffs etc.
- Disadvantages
  - Gases are poisonous and must be dissipated by means of aeration in a controlled environment.
  - Aeration is a slow process so items need to be sent for sterilization well in advance of the time they will be needed.

Gas Plasma Technology

- Items are cleaned, wrapped and placed in a compact mobile unit where low-temperature hydrogen peroxide gas plasma diffuses through the wrapped instruments.
- Gas plasma is formed within the sterilization unit when vaporized hydrogen peroxide is subjected to radio-frequency energy, changing the vapor into a low-temperature plasma.
- Plasma then breaks down into free radicals.
  - Atoms with unpaired electrons in outer shells
- Free radicals destroy the microorganisms by stripping their atoms of electrons.
- Remaining free radicals are converted into nontoxic byproducts.
  - Water and oxygen
- Used to sterilize endoscopes, fiber optic devices, microsurgical instruments, and powered instruments.

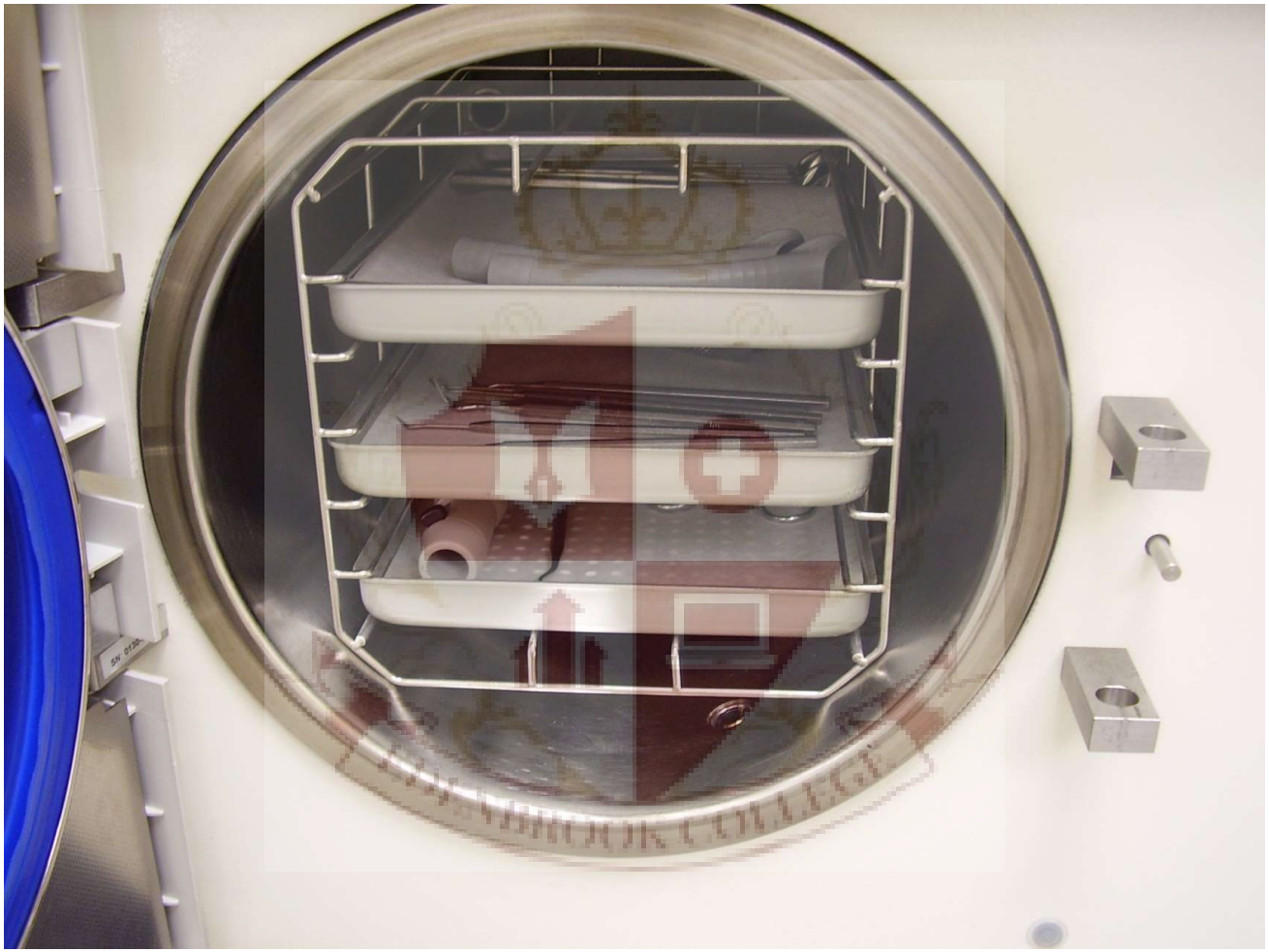
Gas Plasma Technology

- Advantage
  - Safer method of sterilizing heat and moisture safe items. No toxic fumes, byproducts or residues; and no handling of chemicals.
  - Uses very low heat and moisture.
  - Effectively kills both microorganisms and spores.

- Disadvantage
  - Cannot sterilize instruments that have long, narrow lumina. It can not used for powders, liquids or any cellulose materials, such as paper, cotton, linen, or muslin.

Autoclaving (steam)

- Steam sterilization under pressure.
- Advantages
  - Most commonly used sterilization method.
  - Cheap, quick, and most convenient for items that can withstand heat and moisture.
    - High temperatures can be achieved under pressure making this an extremely effective method.
    - Temp range from 121-135 degrees Celsius or 250-275 degrees Fahrenheit.





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Sterile Indicators

- Indicators are placed inside and outside of each pack to be sterilized. This indicates that sterilization has penetrated all surfaces.

- When the indicator changes colour, it is proof that the contents of the pack have been exposed to the sterilization method sufficiently to change the colour of the indicator.

- Several materials can be used for packaging items that are to be sterilized.
  - Cloth, nonwoven fabrics, paper and plastic.

Biological Indicators

- Ensures quality control and proper function
- Ensure all microbial life is destroyed
- Small capsule containing bacterium placed within each load of supplies
- Once autoclaved, capsule is incubated to ensure that no living bacteria are left to culture.

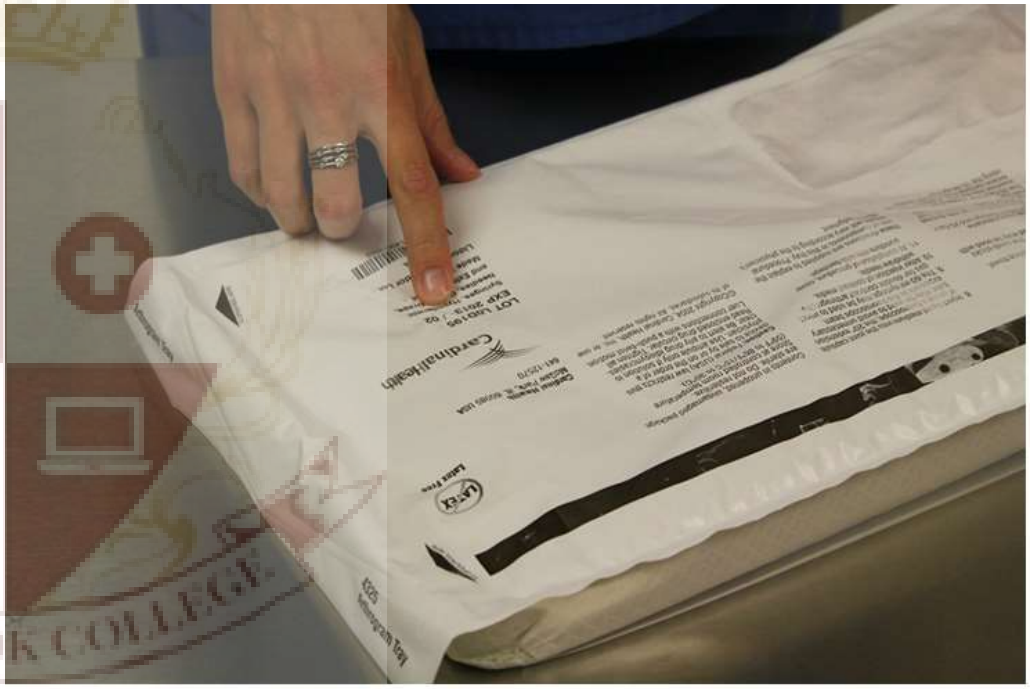
Sterile Supplies

- Items packaged must be covered completely by the wrapper and securely fastened with tape or a heat seal that can not be reused.
- Contents must be identifiable, and evidence of exposure to the sterilization agents must be present.
- Items must be wrapped to allow opening and removing them without contamination.

Sterile Supplies



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Storage of Sterile Supplies

- Sterile items are to be stored in the same place, separate from nonsterile items.
- Area must be clean, dust free, vermin free and draft free.
- Items that have been sterilized in the hospital and stored in a closed cupboard are considered sterile for 30 days.
- On an open shelf they are considered sterile for 21 days.
- Items sealed in plastic bags immediately after sterilization are considered sterile for 6-12 months.
- Commercially packaged sterilization items are considered sterile until the seal is broken, the package has been damaged or until the expiration date has passed.

Sterile Packages Criteria

- Packages are considered sterile if they meet the following criteria:
  - They are clean, dry and unopened
  - Their expiration date has not been exceeded.
  - Their sterility indicators have changed to a predetermined color, confirming sterilization.



Sterile Conscience

Refers to an awareness of sterile technique and the responsibility for telling the person in charge whenever you contaminate a field or observe the contamination by someone else.