Third Edition



# Operating Room Technique & Anesthesia for General Nursing Course

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JAYPEE

# Contents


1. **Operating Room: Physical Set-up, OR Team and Functions of Nurses** ..... *1*

2. **Operating Room: Procedure According to the Work Record of the Student** ..... *8*

3. **Operating Table and Positions** ..... *13*

4. **Sterilization and Disinfection** ..... *18*

5. **Common Technical Terms** ..... *34*

6. **Role of the Nurses in Major Operations** ..... *42*

7. **Prevention of Contamination in Operation Room** ..... *55*

8. **Setting up of Instruments** ..... *63*

9. **Instruments: Specifications and their Uses** ..... *91*

10. **Anesthesia** ..... *164*

*Index* ..... *197*

# 4 Sterilization and Disinfection

## STERILIZATION

Complete destruction of micro-organisms is called sterilization. A material is said to be sterile when it is free from all micro-organisms. There is no midway between sterile and unsterile. Complete sterilization of instrument and equipment is used in the surgical practice. It is effected by exposure to high temperature for sufficient length of time to kill all living organisms and their spores. Heat is the most efficient agent whenever its use is possible in the form of high pressure steam sterilizers (autoclaves). Hot air ovens and boiling water sterilizers are also in common use and with proper care and precautions, it can be regarded as reasonably safe for the sterilization of metal equipment such as instruments and bowls.

Disinfection by chemical agents is used for materials and equipment which cannot stand exposure to heat such as endoscopes, bronchoscopes, etc. Chemical disinfectants are also used for disinfection of the skin and the irrigation of body cavities.

All methods of sterilization begin with thorough cleansing of the equipment. Cleanliness is the basis of sterilization. So irrespective of the method of sterilization and disinfection, the materials should be absolutely clean.

### Sterilization by Heat

1. Autoclaving (moist heat) or steam under pressure.
2. Dry heat.
3. Boiling.

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### Autoclaving

Since moist heat is the most effective means of sterilization, it is used whenever possible. Steam under pressure which is an autoclave is recognized as the best method of sterilization where the material will stand this treatment. Steam kills organisms by coagulations of the cell protein; provided that certain factors are present; the steam must be under pressure, dry and saturated. With these conditions fulfilled, the steam will condense when it meets the cooler surface of the article in the autoclave and the latent heat released on condensation will penetrate and kill the organisms. Autoclaving at a pressure of 20 Ibs per square inch and a temperature of 126°C (260°F) for twenty minutes is an efficient method of sterilizing fabrics such as gowns, towels and dressings and also instruments. The latest type of high speed, high vacuum autoclaves operating at higher temperatures reduce the time needed for sterilization. Rubber is readily damaged by exposure to high temperatures for long periods, such as are necessitated during the process of creating a vacuum and subsequent drying process in all but the most modern autoclaves. Rubber gloves are usually autoclaved at a lower temperature, e.g. 121°C (250°F), for ten minutes. The gloves should be very loosely packed, in order to ensure full penetration of the steam.

It is important to remember that any sterilization by autoclaving is reliable only if the autoclave is correctly installed, efficiently operated and the materials packed loosely so that all parts are accessible to the steam. The operation of the autoclave is a serious responsibility and should be entrusted only to one who understands its working. Tests of efficiency, in addition to checking the accuracy of the pressure gauges and temperature readings, should be carried out at regular intervals; these include indicators, control tubes and bacteriological tests.

### Signaloc

Signaloc is an autoclave table to check the sterilization of materials, 2.5 × 10 cm, tapes are available in cardboard packets. If the sterilization is cent percent, color change is indicated on the tabel.

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So before keeping the things inside the autoclave, a strip of signaloc is pasted on the packet. Lengthwise half of the tape is slightly green originally which is pasted on the packet. If the sterilization is perfect, green color change into dark black in color. If no color change, it means sterilization is not complete and autoclave is not working properly.

### *Dry Heat*

Dry heat kills micro-organisms by oxidation provided that the articles to be sterilized are exposed to a temperature of 160°C (320°F) for one hour, all organisms and their spores will be destroyed. This method is suitable for all types of glass ware including glass syringe (but not glass and metal syringes where the solder will melt in high temperature in the oven) and some instruments such as knife, blades and skin-grafting knives.

### *Boiling*

All pathogenic organisms in the vegetative form and many spore forms are killed by five minutes immersion in boiling water, although there are resistant spores which will withstand long periods of boiling. If the water is made alkaline its lethal effect is increased: therefore sodium carbonate is added to the water in which instruments are boiled if this method of preparation is used. 2% solution of sodium carbonate also retards rusting and reduces the blunting of sharp instruments during boiling. In order that this method of sterilization may be as efficient as possible the following points should be carefully observed.

1. The water must be boiling for the full five minutes. The addition of a large number of cold metal instruments to the water reduce the boiling point.
   The water must be boiling again before the five minutes time is begun.
2. All instruments in the sterilizer must be completely immersed in the water.
3. After use all instruments must be boiled for five minutes and carefully dried before being put away.

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4. Instruments when not in use must be stored in a dustfree and dust proof instrument cupboard.
5. The material to be sterilized must be either a good conductor of heart, such as metal, or so constructed that all surfaces are easily reached by the boiling water. Material such as thread wound on reels requires a longer period of boiling because the heat does not penetrate at once to the inner layers.

In cases where contamination with spore-forming organisms, such as anthrax or tetanus organisms are suspected, all instruments and other articles which have been used should either be autoclaved or subjected to prolonged and repeated boiling. The articles should first be boiled for one hour and after a period allowed for cooling: the boiling should be repeated for a further hour. Any spores which have escaped destruction will revert to the vegetative form during the interval and are then killed during the second boiling. This method is called *intermittent sterilization.*

### Disinfection by Chemicals

These methods must be used only for the preparation of non-boilable surfaces. Disinfection by chemicals is effective if and only if, the articles are thoroughly cleaned and free of debris, blood, pus, oil and grease. The presence of organic matter greatly diminish the efficiency of the chemical and in some cases may inhibit its action altogether. Oil and grease may be removed by washing the articles in a detergent agent such as 1 percent cetrimide. Penetration of the chemical into the joint of the scissors and forceps may be slow and this sort of immersion will be effective only if the disinfectant solution has rapid access to all surfaces. Whenever, possible instruments should be taken to pieces for chemical sterilization. Antiseptic solutions are also used in the preparation of the patient's skin for operation and for the irrigation of body cavities.

### Preparation and Sterilization

1. *Rubber Goods*

Rubber tubing, drainage tubes, rubber catheters and tracheal tubes are sterilized by boiling for five minutes or by autoclaving. Care

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should be taken to keep the material immersed during boiling and it is necessary to expel air bubbles first and in some cases to weigh the rubber articles in order to keep them immersed. Put a piece of wet cotton over the rubber tube so that the weight of the wet cotton will keep the tube immersed under water while boiling.

After use careful washing is necessary, especially if the tubing is stained with blood, as these stains are difficult or impossible to remove after boiling. The lumen of tubing is best cleaned by attaching the tubing to a pressure nozzle of a cold water supply and forcing water through it. In the case of suction tubing, this must be done very thoroughly. Rolling the tubing under the hand on a board will help to loosen any particles adhering to the interior of the tubing. The tubing is then well washed in warm soapy water, rinsed, boiled for five minutes and hung up to dry. Rubber catheters are cleaned in the same way. Passing of stillet or thin wire through the lumen of the rubber tube or catheters is of great use to clean the inside and to remove block.

The rubber face pieces of the anesthetic apparatus and rubber airway are washed in warm, soapy water after use and boiled for five minutes. The spigot in the cushion must be removed before the face piece is boiled. Chemical disinfectants should not be used because instances have occurred of irritation of the skin of the patients face due to the chemical absorbed by the rubber during immersion.

### 2. *Gloves*

Rubber gloves are sterilized by autoclaving at a pressure of 15 lbs, for ten minutes. Talcum powder which was once widely used as a glove powder, is replaced by a prepared corn starch powder. It has been found that grains of talc: implanted in operation wounds from gloves or mackintoshes can produce granulomatous reactions leading to the formation of adhesions. Corn starch produces no such action and the mixture of amylase and amylopectin obtained from this source treated to prevent gelatinization, is obtainable under the name of Biosorb powder or K.285 prepared corn starch powder. It can be sterilized by autoclaving and is preferably packed with the gloves in small paper envelopes.

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When gloves are removed after use they may be discarded into a pail containing soapy water. At the end of the operation, used gloves are removed from the pail, washed in warm soapy water, rinsed well and tested for holes. The gloves are then hung up to dry, keeping intact gloves separate from those with holes. When dry on the outside they are turned and left until both surfaces are dry. Undamaged gloves are grouped in sizes and put away. Patched gloves are not suitable for theater use but may be used in wards and departments for examination purposes or for barrier nursing.

### 3. *Gum Elastic and Plastic Materials*

Some of these materials can be autoclaved or boiled and the instructions given by the manufacturers should be followed. If the material cannot be subjected to heat without risk of damage, the articles should be immersed in bactericidal solution such as 2 percent solution of chlorhexidine (Hibitane) or 1 percent domiphen bromide (Bradosol) solution for twenty minutes. Phenol disinfectants must not be used for elastic gum or plastic materials, as these articles will be damaged by phenol.

Hollow instruments such as catheters if treated by chemical disinfection should be filled with the solution and immersed in a vertical tank in order to get rid of air bubbles.

### 4. *Surgical Dressings and Linen Drapes*

All types of cotton materials such as gauze, cotton wool and bandages are autoclaved in drums. Dressings for use in the theater are usually larger in size than those commonly used for ward dressings. Swabs and dressing materials such as gauze, cotton wool and cellulose can now be obtained ready. Made, prepared in a great variety of shapes and sizes. Dressings must be packed loosely in drums or packets to be sterilized by autoclaving.

Small and large swabs and pads used during operations may be made of gauze or muslin. The size required will depend on the type of operation and the choice of the surgeon. Small mops may be made up in the packets of ten lightly bundled together to facilitate counting. The bundles should be checked by a second person

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before they are packed for sterilization. Large pads, sometimes known as abdominal or laparotomy pads, are made of thirty-two layers of gauze about 9 inches by 14 inches. The layers are stitched together with a sewing machine so that there are no loose threads and a tape is sewn to one corner. Some surgeons use swabs with a metal thread running through the gauze, should there be any question of a swab having been left in the abdominal or any other cavity the metal thread will show in an X-ray film; alternatively a fine plastic tube loaded with barium, which is opaque to X-rays may be incorporated in the swabs. It should be remembered that such specially prepared swabs are more expensive than plain gauze and therefore they should not be used as ordinary dressing material for covering a wound. Loose mops can be used for superficial operations where there is no chance of a swab being overlooked. In some theaters loose mops are colored, for example, green and counted mops are left white.

Gauze rolls 3 yards long and 6 inch wide made by folding 12 inches into three and rolled are used for packing off a part or a cavity, e.g. during a gallbladder operation or partial gastrectomy, and may also be used for dressing as for example, on an amputation stump.

One inch ribbon gauze is used for small mops for operations on the lung, in neurosurgery, for thyroid operations and in lengths for nose and ear surgery.

Small lintin or gauze swabs are useful in neurosurgery; these have a black silk thread attached.

Lintin is a wood-pulp dressing which can be cut into strips which are soft and have no loose threads. This is a useful mopping material, particularly in small cavities.

Wool rolls, cellulose, and gamgee may be used for outer dressings and packing. Roller bandages in varying widths from 1 to 6 inches are required sterile for some operations on the limbs.

*Eye dressings:* The eye drum is packed with small mops of best quality gauze, eye pads of gamgee or best quality cotton wool and eye bandages. The latter are made from a piece of cotton material, preferably a fine quality 6 inches long and 2 inches wide, with a

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small notch cut in the lower border to accommodate the nose. A tape about 4 inches long is sewn on each of the four corners. At each side, the ends of the two tapes are sewn together and at the joint a single tape is attached which is long enough to pass round the back of the head and round to front again where the two tapes are tied in a bow over a wool mop. To cover the face, square muslin with holes cut for the eyes, can be used in place of a sterile towel. Oiled silk is used in certain dressing, e.g. colostomy.

Cotton drapes such as sheets and towels and gowns must be inspected to ensure that they are clean and free from holes before being packed for sterilizing. They should be folded in such a way that they can be handled when required by a sterile assistant (or by unsterile assistant using cheatle's forceps) maintaining a sterile surface. Rubber sheeting should be folded with a cotton sheet to aid penetration of steam and also subsequent drying. All these articles must be loosely packed for autoclaving. The size and types of drapings and the number of drapings varies in various theaters depending upon the routine of the hospital or the interest of individual surgeons. Sterilizing period is 20 minutes at a pressure of 20 lbs with a temperature of 260°F.

The holes in the sides of the drum should be positively opened before putting them in the autoclave. As soon as the drum is taken from the autoclave after sterilization these holes must be closed. Then only the quality of sterilization retains. The pattern of bundles in special cotton bags also is followed in some hospitals instead of packing in drums. The packets are taken only in sterile trays to field of use for handling to the instrument nurse.

### 5. *Sterile Water and Infusion Fluids*

The bottle should not be full with solution for autoclaving. There should be an allowance of space in the bottle to permit the expansion of fluid when heated. Solutions should not be autoclaved along with any other articles. The mouths of the bottles should be covered with several thickness of gauze or one layer of lint tightened with a string at its neck or very loosely covered with its own screw cap. As soon as it is taken away from the autoclave after

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sterilization and became cold, bottles should be tightly screwed and preserved in almarrha. The time and amount of temperature are same as that of surgical dressing.

Bottles of water and saline solution are sterilized by autoclaving in screw-capped bottles. Unless very special precautions are taken, any bottles of sterile water or sterile saline solution, should be regarded as contaminated once it has been opened. Unless the seal is unbroken, the contents of the bottle should not be used for rinsing instruments removed from disinfectants or for washing instruments during operations. Once the screw cap has been removed and the contents exposed to the air the label "sterile" on the bottle is meaningless. Screw cap should be used in preference to stoppers as they protect the rim of the bottle from contamination.

### 6. *Instruments*

Metal instruments are two types boilable and nonboilable. Boilable instruments are packed separate. This packings are usually done as a particular set of instruments required for the particular operation which is the common practice for the planned operations. Several sets of instruments are preserved for meeting the emergency operations to use at any time depending upon the usual occurrence of emergencies in the particular hospital. Sharp instruments as blade and scissors are covered in a piece of lint or gauze to prevent rubbing their sharp edges with other instruments and thereby reducing their sharpness.

Nonboilable instruments may be of different groups such as cystoscopes, bronchoscopes, etc. with special electric fittings of bulb and wires which may be spoiled by boiling. Such materials are sterilized or disinfected by chemical agents.

The sterilization of boilable and nonboilable instruments are given separate.

#### Boilable Instruments

The time and temperature required are same as that of surgical dressings. Metal instruments, including scissors and needles, are either boiled or autoclaved. Detachable knife blades and scalpels may also be autoclaved or sterilized by dry heat.

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The care and cleaning of instruments is an important duty. *After use all sharp instruments and needles are separated from the group.* Then all instruments should be thoroughly scrubbed with a fairly stiff brush under running cold water and then boiled for five minutes. They are taken out of the sterilizer and thoroughly dried while still hot. They should then be examined and oiled as necessary with a fine machine oil, with particular attention paid to the joints of such instruments as forceps and scissors. If oil is used, it is removed before sterilization. Any instruments needing repair or resharpening are then put aside. Sharp instruments must be handled with the greatest care, particularly delicate knives such as cataract knives should never be picked up by the blade. Scissors need only occasional sharpening if they are of good quality.

*Nonboilable instruments*: Some instruments need special care and it is important to follow meticulously the directions given by the makers. It is difficult to give exact rules for the sterilization of all types of endoscopes (i.e. electrically illuminated instruments for the examination of various body cavities and passages such as cystoscopes, sigmoidoscopes, bronchoscopes and esophagoscopes), but the makers usually specify which parts of the instrument cannot be subjected to heat in the case of the "nonboilable" types. Those instruments which are made to withstand the boiling of all parts must be warmed and boiled gradually as they may be damaged if suddenly plunged into boiling water. Sudden cooling by immersion in cold water after boiling may also damage optical instruments. In the Nonboilable type, the telescope, light and light carriers are immersed in phenylmercuric nitrate or (acetate) solution 1 in 10,000 and other parts of the instrument can be boiled.

Leads from the electric supply to endoscopes or to diathermy apparatus can usually be boiled for five minutes in water without the addition of soda. If they cannot be boiled, formalin vapor is the most suitable method of sterilization. Diathermy electrodes if not boilable are sterilized either in formalin vapor or in phenylmercuric acetate solution. Bronchoscopes, laryngoscopes and esophagoscopes are often kept in a formalin cabinet and are considered to be sterile after twelve hours in the vapor.

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After use, endoscopes should be washed in cetrimide, the boilable parts are boiled and nonboilable parts are placed in one of the disinfectant solutions mentioned above for twenty minutes. A fine brush should be used to clean the interior of sheaths. The apparatus is then dried. Alcohol can be used to dry the interior of the hollow parts but must not come in contact with the cement of the lenses. When the instruments are reassembled, valves lights and leads should all be tested.

### 7. *Suture Needles*

Needles may be fixed on a piece of lint to prevent missing among instruments and boiled or autoclaved along with the other instruments. Usually needles required for a particular operations are sterilized along with their own set of instruments.

In some hospitals the sterilization of needles and sharp instruments are done by the use of chemical agents. Then the time and strength of the lotion required for sterilization depends upon the type of agent used for it.

#### More Details about Needles

Suture needles may be classified according to the:
1. Thickness and size
2. Curve
3. Use

#### 1. *Thickness and Size*

Needles may be very small, medium size and large.
a. Very small needles, e.g. VVF needles, eye needles, etc.
b. Medium size: Cervix needles, intestinal needles, etc.
c. Large size: As used in stitching peritoneum, skin, etc.

#### 2. *Curve*

a. Straight needles (may be big or small), e.g. skin needle, intestinal needle
b. Semicurved needle (may be big or small), e.g. as used in stitching peritoneum, scalp of the head, etc.

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c. Half circle needle (may be big or small), e.g. Intestinal needles, VVF needles, Facia needles, Needles used in stitching uterus, cervix, etc.

3. *According to Use*

According to the area of use the needles may be:

a. Round bodied needles, e.g. intestinal needles eye needles, etc.
b. Round bodied tip cutting needles, e.g. cervix needles.
c. Cutting needles straight or curved, e.g. fascia needles, skin needles, etc.

For soft tissues, round bodied needles big or small may be used and for thick areas like skin and sole of the, leg, etc. tip cutting or full cutting needles big or small may be used. The number and size of needles required for particular operations depends upon the size of the patient, type of area and the thickness of the tissue to be stitched. The nurse has to use her own intelligence and the choice of the surgeon in selecting the type of needles for particular operations.

## ANEURYSM NEEDLE

It is devised for ligating the aneurysm. The suture material is inserted to the eye of the needle and the tip of the needle is passed behind the aneurysm. The ligature thus passed is tied to exclude the aneurysm.

### *Features*

1. It is a blunt tipped instrument which resembles a hook. The blunt tip avoids any injury to surrounding tissues.
2. The tip has got an eye and it may be curved laterally or at right angles to the shaft of the instrument.
3. The eye of the needle is preceded by a groove for the ligature.

### *Uses*

1. It is used for ligation of an aneurysm.
2. It may be used for ligating any vessel in continuity.
3. It is used to hook out and ligate the vein during venesection.
4. It is used to ligate the cystic duct.

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Operating Room Technique
& Anesthesia for

# General Nursing Course

## *Salient Features*

- A fully revised and modified text
- Presents in simple language with attractive format
- Provides theoretical as well as practical aspects of the subject
- Includes important illustrations of useful equipment and instruments
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