

Sterilization and Disinfection*

By

M.M. Wankhede R.N.

What is Sterilization ?

Any process by means of which all pathogenic organisms, including spores, contained in water, on utensils and instruments or in various fabrics and substances, can be completely destroyed.

What are Pathogenic Organisms ?

Those which may cause infection or disease. Some micro-organisms are not pathogenic ; these are of no significance in surgery.

What is Disinfection ?

The term "sterilization" is often used rather loosely to describe both "sterilization" and "disinfection" to the great confusion of students and nurses.

Disinfection may be defined as any process by means of which all except the spore bearing, pathogenic organisms are destroyed. In other words, essentially a process which will destroy the communicable disease organisms, not necessarily sufficiently exacting to kill spores.

What are Spore Bearing Organisms ?

There are certain well-known pathogenic organisms of which *Cl. tetani*, *Cl. welchii*, *Cl. oedematiens* are typical, which under adverse conditions become dormant and enter a spore stage. In the active, growing or vegetative stage they are comparatively easy to kill but in the dormant or spore stage they may lie inactive for years until under right conditions, as when buried in body tissues, they again enter the vegetative or growing stage. In the spore form they are

highly resistant to destruction, require much more heat and more time to kill. These organisms usually have their origin in foul places in decaying matter and are commonly found in cultivated (manured) ground. Almost invariably their association with wounds is traced to an accident in which the victim has been injured and the wound polluted with soil. Comparatively few infections from spore bearers are encountered in normal hospital practice, but they are frequently encountered in war casualties and extensive precautions are exercised in treating all wounded men, to rid wounds of this type of infection. All processes to be described herein for "sterilization" are prescribed for the destruction of the most resistant of the known pathogenic spore forming organisms, in the spore stage.

How can Sterilization be Accomplished ?

There are various methods commonly employed which are of importance in surgery in the following order :

By direct contact with steam under pressure. This is by far the most effective method but it can be applied successfully only where it is possible for the steam to permeate every fibre of porous supplies or to contact every surface undergoing sterilization.

By boiling the article completely submerged in, and in contact with the water.

By dry heat in an hot air oven. This requires higher temperature and much more time than is needed for sterilization using moist heat.

By use of various chemicals. This

*Collected from the "THE SURGICAL SUPERVISOR" by Shri M.M. Wankhede, Staff Nurse (male) K. H. I. Hospital, Ghataprabha, District Belgaum.

is recommended only in extreme emergency when no other sterilizing agency is available and for the treatment of very delicate eye instruments (cataract knives), cystoscopes and similar instruments which will not withstand excessive heat. It is accepted that chemical treatment rarely brings about "sterilization", and should be considered only as a "disinfecting" agency. There are only a few items used in surgery, such as those mentioned, which cannot be much better handled by heat than by any form of chemical. Chemical sterilisation or disinfection will not be discussed in here.

What Materials Require Sterilization ?

All instruments and utensils, water, gloves, dressings, gowns, sheets, towels, table drapes; all supplies of various kinds used in surgery or in dressing surgical or other wounds.

For what Materials is Disinfection Adequate ?

Bedpans, urinals, dishes in isolation wards, douche cans, mattresses and bedding, clothing. In general, materials from which it is desirable to remove the communicable disease (contagious) organisms.

What are the Mechanical Requirements for Sterilization ?

Pressure steam is the one highly dependable method used for sterilization of nearly all surgical supplies. The process is dependent upon both the heat and the moisture of steam which accounts for our careful stipulation of "direct contact" when steam is employed. The heat alone of steam at the pressure ordinarily employed would be altogether inadequate for destruction of spores. For example, a spore from infected instrument contained in a tightly stoppered test tube would not be sterilized in a pressure steam sterilizer even if exposed for an abnormal period of time. It will be seen that moisture plays quite as important a

part in this type of sterilization as the heat. The more resistant of the pathogenic spore bearing organisms, in the spore stage, are destroyed in direct contact with steam as follows :

With steam at 230 F. in ten minutes.

With steam at 240 F. in four minutes.

With steam at 250 F. in one minute.

The reader must not accept the above data as representing the possible period of exposure for supplies, but only as indicating what the absolute minimum requirements must be to bring about sterilization. In practice it is possible to measure the temperature of the applied steam exactly, but additional time is always needed to insure permeation of the steam through the load. That subject will be discussed in detail later.

Instruments and various kinds of utensils can be sterilized by boiling, completely submerged in water, for 20 minutes. Here again moisture plays an exceedingly important part which accounts for our insistence that the articles be completely submerged in the water. The data relating to this subject of sterilization by boiling are less exact than for pressure steam. Twenty minutes boiling has been for years the almost universal practice for sterilization of instruments and the writer has never heard the process criticized from the standpoint of reliability. It has been reported by numerous authorities that some of the pathogenic spores will withstand boiling for as much as 12 minutes.

Hot air or dry heat sterilization is practised in surgery for such supplies as bone wax, various oils, vaseline, talcum and other powders in bulk form—because it is impossible to bring the moisture content of the steam into direct contact with organisms which may be buried in the substance. The heat of the surrounding steam, of

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