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Review Article

Sterilization techniques of anesthetic and critical care equipment – A review

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ABSTRACT

Disinfection and sterilization are important and core steps in healthcare system. The infection control is not only for the benefit of the patient but presently it is a medico legally held responsible. One should have adequate knowledge about the sterilization of equipment. Although various disposable single use materials are present in healthcare system it will not be a cost effective method especially for the developing and underdeveloped countries. Inadequate knowledge will lead to hospital acquired infections and may also lead to life threatening cross infections. A proper infection control team and multidisciplinary approach will help to counter the infections in a scientific and cost effective way. This article describes various methods used for sterilization and also describes various commonly used equipment and their sterilization techniques.

1. Introduction

In the modern era, high level of importance has been given to avoid the cross infection between the patient or from doctor to the patient. In earlier days most of the equipment was used with simple sterilization techniques, now various techniques have come in practice to avoid such infections. The single use consumables have changed the scenario thus the need of the sterilization and should be used whenever it is possible.[1] Although the disposable or single use materials have come in the market these have its own disadvantages like, it may not be a cost effective material which is a challenging in developing country, and it will add more wastage to the nature and thus polluting it.[2] Lastly it is impossible to make certain materials as a disposable single use material especially like larger machines which are taking care of patients. Thus the authors describe most commonly used anesthesia and critical care equipment sterilization technique which is important for the nurses and doctors taking care of patients using lifesaving equipment.

2. Decontamination

It is a process where the debris over the equipment is removed from running water provided the equipment is compatible for the same.

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Table 1: Anaesthetic and critical care equipment sterilization procedure [3–7]

S. N	Item	Procedure
1	Resuscitation bag	Decontamination after every use, Ethylene oxide (EO) or autoclaving (Based on company recommendation)
2	Airway	Single use
3	Endotracheal tube	Single use
4	Laryngeal Mask Airway	Single use, Decontamination and autoclave or EO sterilization
5	Bougie and Stylet	Single use, Decontamination and EO sterilization
6	Simple Oxygen mask	Single use
7	Face mask	Decontamination and EO sterilization. If silicon material and company permits then use autoclave
8	Breathing circuits	Single use
9	HME filters	Single use
10	Laryngoscope handle	Decontamination
11	Laryngoscope blade	Single use or use disposable covers on it, decontamination and autoclave or EO sterilization
12	Monitor cables and accessories	Decontamination
13	Stethoscope	Decontamination using compatible chemical disinfectants
14	Syringes	Single use
15	Anesthesia machine parts	Based on manufacturer recommendation
16	ICU ventilator parts	Based on manufacturer recommendation

This process may also destroy the contaminants so that it will not reach the susceptible site and initiate cross infection. This procedure may be done manually or an automated way. Here the water temperature should not cross 45 degrees to avoid a layer formation for microorganism. One can use manufacturer recommended or compatible detergent solutions for it. The person performing this technique should be fully protected and this procedure should be carried out in a separate cleaning area of critical care or in operation theatre. The ultrasonic machine has replaced manual technique which uses cavitation process. All critical and non-critical equipment may not be compatible for the ultrasonic cleaning. Whenever there is a possibility of dismantling is there then it has to be carried out with great care. The equipment can be categorized as critical which enters into the sterile tissue or into the vascular structure, semi-critical when they come in contact with mucosal membrane and noncritical if it comes in contact with intact skin. The critical and semi-critical equipment must undergo this process.

3. Disinfection

Various techniques have been come in practice to disinfect the equipment, may it be either chemical or by heating process. Invariably the chemical disinfection is considered to destroy both gram positive and negative bacteria and lipophilic viruses. It is important to consider sporicidal disinfectants when critical or semi-critical equipment is considered. Gluteraldehyde (2%) and chlorine containing solutions are commonly used for high level disinfection. Alcohol (60-80%), hypochloride (1%) solutions can be used to kill vegetative bacteria, fungi and some viruses. Non chemical disinfection is done by Pasteurization technique which is considered to be an intermediate level of disinfection. The materials are exposed to a temperature of 77^o C over a period of 30 minutes. [8]

4. Sterilization

It is a technique where no life of an organism is seen over the equipment after particular technique. It involves destruction of all viable organisms. In the ancient days steam sterilization technique was commonly used. In the present day also various developing and underdeveloped countries are dependent on this technique. In this technique the equipment are made to expose to a heat of 121^o C or 134^o C depending on type of contact period i.e normal mode (15 min) or flash mode (3min) respectively. Since it is time consuming process one should not be in hurry to take out materials, else there will be mechanical hazards and incomplete sterilization is seen. Many organisms get destroyed with the exposure to a temperature more than 100^o C which can be obtained with pressure effect within the chamber. If the equipment tolerates higher degree of temperature then it is ideal to increase the temperature. An adequate spacing should be ensured since penetration of the steam is very important in this procedure. It is the most effective and safe technique to ensure the safety of patient to avoid cross infection. This technique is used for the equipment which can withstand the temperature. As the technology improved plasma sterilization, ethylene oxide sterilization and gluteraldehyde sterilization came into picture. [7] summarizes the type of sterilization that can be used for the anesthetic and critical care equipment.

4.1. Sterilization and Quality Control

Every hospital must have an infection control team. The leader of the team should be from the microbiology department and the team members should include one clinician, one nursing staff and one from administrative officer. The team responsibility is to identify the lacunas in day to day clinical practice and educate, sensitize the healthcare workers regularly. There should be a regular audit and discussion should be made with clinical heads. The quality control of the sterilization should be done with three ways, viz, biological, chemical and mechanical. Biological tests are more superior as they include testing the viability of non-pathogenic organism post sterilization.[9] The chemical method uses, indicators where the physical state or the color change is appreciated with the sterilization.[10] The mechanical mode includes use of thermometer or other gadgets to ensure particular temperature or pressure is achieved. Although it may not be cost effective, it is ideal to include all 3 to ensure adequate sterilization.[11] One should always ensure with the manufacturer to understand the type of sterilization required for that particular equipment.[12]

5. Conclusion

The sterilization technique is an important topic and is neglected to teach for postgraduate students. In developing and underdeveloped countries to make cost effectiveness there will be repeated use of healthcare instrument and patients are bound to get cross infection, especially this is in concern with anesthesia and critical care services. One should get updated with sterilization technique and never ignore it. It should be the part of patient care and safety.

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7. Conflict of Interest

None.

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