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Review Article

Sterlisation and disinfection: A review

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ABSTRACT

Sterlisation as well as disinfection is the key factor of preventing infection control. Both the processes i.e. sterlisation as well as disinfection helps in removing the pathogens. Endospore is the only key factor to distinguish between the two techniques. In the process of disinfection only pathogens are removed but endospores didn't removed from the process of disinfection. While the process which includes the destruction of endospores as well as the pathogens is known as sterlisation.

1. Introduction

The main purpose of sterlisation as well as disinfection is inhibiting the growth as well as transmission of the microorganisms or pathogens that are capable of doing infection. Inhibition of growth or transmission of microorganisms should be done in two ways, first is the prevention of the vertical transmission and second is the prevention of the lateral transmission.[1–4] Vertical transmission is the one in which there is propagation of microorganisms from one generation to the other generation and lateral transmission is the one in which there is transfer of resistance of pathogen to the other pathogen of the same generation and along with it there will be spreading of the pathogen to the surrounding.

To prevent the spread the of vertical transmission, there should be proper use of antibiotics. And to prevent the lateral transmission is by the help of health care workers by hygiene maintenance, by the process of hand hygiene measure, maintaining hygiene by the process of disinfection in the surrounding area, health care workers must be having adequate knowledge disinfection measures.[5–8]

Both the processes i.e. disinfection as well as sterlisation both occurs at the molecular level. Both the processes i.e. sterilisation and disinfection requires electrons for the process of oxidation, acidification and coagulation

2. Sterilisation

It can be defined as the process by which an article or surface or medium is made free from all the microorganisms either in the vegetative or in the spore form.

3. Disinfection

It is the process which helps in destruction of all pathogens that are capable of producing infection but not the spores necessarily. In the process of disinfection all the organisms that are capable of producing infection might not be killed by the process of disinfection but the number of infection causing microorganisms got reduced to the level that is not

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at all harmful to health.[9–16]

3.1. Different methods of sterilization

1. Physical methods
   (a) Sunlight
   (b) Heat : dry heat, moist heat
   (c) Ozone
   (d) Radiation
   (e) Filtration
2. Chemical methods
   (a) Alcohols
   (b) Aldehydes
   (c) Halogens
   (d) Phenols
   (e) Salts
   (f) Dyes
   (g) Various gases

3.2. Sunlight

It is found to be the most common as well as natural method of sterlisation. Due to the presence of ultra violet rays in it. It is used in the sterlisation of water that is stored in tanks, sterlisation of rivers and lakes.

3.2.1. Dry heat

In dry heat sterlisation following procedures are used

1. Red heat
2. Flaming
3. Incineration
4. Hot air oven

Dry heat sterlisation works on the principle, it kills the microorganisms by the process of denaturation of bacterial proteins, by the process of oxidative damage along with the toxic effects of increased levels of electrlytes.

Red heat: -is used for sterlisation of inoculating wires, used to sterlise the tip of various forceps or needles, which are held in the flame until they become red hot.[11]

Flaming : - in the process articles such as glass slides, scalpels are passed through the burner flame and in this process the article which is subjected to the process of sterilization is not allowed to become red hot.[11,13]

Incineration: - this procedure is basically employed for the destruction of the infectious material. In this process the infectious material is turned in to ashes. This procedure of incineration is also used in the treatment of bio medical waste.

Hot air oven: - most commonly used method of sterlisation by the process of dry heat is hot air oven. Temperature of 160 degrees is required for the process of sterlisation with holding time of 2 hours. This equipment can be used to sterlise glass syringes, flasks, test tubes, scissors, forceps, liquid paraffin. To check whether the process of sterlisation is completed or not spores of non toxigenix strain like clostridium tetani are placed inside the oven, and when the sterlisation is completed these spores of clostridium tetani are destroyed.[17]

4. Moist Heat Sterlisation

The most common example of using moist heat sterlisation is the use of autoclave. Autoclave is most commonly used in dental practice for the proper sterlisation of the dental instruments. Autoclave works on the principle of saturated steam. Most of the bacteria are more susceptible to moist heat sterlisation as bacterial proteins coagulates more readily by moist heat sterlisation as literature stated that moist heat can penetrate the material easily especially the porous material. It works on the principle of saturated steam which stated that whwn staeam comes in direct contact with the surrounding cooler surface it condenses in to water and results in liberation of latent heat to that surface. So the condensed water results in production of moist conditions that are responsible for the destruction of the microorganisms present over the surface of the article. Temperature sets at 121 degree Celsius for 15 minutes with the pressure of the chamber at 15 pounds, some other holding temperature for autoclave is at 126 degree Celsius for 10 minutes at 20 pound per square inch or at 133 degree Celsius for 3 minutes at 30 pounds per square inch. This equipment is used to sterlise the gowns, dressings, gloves, useful for all the materials that cannot with stand higher temperature of the hot air oven. One should take proper care of arranging the article to be autoclaved in such a manner, such that to ensure the free circulation of the steam inside the chamber. Spores of geobacillus stearothermophilus are use to check the proper sterlisation, brownes tube can also be used, brownes tube contains red solution when ultimately after proper sterlisation turns in to green.[18,19]

5. Radiations

Gamma rays, x rays and cosmic rays come under the category of ionizing radiations. They have a high penetrating power. They can damage DNA by various mechanisms. These gamma rays are most commonly used for the process of sterlisation of plastic syringes, cannulas, culture plates. The other type of radiations that include infrared radiations and ultraviolet radiations comes under the category of non ionizing radiations. These radiations are most commonly used to disinfect laboratory areas, operation theatres.

6. Alcohols

Ethyl alcohol and isopropyl alcohol are most commonly used alcohol in dentistry. They are used most commonly

as topical antiseptic agents. They act by the process of denaturating of bacterial protein.

7. Aldehydes

Formaldehyde falls under this category. It is basically bactericidal, sporicidal as well as virucidal. It is used in the concentration of 10 percent aqueous. It is most commonly used as tissue preservation for the process of histological examination. It is also helpful in sterlising bacterial vaccines. The second most commonly used aldehyde is glutaraldehyde. It very much effective against bacteria, viruses and fungi. it is used in the concentration of 2 percent as buffered solution. Glutaraldehyde is most commonly used in the sterlisation of endoscopes, bronchoscopes.

8. Phenols

The derivatives of phenols such as cresols, chlorhexdinie and hexachlorophene are most commonly used in dentistry and they used as antiseptics. Cresols most commonly used in the cleaning of the floor, disinfection of the excreta. Chlorhexidine solution is the most commonly used solution as an antiseptic mouth wash in the field of dentistry. They are mostly active against gram positive bacterias as compared to the gram negative bacteria.

9. Halogens

Chlorine and iodine falls under the category of the halogens. Chlorine is most commonly used in water supply, in swimming pools. Chlorine most commonly used in the form of bleaching powder, sodium hypochlorite solution. Its mechanism of action is basically due to release of free chlorine ions.

10. Oxidizing Agents

Most commonly used oxidizing agent is hydrogen peroxide in the concentration of 5 to 6 percent and is effective against most of the organisms at this concentration, hydrogen peroxide is effective over spores also at higher concentration of 10 to 25 percent. Its mechanism of action is basically from liberation of free hydroxyl radical. It is most commonly used in the disinfection of lenses, surgical prosthesis.

Salts such as copper, silver or mercury can be used as a disinfectant, as they have toxic effect on bacterial cell wall. Gases like formaldehyde gas, ethylene oxide are most commonly used as fumigation of operation theatres, ethylene oxide gas is mostly effective on most of the bacteria and viruses including spore form also, used for sterlisation of disposable needles.[16]

11. Conclusion

It is very much required to have an adequate knowledge of various materials that can be used for disinfection as well as sterlisation. As now a days sterlisation is very much helpful in inhibiting the spread of infection from dentist to the patient as well as from patient to the dentist.

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13. Conflict of Interest

The authors declare no conflict of interest.

References

1. Mcdonnell G, Burke P. Disinfection: is it time to reconsider Spaulding? *J Hosp Infect*. 2011;78(3):163–70.
2. Mcdonnell G. General mechanism of action. In: McDonnel GE, editor. Antisepsis, Disinfection, and Sterilization. Washington DC: ASM Press; 2017. p. 255–69.
3. Wallace CA. New developments in disinfection and sterilization. *Am J Infect Control*. 2016;44(5):e23–7.
4. Rutala WA, Weber DJ. Uses of inorganic hypochlorite (bleach) in health-care facilities. *Clin Microbiol Rev*. 1997;10(4):597–610.
5. Cotter JL, Fader RC, Lilley C, Herndon DN. Chemical parameters, antimicrobial activities, and tissue toxicity of 0.1 and 0.5% sodium hypochlorite solutions. *Antimicrob Agents Chemother*. 1985;28(1):118–22.
6. Strand CL, Wajsbort RR, Sturmann K. Effect of iodophor vs iodine tincture skin preparation on blood culture contamination rate. *JAMA*. 1993;269(8):1004–6.
7. Berkelman RL, Holland BW, Anderson RL. Increased bactericidal activity of dilute preparations of povidone-iodine solutions. *J Clin Microbiol*. 1982;15(4):635–9.
8. International Specialty Products. PVP-Iodine-Povidone Iodine antiseptic agent. Available from: https://web.archive.org/web/20060313193322/http://www.ispcorp.com/.
9. Falagas ME, Thomaidis PC, Kotsantis IK, Sgouros K, Samonis G, Karageorgopoulos DE. Airborne hydrogen peroxide for disinfection of the hospital environment and infection control: a systematic review. *J Hosp Infect*. 2011;78(3):171–7.
10. Kyi MS, Holton J, Ridgway GL. Assessment of the efficacy of a low temperature hydrogen peroxide gas plasma sterilization system. *J Hosp Infect*. 1995;31(4):275–84.
11. Mannion PT. The use of peracetic acid for the reprocessing of flexible endoscopes and rigid cystoscopes and laparoscopes. *J Hosp Infect*. 1995;29(4):313–5.
12. Cheung RJ, Ortiz D, Dimarino AJ. GI endoscopic reprocessing practices in the United States. *Gastrointest Endosc*. 1999;50(3):362–8.
13. Kim JB, Han DS, Lee HL, Kim JP, Sohn JH, Oh MS, et al. The value of peracetic acid for endoscope disinfection. *Korean J Gastrointest Endosc*. 2004;28:284–90.
14. Bragg R, Jansen A, Coetzee M, Westhuizen WD, Boucher C. Bacterial resistance to Quaternary Ammonium Compounds (QAC) disinfectants. *Adv Exp Med Biol*. 2014;808:1–13.
15. Tabata A, Nagamune H, Maeda T, Murakami K, Miyake Y, Kourai H. Correlation between resistance of Pseudomonas aeruginosa to quaternary ammonium compounds and expression of outer membrane protein OprR. *Antimicrob Agents Chemother*. 2003;47(7):2093–9.
16. Lynam PA, Babb JR, Fraise AP. Comparison of the mycobactericidal activity of 2% alkaline glutaraldehyde. *J Hosp Infect*. 1995;30(3):237–40.
17. Abreu AC, Tavares RR, Borges A, Mergulhao F, Simoes M. Current and emergent strategies for disinfection of hospital environments. *J Antimicrob Chemother*. 2013;68(12):2718–32.

18. Dancer SJ. Controlling hospital-acquired infection: focus on the role of the environment and new technologies for decontamination. *Clin Microbiol Rev*. 2014;27(4):665–90.
19. Centers for Disease Control and Prevention (CDC). Disinfection and sterilization. Available from: https://www.cdc.gov/infectioncontrol/guidelines/disinfection/index.html.

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