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EFFECTIVENESS AND EVALUATION OF VARIOUS DISINFECTANTS ROUTINELY USED IN CLINICAL LABORATORY AND HOSPITAL

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ABSTRACT

Disinfectants are the chemicals agent which is intended to kill the microorganism or which is used to stop the activity of microorganism. The experiment is conducted to investigate the effect of different disinfectants against the different pathogens purchased from ATCC. The strains were both which usually sensitive and few resistant organisms also used as control.[1] There is different type of disinfectant which is used in hospitals and laboratories to control the hospital-acquired infections. Therefore a comparative study was done to find out the effectiveness of supplied disinfectants in clinical labs and hospital.[2] The advantage of this study will help in the reduction of nosocomial infection or hospital-acquired infection.[3] The disinfectants considered for study having their own ideal characteristics, properties and mode of action. In this study total six different disinfectants were used. This study was done to check the efficacy of each disinfectant with time exposure. In this study few disinfectants showed satisfactory result and for few unsatisfactory results. Hospital-acquired infections are not new kind of infection but day by incidences of HAI increasing so mild safety measures can be helpful in decrease of HAIs. A disinfectant who's having ideal characteristics is offering complete sterilization without harming other forms of life. Disinfectant failure could increase microbial load and cause nosocomial infection. Each laboratory and hospital should have a written disinfectant policy specifying the kind and concentration of disinfectant for each type of use.

KEYWORDS: Disinfectant, ATCC, Resistant, Fomites, Sterilization.

INTRODUCTION

Disinfectants are the chemicals agent which is designed to kill the microorganism or which is used to stop the activity of microorganism. Disinfectant is referred to as antimicrobial agents. It helps to stop the growth of microorganism which leads to cause the infection. It is basically applied on insensate object. Disinfectants are also called as germicides.[4] According to three dictionaries, Stedman's, International, and Hawley's explain two types of disinfectant-complete disinfection and incomplete disinfection. The meaning of complete disinfection that no evidence of bacterial presence after applying chemical at particular place in hospital or clinical labs. It will reduced the HAIs infection, growing very fast since 1980. A few of the majority significant pathogens involved in HAIs include Methicillin-resistant *staphylococcus aureus* (MRSA), *Clostridium difficile*, *Pseudomonas aeruginosa*, *Vancomycin-resistant Enterococcus.* (VRE), *Acinetobacter baumannii* and some Enterobacteriaceae strains. Most of these pathogens can survive on the surface for several months. So using a disinfectant is one way to reduce the nosocomial infection in hospitals and clinical laboratories. There are different type of disinfectant we used in the hospitals to control the microbial infection. The experiment was conducted to investigate the effect of different disinfectants against the different pathogen including ATCC strains and multidrug-resistant organisms.[5] There are different type of disinfectant which is used in hospitals and laboratories to control the infections. for e.g., Phenols, Alcohol, Hypochlorite, Hydrogen peroxide, Iodine and Iodiophore disinfectant, Glutaraldehyde, Formaldehyde, Per acetic acid, etc.[6] They all are divided into different level of disinfectant according to CDC. All disinfectant have different efficacy to kill the microorganism. All type of disinfectant has a wide spectrum of antimicrobial activity. Disinfectant can be sporostatic but not necessarily a sporicidal and has their own ideal properties which include not being toxic and corrosive, being stable, having speedy action, high penetrating power etc.

The main objective to do this research was, to check the efficacy of the effectiveness of different disinfectants with the passes of time. Perfect disinfectant provides full sterilization or complete cleaning without harming other

forms of life. Along with that there are some factors which affect the effectiveness of disinfectant like concentration and quantity of disinfectant, contact time and temperature, pH, toxicity to the environment etc. All disinfectants have different mode of action to stop the activities of microorganism or viruses.

Jin-Hong Yoo in 2018 explained that the complete knowledge of disinfection and sterilization.[7] A study showed the choice of disinfection or sterilization should first be based on Spaulding's classification mainly in the case of a important item, a method that kills spores should be selected, *i.e.*, sterilization. In addition, when disinfecting highly communicable species or non-enveloped viruses, the suitable disinfectant or chemical sterilants must be selected prudently and correctly.[8]

Richmond, Jonathan Y, McKinney, Robert W.(1999), they have described the levels of disinfectant. According to their study there are three levels of disinfectants – High Level of Disinfectants, then come intermediate level Disinfectant and last is Low-level disinfectant. In case of high-level disinfection, we use that disinfectant which has a high concentration.[9] In this level of procedure it kills the vegetative microorganisms and also inactivates the viruses. It might not kill the high no. of bacterial spores. These high-level disinfectants are used for short time periods from 10 to 30 minutes.

In other study the result suggest that disinfectants can act on microbes in two different ways: growth inhibition bacteriostatic, fungi static or deadly action bactericidal, fungicidal or virucidal effects. Only the deadly effects are of interest in disinfection and, as the objects of treatment have no inherent means of defense, lethality is the desired aim. In this literature the main focuses are on the action of a certain number of active molecules. However, disinfectants are usually complex formulations of active molecules, sometimes also containing co-solvents, chelating agents, acidic or alkaline agents, or surface-active or anti-corrosive products.[10] Aberu in 2013 given emphasis on current and emergent strategies for disinfection of hospital atmosphere and Manuel Simões, both researchers imparted their work on same objective and discussed the role of the disinfectant and their effectiveness.[11] Various studies were done to check the hospital-acquired infection due to the inefficient disinfection of hospital surface and other health care areas.[12]

MATERIALS AND METHODS

To conduct this study all the basic and sophisticated lab types of equipment were used along with recommended media like Peptone water, culture media- MacConkey agar, disinfectants, wooden swab, chemicals and reagents. The all material was supplied by the Clinical microbiology laboratory, Fortis Hospital Mohali.[13]

Research design – To conduct this research the set up was arranged at Clinical microbiology laboratory, Fortis Hospital, Mohali. The setup was free from contamination and was following NABH and NABL guidelines for microbial procedures. All the procedures were carried out aseptically in the bio-safety cabinet, taking universal precautions. The study was conducted during the period of January 2019 to April 2019.

Testcontrols

In the is project ATCC (American Type Culture Collection) culture were used, the strains purchased are mentioned below.

ATCC STRAINS ARE

- *Staphylococcus aureus 29213*
- *Escherichia coli 25922*
- *Candida albicans 14053*
- *Pseudomonas aeruginosa 27853*
- *Proteus mirabilis 29906*
- *Enterococcus fecalis 29212*
- *Hemophilus influenza13377*
- Salmonella typhii 35664

1. Resistant strains

- *Klebsiella pneumoniae*
- *Acinetobactor baumannii*
- *MRSA (Methicillin-resistant Staphylococcus aureus)*

These strains were mixed into the one tube containing peptone water; the mixed solution is then further measured in density meter to measure the solution density. After measuring the density, the growth is further passed into the respected disinfectant in a sterile tube and then applied to the recommended media.[14]

The disinfectant used for testing

Following disinfectants were used in research

1. Algard^{tm} HWS-256.
2. Avert.
3. Sanosil.
4. Baccishield.
5. Sodiumhypochlorite.
6. Mikrozoid^{tmu} HP-10.

Peculiar characteristics of disinfectants

-Algard^{tm} HWS-256:- It is one step disinfectant, bactericidal, fungicidal and virucidal concentrate. [Inactivates Avian Influenza (H5N1)], Hepatitis B and C virus and HIV-1. Algard^{tm} HWS-256 is registered formulation, recommended for use in hospitals, commercial and industrial institutions.

Avert:- This disinfectant is a one-step, hospital disinfectant cleaner designed for general cleaning, disinfection and deodorizing of hard, nonporous surfaces. It is designed to use on hard non- porous surface. It is virucidal, fungicidal, sporocidal disinfectant. 1 min. contact time was effective against a broad spectrum of pathogen including bacteria, antibiotic-resistant bacteria, viruses and fungi.

Sanosil:- Sanosil contains two main ingredients – hydrogen peroxide and silver. Hydrogen peroxide attack cell membrane and silver attack internal cell structure of bacteria upon direct contact (The chemical reaction of oxygen with molecule in the cell wall denatures and disrupts them). This effect is boosted by silver ions that bind to the exposed disulfide bond of protein associated with reproductive and metabolic system and deactivates them resulting in rapid cellular degradation and microbial death.[15]

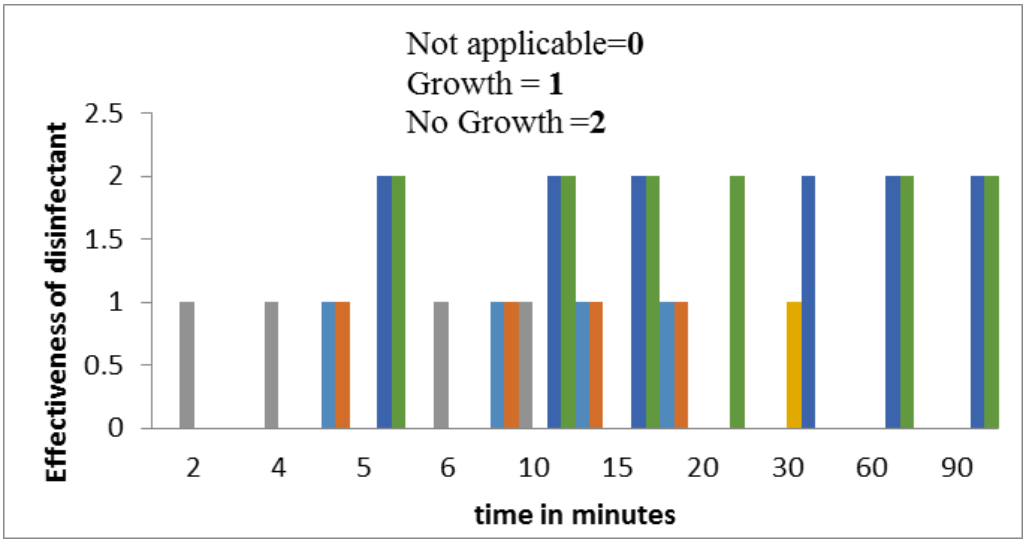
Baccishield:- It is an Aldehyde free broad-spectrum, bactericidal, fungicidal, sporocidal. It contains a complex formulation of stabilized hydrogen peroxide with diluted silver nitrate solution. It is non- toxic and non-irritant and has good material compatibility. Its exposure time is 15 minutes.[16]

Sodium Hypochlorite:- It is used as an oxidizing and bleaching agent and as a disinfectant. While sodium hypochlorite is non-toxic, its corrosive properties, common availability, and reaction products make it a significant safety risk. Sodium hypochlorite is most often encountered as a pale greenish-yellow dilute solution.[17] Sodium hypochlorite in solution exhibits broad spectrum anti-microbial activity and is widely used in healthcare facilities in a variety of setting

Mikrozoid^{tm} HP-10:- It is eco-friendly, non-toxic, non-irritating environmental disinfectant for critical area fumigation and surface distinction. It also contains hydrogen peroxide and silver solution. It is used in hospitals- OT's, ICU, Blood Bank, etc. Its exposure time is 60minutes.[18]

Sample processing – 3 ml of peptone water was taken in the tube and added particular strains into it later tube was incubated at required temperature and taken the optical density, high turbidity shows good bacterial load. After that disinfectant added and given particular exposure time, later the solution was inoculated on agar containing media plates, then incubated 37ºC for 24-48 hours and noted down the results.

RESULT AND DISCUSSION



Graph 1.

According to graph1, not applicable means chemical or disinfectant at initial level, no minimum exposure so indicated with 0, growth denoted with 1 showing time was given and found growth on media and 2 denoted for no growth seen after exposure to disinfectant.

The results of the prospective study demonstrate the efficacy of different disinfectant that is used in hospitals and laboratories to control the infection to kill the microorganism which causes the infection that person carries from the hospitals or health care center. According to this study the result was showed that out of 6 chemicals four were given a satisfactory result and two were shows growth on media.

For each disinfectant different time interval time was given, for Algard, Sodium hypochlorite, Sanosil and Baccishield 5 minutes, 10 minutes, 15 minutes and 20 minutes were given but in case of Baccishield instead of 20 minutes, 30 minute.

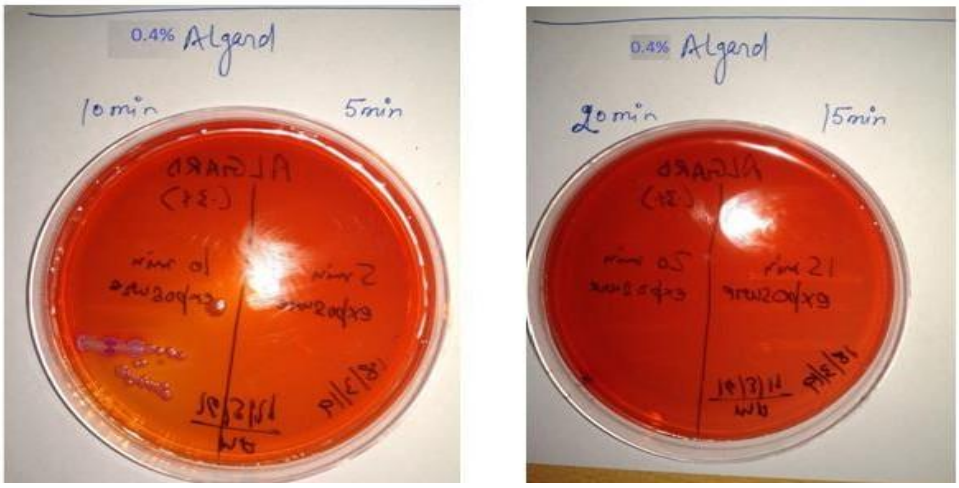


Fig no 1.

was given for last tube and for avert 2 minutes, 4 minutes, 6minutes and 10 minutes were given. For Microzoid 30 minutes and 60 minutes time was given. So as per result out of 6 disinfectant, 4 disinfectant shown satisfactory result means four chemicals were more effective or able to kill the bacteria however two disinfectant showed unsatisfactory result.[19]

According to the figure number 1 and 2 found that Algard was more effective as compare to Sanosil, fig.1 no bacterial growth but fig. 2 having bacterial growth.

Fig no 2.

Sanosil and Baccishield both are used for the fogging purpose. Fogging is a process in which disinfectant is spray in the air to kill those microorganisms which are present in environment.[20] Each disinfectant has its own ideal properties to kill the microorganism by various mechanisms.[21] If inoculated media plates showed growth of most bacteria it means that disinfectant is probably ineffective and no growth means it is most effective.

CONCLUSION

Infections are never new in healthcare set up. The current research titled "comparison of various disinfectants used to kill the microorganism in hospitals and laboratory" focuses on the efficacy of different disinfectant that helps us to kill the microorganism, by understanding their properties. The result shows that few disinfectants are effective and some are not. A good disinfectant having ideal characteristics is offering complete sterilization without harming the other forms of life. It is helpful to control hospital infection. Disinfection of environmental surfaces in healthcare facilities is essential elements of infection control programs. Disinfectant failure could increase microbial load and may leads more healthcare-associated infection to patients. Each laboratory and hospital should have a written disinfectant policy specifying the kind and concentration of disinfectant for each type of use. Selection of ideal disinfectant is very important in hospitals to clean the hospital environment. The World Health Organization publishes the chemical safety sheets for common disinfectants and pesticides.

CONFLICT OF INTERESTS

The authors declare that there is no conflict of interest regarding the publication of this paper.

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