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Antimicrobial Activity of Chlorhexidine, Peracetic acid/ Peroxide hydrogen and Alcohol based compound on Isolated Bacteria in Madani Heart Hospital, Tabriz, Azerbaijan, Iran

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ABSTRACT

Purpose: The aim of present study was to investigate the effect of chemical agents on the clinical isolates in Madani Heart Hospital, Tabriz, Iran. ***Methods***: The minimum bactericide concentration (MBC) of disinfectants including chlorhexidine (Fort), peracetic acid (Micro) and an alcohol based compound (Deconex) on selected bacteria at various dilutions were determined by the standard suspension technique. ***Results***: MBC of Micro, Fort and Deconex were 2-128 mg/L, 2-64 mg/L and 4 - 32 mg/L, respectively. The Gram negative bacteria were more resistance to disinfectant relation to Gram positive bacteria. ***Conclusion***: The results showed that these agents are able to eradicate the bacteria and they can be used lonely.

Introduction

Nosocomial infections remain a major worldwide problem, and a lot of people are victims of hospital infections.[1] For instance, 2 million nosocomial infections happen annually in the United States and it lead to additional days of treatment, increase the risk of fatality and increase management costs.[2] Efforts to diminish the risk of transmission of nosocomial infections have a fundamental role.[3] Microorganisms caused hospital infections may be controlled by inhibition or killing by physical or chemical agents as antiseptics, disinfectants, and detergents.[4] Disinfectants are chemicals agents that destroy the growing forms of bacteria but do not destroy spore forms of microorganism. Disinfectants are applied on lifeless things resembling floor and work benches as phenols, chlorhexidine, hypochlorite and alcohol.[5] Deconex is a fluid; alkaline, new production of alcohol based disinfectant and is widely used in hospitals and clinics.[6] Micro is a peracetic acid and peroxide hydrogen compounds, and it is a broad spectrum chemical agent that effective against bacteria, fungi, yeasts as well as all known classes of virus. Fort is a chlorhexidine diacetate based disinfectant agent and it may be applied on wet floor, scraper, cotton wipe, wash bucket, or spraying on the inanimate surface.[7]

The surfaces of medical tools, apparatus, and hospital areas should be disinfected by suitable disinfecting agents. There is a great variety of disinfecting agents on the market; so it is extremely very important to recognize the main microorganisms encountered in health care centers and its sensitivity to antibacterial agents before choose a chemical agent. In consequence, the purpose of testing disinfectant is to set up whether microorganisms are killed by the disinfectant.[8]

The aim of present study was to investigate the range of disinfectants action on the most common bacteria involved in the infectivity and deaths of patients in Shahid Madani Heart Hospital, Tabriz.

Materials and Methods

The following ten clinical isolates from each bacterium were used: *Pseudomonas aeruginosa*, *Staphylococcus aureus*, *E. coli*, *Enterobacter aerogenes*, *Enterococcus facalis*, *Klebsiella pneumoniae* and *Staphylococcus epidermidis*. A stock solution of Deconex solarsept (Borerchemie, Switzerland) and Micro **10 (Unident, Switzerland**) and Fort (Iranfarma, Iran) was prepared as recommended by the company. The antibacterial activity of disinfecting agents was observed by standard suspension test in 5, 15, 30, and 60 minute contact times.[7] Minimum bactericidal concentrations (MBC) were determined at various dilutions as briefly: a series of increasing concentrations of the antimicrobial agent are prepared in the brucella broth medium. At first, bacteria was grown for 24h on blood agar were resuspended in normal saline and diluted to

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0.5 McFarland densities (10^8 colony-forming-units). Each tube is uniformly inoculated and was incubated at 37 ^{0}C at various contact times.[6] Then the tubes were cultured on solid agar. The MBC was considered the lowest concentration of the antibacterial agent that killed the microorganisms. In this research, statistical analysis was performed by SPSS software ver-18 and the results were significant at the $p \leq 0.05\%$ level.

Results

In this study, the efficacies of three disinfectant solutions which usually used in hospitals were assessed on 70 isolates of bacteria.

MBC of Micro, Fort and Deconex disinfectants were 2-128 mg/L, 2-64 mg/L and 4 - 32 mg/L, respectively, and the effective disinfectant was Deconex (*P*v 0.01).

Range of MBC was from 2 to 128 mg/L and the results showed that Micro, Fort and Deconex had bactericidal activity on selected bacteria.

The Gram negative bacteria were more resistance to disinfectants relation to Gram positive bacteria. *Pseudomonas aeruginosa* was observed to show more resistance to the tested disinfectants, followed by *E. coli, Klebsiella pneumonia, Enterobacter aerogenes* and Gram positive bacteria.

Discussion

Among the disinfectants, the eco-friendly new generation is more likely to be considered as proper substrates for reducing the intensity of a wide range of microbial pathogens.[9] In-vitro determinations of susceptibility values of disinfectants were performed by conservative methods as MIC or MBC. The MBC of disinfectants can be determined the same way as for antibiotics, but in use concentration of disinfectants should never be chosen on basis of MIC, because unlike antibiotics, the purpose is to kill bacteria swiftly, in a matter of minutes. It can therefore be assumed that investigation of disinfectant efficacy under standardized conditions allows the user to choose the most efficacious agent. For example, the peracetic acid MBC interval of 0.0063–0.0071% (63–71 mg/L) was reported previously for *Enterococcus cloacae*, *E. coli* and *S. aureus.*[10]

Using antiseptic and disinfectants components are regarded as an essential strategy for fighting with microorganisms, and they are an essential part of infection control practices and assist in the preventation of nosocomial infections.[1,11-13] With regard to the widespread use of disinfectant products, the development of resistance to antimicrobial agents, particularly cross resistance to antibiotics, study on disinfectants seem to be a very important topic.[8,14-15]

In this study, the tested bacteria are commonly found in the individual blood, urinary tract, gastrointestinal tract, upper respiratory tract, and also surgical wounds.

In this research, three disinfectants showed a moderate to severe bacterioside activity against the 70 strains and the most potent agents was Deconex. An example of this study, carried out by Hecht et al with peracetic acid solution 3%, showed a range of MIC between 0.9 – 1.85 % to reduce populations over 109 of Gram-negative bacteria, and half of that (0.46%) to reduce *S. aureus* populations, after 24 h contact.[10] Contrary to expectations, this study showed a relative significant difference between disinfectants with regard to MBC.

Another important finding was that Gram negative organisms were more resistant than Gram positive bacteria, in fact Gram negative strains are inhibited by high concentrations of antimicrobials and this finding is according to other research.[11,14]

P. aeruginosa is a Gram negative bacteria and it continues to be a chief pathogen in hospital acquired infections.[11] The transmission of this bacterium is almost always related to contamination of medical surgical instruments and respiratory apparatus.[16] *Pseudomonas* spp. survives long periods on the surfaces of polyvinyl chloride pipes, stainless steel, soap, dishwashing sink, toilet and glass, showing tolerance to different disinfectants.[17] In this research, the most resistant bacteria to the tested disinfectants were *Pseudomonas aeruginosa*. As mentioned; different types of microorganisms vary in their response to antiseptics, in view of their different cellular structure, composition and physiology.[8,18] These findings suggest that bacteria susceptibility to antimicrobial agents was achieved occasionally.

Finally, some limitations needed to be considered. However, with a small sample size, level of microbial resistance to the antimicrobial agent and other characteristics of the local surroundings; caution must be applied, as the finding might not be transferable to all hospitals.

In conclusion, we showed that the effective agent is Deconex, Gram negative organisms are considered high resistant and further work is required to establish susceptibility tests to disinfectants in this area.

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Conflict of interest

The authors report no conflicts of interest in this work.

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