

THE COMPARISON OF THE EFFECTIVENESS OF NEWLY MARKET DISINFECTANTS WITH COMMONLY USED DISINFECTANTS IN IRAN IN REDUCING HOSPITAL INFECTIONS INDEX- A CASE STUDY: KERMANSHAH HOSPITALS (2015)

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ABSTRACT

Background and aim: Disinfection is a process in which pathogenic microorganisms of Abiotic surfaces are disappeared. Choosing a suitable disinfectant and using standard methods of disinfection can be effective in reducing nosocomial infections. This study aims to compare the effectiveness of newly market disinfectants with commonly used disinfectants in Iran in reducing hospital infections index: Case study of Kermanshah hospitals.

Materials and methods: In this descriptive analytical study, a total of 450 microbial samples were randomly taken from different parts of Kermanshah hospitals. In microbiology lab of Kermanshah University of Medical Sciences, all the samples were cultured on blood agar medium and the specific culture medium for each bacteria was used. In this study, three new disinfectants supplied to the market including Saysept HI, Turbo septi, 50 Deconex AF were compared with commonly-used disinfectants including Saysept HP, Deconex 53 plus and DeconexSolarsept. Data were analyzed using one-way ANOVA, independent two-group T-test and chi-square test.

Results: In examining the effectiveness of new and current disinfectants in surveyed hospitals, it was observed that the average of overall performance of common disinfectants was 96.7 % and the average of overall performance of new disinfectants was 98.5 % in reducing the indicators of hospital infections. Among large surface disinfection Deconex 50 AF had the highest performance in reducing nosocomial infection; and among small surfaces disinfection septi Turbo had the highest performance in reducing nosocomial infection. Also among equipment and materials disinfection Saysept HI had the highest performance in reducing nosocomial infection.

Conclusion: According to the results, to disinfect tools and equipment Saysept HI is proposed. To disinfect large surfaces 50 Deconex AF is recommended and to disinfect small surfaces DeconexSolarsept is suggested.

Key words: Disinfectants, Hospital Infections, Kermanshah.

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Introduction

Every day disinfectants are used to sterilize or disinfect devices and medical devices such as endoscopy devices, surgical supplies, wound dressing, operating rooms and obstetrics, burn ward, and ICU and CCU. They are also used for disinfecting the hallway and physical surfaces of hospitals⁽¹⁾. The importance of the use of disinfectants even in the golden age of antibiotics is not decreased and now using disinfection is one of the most important principles of successful programs of control of

nosocomial infections⁽²⁾. In a study conducted from 1990 to 1994, it was found that the following figures related to viruses and parasites are involved in the development of nosocomial infections: Aerobic bacteria in 87% of cases, anaerobic bacteria in 3% of cases, fungi in 9% of cases and 1% other of other cases⁽³⁾. Bacteria causing hospital infections that in this study are evaluated by alternative disinfectants are *Pseudomonasaeruginosa*, *Enterococcus*, *Staphylococcus aureus*, *Escherichia coli* and *Acinetobacter*. The main purpose of the using disinfectants in hospital environments is to reduce

the risk of nosocomial infections in patients. Many nosocomial infections occur due to inadequate use of disinfectants. The several commercial disinfectants are used to prevention and control nosocomial infections that each of which have their own advantages and disadvantages. Using effective and safe disinfection with minimum damage to equipment and personnel is one of the basic principles of disinfections.

Since a variety of compounds and disinfectants with different characteristics are made by different companies each of which has its own advantages and disadvantages; while a compound that meets all the circumstances of a disinfecting solution has not been developed yet. For this reason, choosing a suitable disinfectant in a healthcare environment is of utmost importance. The aim of this study is to determine the effectiveness of various disinfectants to select a suitable disinfectant. To this end, three new disinfectants that were newly supplied to the market, naming Sayasept HI, turbo septi and 50 Deconex AF were compared to three commonly-used disinfectants naming Sayasept HP, Deconex 53 plus and Deconex Solarsept in two Kermanshah hospitals to removal nosocomial infections.

Materials and methods

Disinfectants used in these hospitals in this study are in weak and middle level. Sayaspt HP and Deconex 50 AF are used to disinfect large surfaces and they can be found in the form of concentrated solution. Septi Turbo and Solarsept disinfectants are used to disinfect small surfaces and they are provided in the form of solution. Sayasept HI disinfection and Deconex 53 Plus are used to disinfect tools and equipment and they are available in the form of concentrate. Sayasept HI and Deconex 50 AF and Deconex 53 plus disinfectants are free of Aldehyde and phenol; and they are consisting of Quaternary ammonium compounds (QACs). In Sayasept HP formula instead of the forth Quaternary ammonium compounds (QACs) the fifth Quaternary ammonium compounds (QACs) are used. Deconex Svlarsept and septi Turbo are in the category of the alcohol solution⁽⁴⁾.

This study is descriptive-analytical type and it is done in Microbiology Laboratory in college of Medicine, Kermanshah University of Medical Sciences in 2015. In this study, culture environment consumer for differential diagnosis of bacteria is

presented in table 1.

Culture medium	The purpose application
Eosin Methylene Blue (EMB)	To detect Escherichia coli
Mannitol salt agar	To identify Staphylococcus aureus
Cetrimideagar	To detect Pseudomonas aeruginosa
Bile Esculin Agar (BEA)	To detect Enterococcus
Mueller Hinton Broth	To detect Enterococcus
OF	To identify Acinetobacter
Mueller-Hinton Agar	To identify Acinetobacter
Stewart	Temporary preservatives medium

Table 1: Culture environment consumer for differential diagnosis of bacteria in this study.

This study was conducted in two hospitals of Imam Reza and Imam Khomeini of Kermanshah in which sampling of the 17 sections in 40 levels, which on the whole is 450 samples, were prepared, tested and evaluated. In 14 sections and 37 level of Imam Reza hospital 337 samples were taken; and also from 6 sections and 24 level of Imam Khomeini hospital 113 samples were taken. For sampling, first, a sterile swab which is soaked in sterilized physiological serum was used for sampling from desired levels and quickly swap was placed in pipes containing Stewart culture environment that is a temporary pre-numbered support environment. Then sampled surfaces are disinfected. After the lapse of time which each disinfectant is remained for a necessary time re-sampling was done from these levels while it was prevented from infecting the disinfection area. In the following, the samples were immediately transferred to the laboratory and it was attempted to culture the samples in blood agar environment. Culture plates are placed in the incubator at 37 ° C for 24 hours and after 24 hours each plate is checked from colony growth. For the detection of bacteria, standard methods are used⁽⁵⁾.

So that sampling is done from the blood agar plates the colony with growth (positive plates); and in a specific culture environment each bacteria can be cultured according to standard methods. Independent two-group t-test was used to compare

to average counted colonies in the cases of the surveyed hospitals prior to disinfection; also it was used to average the efficiency of new and common disinfectants (together) in reducing nosocomial infection indicators in two surveyed hospitals. To compare the counted average colonies, one-way analysis of variance (ANOVA) was used in the study samples in various sectors and different levels of Imam Reza and Imam Khomeini hospitals prior to disinfection. To compare total average counted colony in the samples, paired t-test were used before and after disinfection for each of disinfectants

Results

The findings of the study in are summarized in table 2 to 4 and figures 1 to 3. The average total of the counted colony related to indicators of hospital infections, prior to disinfection, in the studied sample is 281.4 in Imam Reza Hospital and it is 364.2 for Imam Khomeini Hospital. During the study, before disinfection, the most polluted parts and the highest number of colonies is related to Kitchen and burn unit and a minimum of pollution is seen in the operating room. Also, the most polluted areas are the bottle suction with 1464 colonies, desk with 815 colonies, and the floor, stairs and lift with more than 600 colonies. In receivers and drug pence in Traleethe least number of the coliforms was observed. After disinfection, the least amount of reduction in the number of coliforms was observed in the Department of Oncology and kidney transplant in Imam Reza hospital and the wall and keyboard had reduction in the number of coliforms 67% and 74%, respectively.

In Imam Khomeini hospital, after disinfection, the reduction in the number of coliforms as observed in the following sections: 86% reduction in the burn unit, 92% reduction in the infectious diseases ward, 75% reduction in nursing stations and refrigerators part, 80% reduction in lockers, and 89% table diet of patients. In evaluating the efficiency of new and common disinfectants in surveyed hospitals, it was observed that the average overall performance of common disinfectants is 96.7 % and the average overall performance of new disinfectants is 98.5 % in reducing the indicators of hospital infections.

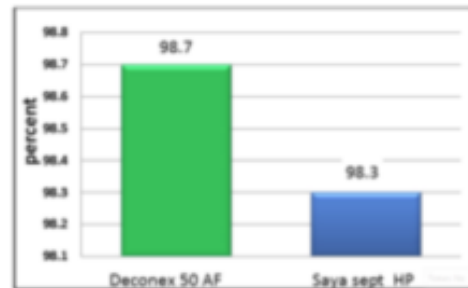


Figure 1: The average efficiency of new and current disinfectants of large surfaces in reducing Nosocomial infection indicators in Imam Reza and Imam Khomeini hospitals.

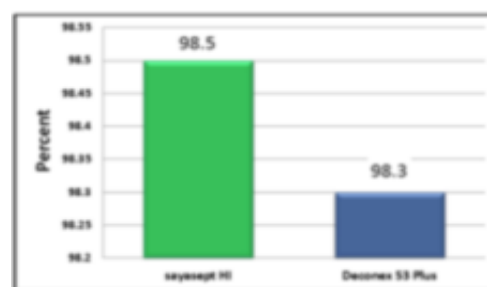


Figure 2: The average efficiency of new and current disinfectants tools and equipment in reducing Nosocomial infection indicators in Imam Reza and Imam Khomeini hospitals.

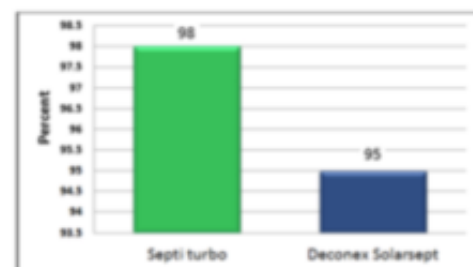


Figure 3: The average efficiency of new and current disinfectants of small surfaces in reducing Nosocomial infection indicators in Imam Reza and Imam Khomeini hospitals.

Disinfectant	Type of current disinfectant	Number of samples	The number of colonies in samples
Current	Sayasept HP	95	98.3 ± 6.9
	Deconex 53 plus	59	96.0 ± 12.8
	Solarsept	65	95.0 ± 15.5
New	Deconex 50 Af	110	98.7 ± 4.6
	Turbo septi	51	98.0 ± 8.9
	Sayasept HI	36	98.5 ± 4.7

Table 2: The average efficiency of new and common disinfectants in reducing nosocomial infection indicators in two surveyed hospitals.

Disinfectant	Parameter	Number of samples	The number of colonies in samples
Current	Deconex 50 Af	78	99.7 ± 1.6
	Turbo septi	32	100.0 ± 0.0
	Sayasept HI	32	98.3 ± 4.9
New	Sayasept HP	54	99.7 ± 0.9
	Deconex 53 plus	56	95.7 ± 13.1
	Solarsept	57	97.4 ± 9.1

Table 3: The average overall performance of 6 examined disinfectants in reducing nosocomial infection indicators of Imam Reza hospital.

Disinfectant	Parameter	Number of samples	The number of colonies in samples
Current	Deconex 50 Af	32	96.4 ± 7.8
	Turbo septi	19	94.8 ± 14.3
	Sayasept HI	4	100.0 ± 0.0
New	Sayasept HP	41	96.5 ± 10.2
	Deconex 53 plus	3	100.0 ± 0.0
	Solarsept	8	77.6 ± 13.9

Table 4: The average overall performance of 6 examined disinfectants in reducing nosocomial infection indicators of Imam Khomeini hospital.

There is a significant difference among the average overall performance of six evaluated disinfectants in reducing nosocomial infection indicators in Imam Khomeini hospital ($P < 0.05$).

Discussion

According to the results of the research, there is a significant difference between the performance of new and common disinfectants in reducing nosocomial infection indicators in hospitals. As the results show new disinfectants are more efficient than traditional ones. In both hospitals, new disinfections are more efficient than common disinfectants. In this regard, bacteria resistance can be pointed to common disinfectants. Sayasept HP, in common disinfectants, and 50 Deconex AF, in new disinfectants, have the highest performance in the removal of bacteria in nosocomial infections index. It is necessary to mention that both of these disinfectants are categorized in large surface disinfectants. Two other disinfectants that are used for disinfection of tools are Sayasept HI and Deconex 53 plus. Sayasept HI is more efficient than Deconex 53 plus. Turbo septi and DeconexSolarsept are used to disinfect small surfaces. Turbo septi is a new disinfectant

and has a higher efficiency than the current disinfectant of DeconexSplarsept. The results show that there is a significant difference between the average efficiency of examined disinfections together in Imam Reza hospital. Thus, the least efficiency is related to Deconex 53 plus. In the case of low relative performance of this disinfectant, it can be noted that, according to the manufacturer’s instructions for disinfecting tools by this disinfectant, immersion method should be used, but in this study, the method used in the hospital was spraying which does not lead to the desired results. Ohering and colleagues, in their study, concluded that spraying is not a good way to disinfect instruments⁽⁶⁾.

NejatiBakhsh and et al. in their research about examining Deconex 53 plus and DeconexSolarsept disinfection performance in the turbines infected with oral microbial flora found different results. He gained Deconex 53 plus efficiency and performance 65% and he calculated DeconexSolarsept efficiency and performance 15%. The reason for these differences can be seen in the procedure. NejatiBakhsh dipped turbines into the bacterial suspension in order to infect them for 5 minutes; and then for 15 minutes the swallow in disinfectant. This method was quite different from the way they used in the present study⁽⁷⁾.

In Imam Khomeini hospital, there is a significant difference between the average efficiency of six reviewed disinfectant. Thus, the least performances are related to the turbo septi and DeconexSolarsept. These disinfectants were ready to use disinfections and they act based on alcohol and other disinfectants are water-based. In this case, according to the principles of disinfectants it can be stated that the disinfectants that are water-based are stronger than alcohol-based disinfectants. Sodium hypochlorite is a water-based disinfection and it tends to be dissolve in water and it can absorb water from the air molecules and this is in conflict with hydrophobic characteristics of the disinfectants and it makes the performance better⁽⁸⁾.

Molinari claims that initial cleaning of surfaces from pollutants (organic matter, blood, pus, etc) is very important⁽⁹⁾. About the effect of organic matter on reducing the efficiency of disinfectants, we can say that some organic compounds stick to the surface and reduce or delay the effects of disinfectant. Sometimes chemical materials react with organic matter and new products are produced and it prevents the disinfectants to affect. Sometimes disinfectant oxidizes organic matter and thus it vitiates the

disinfecting agent⁽¹⁰⁾. She also noted that since these compounds and aldehydes, phenol-free and they are harmless, they are used in Brazil health centers⁽¹¹⁾. Priscilla also pointed out that although alcohol combinations are antimicrobial, they do not have spore property and only in special circumstances they can have growth-preventing property⁽¹¹⁾. Also in the case of disinfection quaternary ammonium compounds such as Sayasept HI, Sayasept HP, 50 Deconex AF and Deconex 53 plus lead to destroying microorganisms through adhesion and tearing of cytoplasmic membranes and consequently departure of cell contents. The effects of these compounds in hard water and organic and inorganic sediments and materials such as gas and cotton are reduced⁽¹⁰⁾. The germicidal capability of Deconex 53 Plus is reduced by soap, non-ionic surfactants and chlorine compounds. Quaternary ammonium compounds in alkaline solutions have more bacterial properties and it is in conflict with soap detergent⁽¹¹⁾.

In many sources, quaternary ammonium compounds lack 100% antibacterial power and in these resources, the effects of quaternary ammonium compounds are in bacteriostatic level⁽¹²⁾. Sayasept HP disinfectant is introduced as the weakest disinfectant according to this index. Sayasept HP disinfection is water-based quaternary ammonium compound. It should be noted that the effect of these compounds against hard water is reduced. In this study, for dilution of the compound, water piping network of Kermanshah University of Medical Sciences was used which a hardness of 300-250 ppm based on calcium carbonate which is considered in the category of hard water. This can be likely the reason for poor performance of this disinfectant. The difference between the strongest and the weakest combination of disinfectants can be possibly in nature and chemical formulations of disinfectants.

Conclusion

According to the results, to disinfect tools and equipment sayasept HI is proposed; to disinfect large surfaces 50 Deconex AF is recommended and to disinfect small surfaces DeconexSolarsept is suggested. It is needless to say that all of these of three disinfectants are new disinfection.

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