

A comparative study of disinfectants for cleaning intensive care unit surfaces

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Abstract:

Disinfection plays a major role in preventing these infections. Aim: treating nosocomial infections is challenging as most of the causative agents are multi-drug resistant. Material & Method: In this context, an attempt was made to compare the efficacy of (5%, 10%) sodium hypochlorite disinfectant and (70%) isopropyl alcohol as surface disinfectants in the Intensive Care Unit (ICU). Samples were collected from bed railings, the surface of the monitor and the side table of all ICUs of Al Wahda Hospital. Samples were collected before and after disinfection using appropriate disinfectants. After cleaning samples were collected after a contact time of 20 minutes. Samples were inoculated onto one set of the blood agar plates and one set of MacConkey agar plates incubated at 37°C under aerobic conditions. After incubation colony count was done manually to compare the results. Result: Under aerobic conditions the 10% sod. Hydrochloride was found 96.7% more efficient than isopropyl alcohol and when used 70% isopropyl alcohol was found only 36.7%. This difference is significant statistically as the p-value is 0.05. 10% sod. Hydrochloride is a better surface disinfectant to be used in intensive care units as it is safe to use and cost-effective on the other hand isopropyl alcohol is less efficient and also it is expensive. **Conclusion:** This study showed that there were statistically significant differences between the efficacies of disinfectants. that 110% sodium hypochloride is a better surface disinfectant to be used in intensive care units as it is safe to use and cost-effective

Keywords: Disinfectants, Intensive Care Unit, Sodium Hypochloride, Isopropyl Alcohol

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Introduction

Nosocomial infections represent a major health problem because of the excess morbidity and mortality. Two million people per year are affected by hospital-acquired infections (5-10% of hospitalized patients). In the United States, it is the 8th leading cause of death directly or indirectly causing 80,000 deaths. (1) Treating nosocomial infections is challenging as most of the causative agents are multi-drug resistant. (2) Major reservoir of multi-drug resistant organisms (MDRO) is the environmental surface and they remain viable for days to months on various inanimate surfaces. From the environment to patients pathogens can be transferred either directly by contact between the patient and contaminated environment or indirectly through the hands of health care workers (HCW). There are so many reasons for hygiene failure which include HCW understaffing, and the ineffectiveness of

common disinfectants against bacteria on the ICU surface. (3) Therefore, we have to give more importance to preventing these infections. Preventative strategies against both development of specific infections and the spread of antibiotic-resistant pathogens play an important role in preventing nosocomial infections. Disinfection plays a major role in preventing these infections. Now a day's several disinfectants are available in the market but still we need to search for a better one which is more efficient and also cost-effective. (2). In this context an attempt was made to compare the efficacy of (5%) Sodium hypochlorite which is a high-level disinfectant and (70%) isopropyl alcohol which is an intermediate-level disinfectant as a surface disinfectant in ICU. Both are having their own advantages and disadvantages

Aim of study

To compare the efficacy of Sodium hypochloride and isopropyl alcohol as surface disinfectants in intensive care units in Al Wahada hospital.

Material and methods

This prospective cross-over study was performed in the department of Microbiology lab, College of Medical Technology –Derna from July 2021 to October 2021. Surface swabs from all the ICUs (both medical and surgical) constitute the source.

Samples were collected from bed railings, the surface of the monitor and the side table of all ICUs of Al Wahada Hospital, using sterile cotton swabs dipped in saline. Samples were collected before and after disinfection using appropriate disinfectants (70% isopropyl alcohol 5% and 10% sodium hypochloride). After cleaning samples were collected from the same place after a contact time of 20 minutes. (13)

Samples were first inoculated into liquid media like peptone water. After incubating for 24 hours at 37°C the sample from the broth was inoculated onto one set of the blood agar plates and one set of MacConkey agar plates. One set of the blood agar plate and MacConkey agar plates were incubated aerobically at 37°C for 48 hours. After incubation colony count was done manually to compare the results. The plated microbes grow from a colony-forming unit (CFU) consisting of one or more cells into a visible colony that was seen and counted.

Statistical analysis

Data were fed to the computer and analyzed using IBM SPSS software package version 20.0. (Armonk, NY: IBM Corp) Qualitative data were described using numbers and percentages. Kolmogorov-Smirnov test was used to verify the normality of distribution Quantitative data were described using range (minimum and maximum), mean, standard deviation, and median. The significance of the obtained results was judged at the 5% level.

Results and discussion

Disinfection plays a major role in preventing HAIs. Now a day's several disinfectants are available in the market but still, we need to search for a better one which is more efficient and also cost-effective. In the study by tuhinabanerji et al (15) it was found that super oxidised water can contain hypochlorous acid which is safe to be used as a surface disinfectant in ICU. A study done by Caroline Blazejewski et al (16) used hydrogen peroxide for surface disinfection and found that it is more efficient than routine terminal cleaning alone in ICU contaminated with multi-drug resistant organisms. This study was conducted in Al-Wahada Hospital including ICUs was found to be 96.7% more efficient than 10% sod. hydrochloride than 5% sod. hypochloride under aerobic conditions and it was only 36.7% more efficient than 70% isopropyl alcohol the difference is significant statistically. After disinfecting with 10% sod. hypochloride Colony count goes reduced from 21 to only one colony in ICUs. Version Penna et al (17) concluded that sod. hypochloride exhibit high bactericidal, fungicidal and viricidal activity and can be used as a high-level disinfectant but it demands a safe work environment and a training programme to assure workers' safety and standards. On the other hand, isopropyl alcohol is not sporicidal but it is effective in inhibiting the germination of spores. But a study done by Maria Reggiani et al (19) concluded that the difference in efficacy of sod. hypochloride and isopropyl alcohol were not significant statistically in killing *Streptococcus mutants*, *Staphylococcus aureus* and *Candida albicans*. As Isopropyl alcohol is cheaper, easily available and there are no side effects. Sod. hydrochloride is considered better to use as a surface disinfectant in I

Table 1 Table title should be of font size 10pt, Times New Roman, justify

Table (1): Comparison of efficacy of isopropyl alcohol (70%) and sodium Hypochloride (5%, 10%) when plates were incubated aerobically

Colonies Count	Time				X ²	P-Value
	Pre		Post			
	No.	%	No.	%		
Dis 1 (Alcohol)						
Negative	9	30.0	11	36.7	$\chi^2 = 0.300$	0.584
Positive	21	70.0	19	63.3		
Min. – Max.	0.0 – 130.0		0.0 – 21.0		U = 270.0*	0.007*
Mean ± SD.	22.10 ± 26.78		5.53 ± 6.11			
Median	13.50		3.0			
Dis 2 (sod. hypo 5%)						
Negative	9	30.0	21	70.0	$\chi^2 = 9.600^*$	0.002*
Positive	21	70.0	9	30.0		
Min. – Max.	0.0 – 65.0		0.0 – 11.0		U = 179.50*	<0.001*
Mean ± SD.	19.83 ± 18.92		1.30 ± 2.53			
Median	17.0		0.0			
Dis 3 (sod. hypo 10%)						
Negative	9	30.0	29	96.7	$\chi^2 = 28.708^*$	<0.001*
Positive	21	70.0	1	3.3		
Min. – Max.	0.0 – 65.0		0.0 – 65.0		U = 160.0*	<0.001*
Mean ± SD.	19.83 ± 18.92		2.17 ± 11.87			
Median	17.0		0.0			

SD: Standard deviation

H: H for **Kruskal Wallis test** χ^2 : **Chi square test**

p: p value for comparing between the studied groups

p₁: p value for comparing between **DIS1** and **DIS2**

p₂: p value for comparing between **DIS1** and **DIS3**

p₃: p value for comparing between **DIS2** and **DIS3**

*: Statistically significant at $p \leq 0.05$

Conclusion

This study showed that there were statistically significant differences between the efficacies of disinfectants. that 110% sodium hypochloride is a better surface disinfectant to be used in intensive care units as it is safe to use and cost-effective.

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