



EFFICACY OF DISINFECTION ON VARIOUS SURFACES

Community Medicine

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ABSTRACT

Introduction: Various workers have demonstrated that environmental surfaces near patients in health care settings are full of contamination. However, despite extensive search on the internet studies on efficacy of disinfection on various surfaces were conspicuous by their scarcity. **Methodology:** Randomly selected sites measuring one sq inch in size were marked on various surfaces in a presumably Non Covid19 health care facility. A total of twenty four samples were taken as against the minimum required of twenty. The surfaces were subsequently disinfected using 70% alcohol based disinfecting wipes which were procured locally. All samples were suitably labelled to avoid any mixing of samples. The samples were plated on blood agar media and McConkey's media and incubated at 37°C for 3 days. The mean levels of contamination on various surfaces before and after disinfection were analysed and compared for log₁₀ reduction using appropriate statistical tests. **Results:** The difference in mean level of contamination across the various surfaces before disinfection was statistically very highly significant at 5% level of significance. (F = 6980453.16, p = 0.00). The difference in mean level of contamination across the various surfaces after disinfection was statistically not significant at 5% level of significance. (F = 3.14, p = 0.08). This study demonstrates that 70% alcohol based disinfecting wipes which are easily available locally are equally effective in reducing microbiological contamination on various surfaces. **Conclusions:** In our study, the workers have confirmed that use of 70% alcohol based disinfecting wipes which are commercially available can significantly reduce the microbiological plate count from various commonly touched surfaces in a health care setting.

KEYWORDS

Efficacy, disinfection, surfaces, alcohol

INTRODUCTION:

In December 2019, the novel coronavirus SARS-CoV-2 outbreak was reported in Wuhan, China. It spread globally; and was soon declared a pandemic by the World Health Organization (WHO).^{1,2}

Various workers have demonstrated that environmental surfaces near patients in health care settings are full of contamination, which spreads through frequently touched surfaces like body of the patient, curtains, door knobs, bed side rails and sinks.^{3,4,5,6}

However, despite extensive search on the internet we observed that the studies on efficacy of disinfection on various surfaces were conspicuous by their scarcity, both in India as well as abroad. It was keeping in view the inadequacy of such studies and the role of inanimate objects in propagating the raging global pandemic that the present study was taken up.

METHODOLOGY

Various surfaces in a presumably Non Covid19 health care facility were identified. These surfaces were Medical Officer's table, (glass top), Nursing Assistant's table, (wooden top), Patient bed railing and patient stool, (metal top), wash basin (ceramic) and computer keyboard (plastic). Randomly selected sites measuring one sq inch in size were marked on each of these surfaces using a suitable marking ink. Based on previous available literature, mean contamination on various surfaces was 10⁵/ml before disinfection and there was a 4 log₁₀ reduction after disinfection.^{5,7,8}

Using appropriate statistical tools sample size was calculated as two. Hence, two samples were required to be taken from each of the five surfaces before disinfection and two after disinfection. From surfaces which were visibly more contaminated i.e. computer keyboard, 3 samples each were taken before disinfection and after disinfection. Similarly, one sample was taken from the patient bed and two from the patient stool which is used more frequently; and since the bed and stool are primarily different objects. Thus, a total of twenty four samples were taken as against the minimum required of twenty.

A dry sterile swab mounted at the end of a stick was rubbed and rotated on the area which was marked on each surface moving from end of the marked area to the other end. Due caution was exercised that the swab is rubbed and rotated over the entire marked area, without missing any

part and without redoing any part. Adequate pressure was applied while rubbing and rotating the swab, so that maximum contamination from the surface is picked up on the swab, while at the same time taking due care that the stick does not break due to excessive pressure. Twenty seconds were spent in taking the each sample. After taking the samples, the swabs were immediately put in air tight screw capped sterile bottles. This method of taking samples has already been validated by previous workers.⁹

The surfaces were subsequently disinfected using 70% alcohol based disinfecting wipes which were procured locally. The area which was marked on each surface was rubbed vigorously and repeatedly for thirty seconds. The surfaces were then allowed to dry for ten minutes. This method of carrying out disinfection of surfaces has also been validated by previous workers.^{5,10}

The samples taken after disinfection were also immediately put in air tight screw capped sterile bottles. All samples were suitably labelled to avoid any mixing of samples of different surfaces or samples taken before and after disinfection. The samples were sent to the Microbiology laboratory of the local service hospital. They were plated on blood agar media and McConkey's media and incubated at 37°C for 3 days. The reports were taken as Colony Forming Units (CFU) per ml after the incubation period. The mean levels of contamination on various surfaces before and after disinfection were analysed and compared for log₁₀ reduction using appropriate statistical tests. One blank sample was used as control to check the validity of the microbiology laboratory report.

Routine disinfection of the premises of the health care facility was being carried out on a daily basis using a commercially available disinfectant containing 70% isopropyl alcohol. However, on the day the samples were collected routine disinfection of the premises was carried out after collecting all the samples.

RESULTS

The results of microbiological plate count before disinfection and after disinfection are tabulated in Table 1.

The above results were subject to test of hypothesis for independent means using ANOVA. The difference in mean level of contamination across the various surfaces before disinfection was statistically very

highly significant at 5% level of significance. ($F = 6980453.16$, $p = 0.00$). There was a reduction of $3\log_{10}$ in the microbiological plate count after disinfection on glass and wooden surfaces, $2\log_{10}$ to $3\log_{10}$ on metal surface; and $4\log_{10}$ reduction on ceramic and plastic surfaces. The difference in mean level of contamination across the various surfaces after disinfection was statistically not significant at 5% level of significance. ($F = 3.14$, $p = 0.08$). In terms of percentage the reduction in microbiological plate count was 99.9% for glass and wood, 99.85% for metal and 99.99% for ceramic and plastic. This study demonstrates that 70% alcohol based disinfecting wipes which are easily available locally are equally effective in reducing microbiological contamination on various surfaces.

Table 1: Results of microbiological plate count before disinfection and after disinfection

Surface	Before disinfection		After disinfection	
	Sample Number	Microbiological Report (CFU/ml)	Sample Number	Microbiological Report (CFU/ml)
Medical Officer's table (Glass top)	1	10^4	1	10^1
	2	10^4	2	10^1
Nursing Assistant's table (Wooden top)	1	10^3	1	10^0
	2	10^3	2	10^0
Patient bed railing and patient stool (Metal top)	1	10^2	1	10^0
	2	10^3	2	10^0
	3	10^3	3	10^0
Wash basin (Ceramic)	1	10^5	1	10^1
	2	10^5	2	10^1
Computer keyboard (Plastic)	1	10^6	1	10^2
	2	10^6	2	10^2
	3	10^0	-	-

CONCLUSION

Nikki et al observed a more than $5\log_{10}$ reduction of CFU for tested wipes and sprays for all reported strains of bacteria, except with hydrogen peroxide spray and vancomycin-resistant enterococci (VRE).⁵

Liyan et al reported > 99.95% killing efficiency of 3-second steam treatment on biofilms of *Escherichia coli*, *Acinetobacter baumannii*, *Pseudomonas aeruginosa*, and *Staphylococcus aureus* on polycarbonate; and biofilms developed by *E coli* on polycarbonate, rubber, stainless steel, and ceramics.⁴

Katrin et al did not observe any difference in antimicrobial efficacy of alcohol-based disinfectant when applied to antimicrobial active copper alloy carriers, tiles or stainless steel discs against *P. aeruginosa*, *S. aureus*, and *C. Albicans*. They observed a 5 log reduction for the tested bacteria and a 4 log reduction for the yeast.¹¹

Abel et al observed a ≥ 4 log CFU/mL reduction against *Escherichia coli*, *Staphylococcus aureus*, *Enterococcus hirae*, and *Pseudomonas aeruginosa* on stainless steel surfaces using 0.5% hydrogen peroxide with a cationic polymer, ethoxylated fatty alcohol, and ethyl alcohol.⁷

Jana et al reported a reduction in contamination ranging from 31.8% to 100% due to various bacteria, yeasts and moulds from mobile phones and computer keyboards after disinfection with disposable, commercially available disinfectant wipes with active ingredients chlorhexidine digluconate and triclosan.⁹

The findings of all the above workers are similar to the present study.

In our study, the workers have confirmed that use of 70% alcohol based disinfecting wipes which are commercially available can significantly reduce the microbiological plate count from various commonly touched surfaces in a health care setting.

We also advocate good hygiene practices to prevent transmission of pathogens through these surfaces. Regular health education and training on proper standards of hygiene, cough etiquette, and hand hygiene should be imparted to all.

LIMITATIONS

The limitation of this study is that no species identification of the

bacteria was carried out; and efficacy of the disinfectant for viruses could not be tested due to constraints of manpower and resources owing to the ongoing Covid19 pandemic.

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