PEDIATRIC INFECTIOUS DISEASE SOCIETY OF THE PHILIPPINES

PIDSP JOURNAL

Vol 17, No. 1
January-June 2016

Vol.17 No.1
January-June 2016

Pediatric Infectious Diseases Society of the Philippines Journal
Vol 17 No.1 pp. 45-50 Jan – Jun 2016
Lagaya-Aranas LM. RCT of isopropyl alcohol vs hand washing for hand hygiene

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The authors declare that the data presented are original material and have not been previously published, accepted or considered for publication elsewhere; that the manuscript has been approved by all the authors, who have met the requirements for authorship.

BRIEF REPORT

RANDOMIZED CONTROLLED TRIAL COMPARING THE EFFICACY OF 70% ISOPROPYL ALCOHOL HAND RUB VERSUS STANDARD HAND WASHING FOR HAND HYGIENE AMONG HEALTHCARE WORKERS

ABSTRACT

Access to handwashing areas is not as convenient as having alcohol in one's pocket or bedside. Alternatively, cleaning the hands with alcohol can save us a lot of time and effort in disinfecting our hands thus giving us more time for patient care. If alcohol can be proven as effective as soap and water in hand disinfection, then residents and nurses may use this method of hand hygiene instead.

Objective: To compare the efficacy of 70% isopropyl alcohol against standard handwashing in hand hygiene among medical residents and nurses at a tertiary hospital.

Methods: Seventy-six doctors and nurses were randomly assigned to two groups with 38 subjects each. Group 1 used plain soap and water while group 2 used 70% isopropyl alcohol hand rub. Hand swabbing was done before and after hand hygiene. The presence or absence of bacteria was compared for the same subject, before and after hand disinfection. The mean decrease in colony count in group 1 was compared to group 2.

Results: Both groups were successful in reducing the mean colony count. Handwashing group had a decrease from 27.34 $\pm$ 33.17 to 3.58 $\pm$ 6.63 CFU, while the alcohol group from 21.5 $\pm$ 31.13 to 0.76 $\pm$ 1.48 CFU, both with p values <0.05. But in comparison, the mean changes for both groups were not statistically significant, therefore no intervention was superior to the other and both were equally effective.

Conclusion: Seventy percent isopropyl alcohol is as effective as standard handwashing in disinfection. It is recommended to have 70% isopropyl alcohol at bedside/individually carried by doctors/nurses for easy access. Observation of proper hand washing technique should always be emphasized. Bacterial colony identification is ideal for future studies.

KEYWORDS:
hand washing, isopropyl alcohol, hand hygiene

INTRODUCTION

Hand washing is very important especially for hospital employees whose main job is patient care. Hand washing prevents the spread of bacteria and viruses that cause diseases. In government hospitals such as the National Children's Hospital, there is abundance in patients with different diseases and doctors and nurses handle quite a handful of them. Daily rounds and examining patients, jumping from one bed to another, is part of their job, exposing them to more bacteria and viruses which may be transmitted if without proper care and hygiene. Access to hand washing areas (sink/water supply) is not as convenient as having alcohol in one's pocket or at one's bedside. Going to the nearest sink after every examination of a patient can be quite tedious and time consuming that is why some forego this procedure and continue on examining patients without even cleaning their hands. Cleaning the hands with alcohol, as an alternative can save us a lot of time and effort in hand disinfection, and is more convenient, thus giving more time for patient care. If alcohol can be proven as effective in hand hygiene as soap and water, then residents and nurses at the National Children's Hospital may use this method of hand cleaning instead.

Proper hand hygiene can never be overemphasized especially in hospitals wherein it plays a big role in preventing the spread of diseases. Hand hygiene, a very simple action, remains the primary measure to reduce health care associated infections and spread of antimicrobial resistance, yet compliance with hand hygiene is very low[7]. In developing countries, 4,384 children die every day of health care associated infection[7]. Several techniques have been used to clean the hands and the technique's effectiveness in eliminating contamination has been compared several times. Different studies showed different results. A study done at the Philippine General Hospital by Cotillon et al in 1997 showed that 70% isopropyl alcohol was more effective compared to routine hand washing using soap and water in reducing resident bacterial flora specifically coagulase positive organisms. The use of soap and water had a mean decrease in the number of colony count of 21, while alcohol use was 109, with a $p<0.0001$[1]. In a study by Larson et al, traditional hand washing technique with soap and water was compared with an alcohol hand sanitizer which showed no significant difference in the spread of neonatal infection at the neonatal intensive care unit. The odds ratio for alcohol compared with hand washing were 0.98 with a 95% CI (8% - 44%)[2]. Another study by Girou et al, hand rubbing with an alcohol-based solution is significantly more efficient in reducing hand contamination than handwashing using antiseptic soap. The median difference in the percentage reduction was 26% with a p value of 0.012[3]. This is contrary to the study of Oughton et al which showed that handwashing is superior over alcohol based solutions, particularly in decreasing *Clostridium difficile* to 2.14log CFU/mL with a 95% CI (1.74 – 2.54log10 CFU/mL) [4]. In the American Journal of Infection Control, their study showed that although the regular use of hygienic soap and water is the gold standard for hand hygiene, the use of alcoholic solutions is effective and safe and deserves more attention especially in situations in which hand washing compliance rate is hampered by problems such as work overload or lack of facilities.

The objective of this study is to compare the efficacy of 70% isopropyl alcohol hand rub against standard handwashing in hand disinfection among medical residents and nurses at the Neonatology, Gastrointestinal, Miscellaneous 3, Respiratory and Neurology wards at the National Children's Hospital. Outcome measures include the decrease in hand

bacteria colony count and eradication of bacteria. The adverse effects of both interventions shall also be determined.

MATERIALS AND METHODS:

Seventy-six subjects consisting of medical residents and nurses assigned at the infectious wards of the National Children's Hospital were included in the study. Those with existing hand dryness, pruritus or irritation were excluded. The sample population was randomized into two groups using manual randomization (draw lots), with 38 subjects per group. Group 1 was composed of medical residents and nurses who used antiseptic free or plain soap (Perla soap) and water for hand disinfection (the same brand of soap was used by all subjects, same amount of time spent in hand washing which is 20 seconds, and all used clean disposable tissue for wiping) and followed the standard way of hand washing according to the World Health Organization[7]. Group 2 was composed of medical residents and nurses who used 70% isopropyl alcohol for hand disinfection (the same brand of alcohol was used by all subjects, amount applied liberally and rubbed properly until dry for every subject) [7]. A participant data collection form was used to collect data after signing the informed consent). The research was conducted after approval of the ethics committee.

The medical residents' and nurses' hands were swabbed by a medical technologist, unaware of the subjects' group assignments and under the supervision of the investigator, after doing their rounds with patients admitted at the Neonatology, Misc 3, Respiratory and Neurology wards in the hospital. First swabbing was before hand disinfection (group 1 with soap and water, group 2 with 70% isopropyl alcohol) and second swabbing was right after hand disinfection.

The swab samples were inoculated on blood agar plates. The collected samples were sent to the laboratory where incubation was done for 18 – 24 hours. The presence or absence of bacteria and the number of colony count were compared for the same person, before and after hand disinfection. The presence or absence of bacteria was noted and/or the mean decrease in the number of colony count in group 1 was compared to that of group 2.

Adverse effects for every subject were monitored.

Data Analysis: Independent t-test was used to compare between groups and paired t-test was used to compare before and after data within the group. Fishers Exact Test was used to determine if there was significance in the adverse effects across groups. Alpha was set at 0.05 for all tests.

Definition of terms:

1. Hand washing - the use of tap water and Perla soap, using the World Health Organization guidelines for hand washing for at least 20 seconds.
2. Alcohol washing - the use of 70% isopropyl alcohol rubbed on the hands until dry, liberal amount of alcohol to be used per subject
3. Control group - residents and nurses who used hand washing with soap and water
4. Test group - residents and nurses who used 70% isopropyl alcohol for hand disinfection

Limitations of the study:

This study does not include other disinfectants used for hand washing such as povidone iodine, alcogels, hand wipes, etc.

Time of data collection may be a non-peak season for patients, which may result in a lower yield of bacteria in hand swabbing.

Reading of results is limited only to colony count and not the identification of bacteria due to financial restrictions.

RESULTS

The sex distribution for both groups is composed mostly of females with 78.95%. There was no

difference in the mean age for both group 1 and group 2. The mean age for both groups is 27.12 ± 5.06 with a p value of 0.482012, making no statistical difference between the two groups. The baseline colony count data before the intervention of the hand washing group versus that of the alcohol group were comparable. Although the hand washing group had a higher mean colony count, this is not statistically significant compared to that of the alcohol group as shown in table 3. Table 4 shows that both groups were successful in reducing the mean colony count, granted that both interventions were effective on their own. But in comparison, the mean changes for both groups were not statistically significant, therefore no intervention was more superior than the other and both were equally effective. There was a 90.43% ± 21.03 mean decrease in the colony count in the hand washing group compared to that of the alcohol group with an 84.77% mean decrease. In the alcohol group, 65.79% of its subjects had bacteria eradication compared to that of the hand washing group with 52.63% of its subjects with bacteria eradication.

Table 1. Demographic Characteristics of Standard Hand Washing Group versus 70% Isopropyl Alcohol Group Healthcare Workers

	Soap and water N(%)	Isopropyl Alcohol N(%)	Total N(%)
Female	32(84)	28 (74)	60(79)
Male	6(16)	10 (26)	16 (21)
Total	38	38	76 (100)
Age Mean ±SD	27±5.87	27.2 ±4.17	

Table 2. Bacteria Colony Count of Hand washing versus Isopropyl Alcohol

	Hand washing	Alcohol	p-value
Mean Baseline colony count (SD)	27.43 (33.17)	21.5 (31.13)	>0.05
Mean Colony Count after intervention	3.58	0.76	-
Mean decrease in colony count (SD)	23.76 (29.44)	20.74 (31.13)	<0.05

Table3: Adverse Effects Seen in the Standard Hand Washing Group versus 70% Isopropyl Alcohol Group among Medical Residents and Nurses at the National Children's Hospital (is this the actual number or percentage)

	Handwashing	Alcohol	p-value
Dryness	**0**	**2%**	**0.493**
Pruritus	**0**	**0**	
Irritation	**0**	**0**	**0**

DISCUSSION

This study showed that using 70% Isopropyl alcohol as a hand rub was as effective as washing with plain soap and water based on the difference in colony counts before and after either hand hygiene practice. In a randomized controlled trial of routine hand washing versus the use of 70% isopropyl alcohol by Cotillon it showed that the use of 70% isopropyl alcohol was more effective than the use of soap and water in decreasing the colony count by 109, with a $p<0.0001$[1], contrary to this study, where both interventions were equally effective. Same goes with the study of Girou, Loyeau et al wherein the use of alcohol was also more

efficient in reducing hand contamination than hand washing with soap and water. The median difference in the percentage reduction was 26% with a 95% CI 8% - 44% with a p value of 0.012[3]. The study by Zaragoza, also showed that there was a statistically significant difference in favor of the use of alcohol solution wherein there was an 88.2% decrease in the number of colony units compared to soap and water with only a 49.6% decrease with a p value of less than 0.001[5].

A study by Oughton comparing hand hygiene with soap and water with different interventions such as hand wipes and alcohol based rubs showed that soap and water were still superior in decreasing hand contamination to 2.14log10 CFU/mL with a 95% CI 1.74 – 2.54log10 CFU/mL, in contrast to this study[4]. Other factors that affected the outcome were that of time constraints in hand washing and inadequate facilities[4].

There was no significant difference in the use of soap and water versus alcohol sanitizer in decreasing neonatal infections in the study by Larson[2], wherein the Odds ratio for alcohol compared with hand washing was 0.98 with a 95% CI, same as in this study. Confounders seen in the study by Larson et al were unit design, staff behavior, the frequency of hand washing and the quality of hand hygiene, which could also be found in this study. Another study by Parrienti showed that hand rubbing with alcohol can be safely used as an alternative to traditional surgical hand scrubbing with soap and water wherein there was a 0.04% difference in infection rates (CI 95%)[6], with the same result as this study.

The World Health Organization has released a guideline on hand hygiene last 2005 to globally promote hand hygiene in health care. Worldwide, at least 1 in 4 patients in intensive care will acquire an infection during their stay in the hospital and may even be doubled in developing countries[7]. Availability of alcohol-based hand rubs is critical to promote effective hand hygiene practices, in particular in settings without access to running water, and the introduction of these hand rubs has led to increased hand hygiene compliance among health workers and reduced healthcare associated infections[7]. In this study, several factors may affect the compliance of hand hygiene. Inconvenient sink locations and lack of facilities were some of the factors. The same towel for hand drying was used by everyone and this may further promote the spread of infection rather than prevent it. Some healthcare workers also did not follow the standard way of hand washing as recommended by the WHO. With these in consideration, other alternatives such as alcohol based hand rubs may still promote hand hygiene without the said inconveniences, granted these hand rubs were proven as effective as standard hand washing with soap and water. In the WHO guidelines, self-reported factors for poor adherence are almost the same as in this study, such as inconvenient sink locations or shortage, lack of soap and towel, insufficient time, forgetfulness and no role model[7].

CONCLUSION

Seventy-percent isopropyl alcohol is as effective as standard hand washing in hand hygiene [disinfection]. Both standard hand washing and 70% isopropyl alcohol significantly decreased bacteria colony count and for some, even eradicated bacteria.

Only 70% isopropyl alcohol had side effects of hand dryness after one use of alcohol but is not significant and the benefit outweighs the side effects.

RECOMMENDATIONS

It is recommended to have 70% isopropyl alcohol at the bedside or individually carried by doctors and nurses for easy access in cases of

limited use of water and sink since 70% isopropyl alcohol is proven as effective as standard hand washing. Bacterial colony identification is ideal for future studies. It would also be beneficial to test the efficacy of other means of hand disinfection such as anti-bacterial soap, povidone-iodine, alcogel, etc.

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