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Efficacy of hand hygiene by use of different handwashing solutions and drying methods- Report from Western India

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ABSTRACT

Aim: To determine efficacy of different hand washing solutions and various drying methods.
Settings and Design: This is a prospective study carried out on health care workers at ICU, & Wards in the Tertiary care hospital, from western India for a period of 1 year 6 months. The study was approved by ethical committee of Medical College and Hospital.
Materials and Methods: Two hand hygiene procedures were compared in this study. Handrubbing with alcohol based solution and handwashing with unmedicated soap.
Fingertips of the HCW\'s dominant hand were gently pressed for 5 seconds on sheep blood agar before and after hand hygiene.1 Colony count was performed after 24 hours of incubation. 60 different samples were collected for each method. Out of these 60 handwashing samples, 30 dried hands by paper towels and 30 by cloth towels. Main outcome measure was bacterial reduction of hand contamination.
Results: 120 HCWs were included in the study. The average reduction in the number of colony-forming units after handwashing was 80% for alcoholic solution and 43.16% for soap and water. The average reduction in the number of colony-forming units was 49.10 when hands were dried with paper towels as compared to 37.23 with cloth towels. CONS were the main bacteria colonising the hands of 60% of health care workers.
Conclusions: Alcoholic hand rub is effective and should be followed as standard method for hand hygiene of HCWs in the hospital. It will help to reduce transmission of HAIs and to prevent the spread of antibiotic drug resistance.

1. Introduction

Hand hygiene is the single most important step to stop cross transmission and avoid nosocomial infections since most illnesses are transmitted by the palms of healthcare workers (HCW's).[1–3] The introduction of alcohol based hand rubs has shown significant improved compliance and decrease the nosocomial infection rates.[4,5] Bacteria from ESKAPE group are the common causes of life-threatening HCAIs. MRSA attack rates have been suggested as markers of hand hygiene adherence.[6–8] The present study was done to find out the reduction in the degree of bacterial contamination after using alcohol based handrub and unmedicated soap, and to compare the efficacy of hand drying methods using paper towels and cloth towels. This study will help the infection control committee to train health care workers to reduce transmission of HCAI's.

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2. Materials and Methods

This is a prospective study carried out at ICU, & Wards in the Tertiary care hospital, Western INDIA for a period of 1 year 6 months. The study was approved by ethical committee of Medical College and Hospital.[9] Health care workers working in tertiary care hospital were included in the study after giving informed consent.

Consent for participation was taken from all heath care workers keeping their identity hidden and procedure explained to them. Two hand hygiene procedures were compared- Handrubbing with alcohol based solution and handwashing with unmedicated soap. Fingertips of the HCW's dominant hand were gently pressed for 5 seconds on sheep blood agar before and after hand hygiene.[1] Plates were incubated aerobically at 37°C. Colony count was performed after 24 hours of incubation. 60 different samples were collected before and after use of alcoholic hand rub solution. 60 different samples were obtained from the hands of health care workers before use of unmedicated soap. Out of these 60 HCWs, fingerprints were collected from hands of 30 health care workers after drying of hands by paper towels and cloth towels each. Standard instructions were given to the health care workers to take 2-3 ml of alcoholic handrub and apply to both hands and perform 6 steps of hand hygiene & rub until dry.[1] Standard instructions were given to the health care workers to wash both hands together with unmedicated soap for 1minute, rinse under running water and then dry with paper towel or cloth towel.[1] Main outcome measure was bacterial reduction of hand contamination. Standard microbiological procedure was used for identification of the isolates. Antibiotic sensitivity testing was done by Kirby baur disc diffusion method using CLSI guidelines.

3. Results

A total of 120 HCWs were included in the study. The average reduction in the number of colony-forming units after handwashing was 80% for alcoholic solution and 43.16% for soap and water. The average reduction in the number of colony-forming units was 49.10 when hands were dried with paper towels as compared to 37.23 with cloth towels.The main bacteria colonising the hands were CoNS which colonised hands of 60% of health care workers. Out of total 73 CoNS 11 strains were methicillin resistant. Second highest contaminant ehich contaminated hands of HCW was Diptheroids 25.83%.[2]

4. Discussion

Hand hygiene is the simplest and most effective measure for preventing cross transmission of micro-organisms. Failure to perform proper hand hygiene contributes significantly to outbreaks of infectious diseases and spread of multi resistant organisms.[10] "SAVE LIVES: Clean Your Hands" campaign takes place on 5 May by WHO to improve hand hygiene. The antimicrobial effect of alcohol-based hand hygiene products has been documented to be superior to hand washing.[2,11] and so the present study was done with specific emphasis on transient flora to assess the comparative microbiological efficacy of hand washing (HW) and hand rubbing with an alcohol-based solution (HWR). In our study 120 health care workers participated & were divided into two groups of 60 health care workers each. One group was allocated alcoholic hand rub and the other group handwashing with unmedicated soap. The handwashing group participants dried their hands by cloth towel and paper towel respectively. The results were obtained during the routine hospital practice and each of the five Hand Hygiene (HH) moments as outlined by the WHO was regarded as a HH opportunity in this study. The samples were collected from the fingertips of the health care workers on commercially available sheep Blood Agar plates before and after hand hygiene procedure. Similar method of fingerprints were used in other clinical studies.[1,9,12] Another method which could have been more effective was glove juice technique[13] but we chose fingerprints because of its easy availability and cost. Moreover, the glove juice technique would have interfered with regular activities resulting in non-cooperation of the health care workers due to increased workload. In our study the average hand contamination of the HCW before Alcoholic handrub was 94 CFU per five finger tips, while average hand contamination after Alcoholic handrub was 14 CFU per five fingertips. The mean reduction in hand contamination observed was 80 CFU (Table 1) This is similar to the results found in the studies by Lucet J.C. et al and Abaza F.A. et al[2,11] where the bacterial reduction was seen after the hand hygiene procedures by alcohol hand rub. The average hand contamination before handwashing was 72.93CFU per five fingertips while average colony count after handwashing was 29.76 CFU per five fingertips (Table 2). There was reduction in hand contamination by 43.16 CFU per five fingertips after performing handwashing. The reduction in hand contamination by hand washing was less as compared to alcoholic hand rub. Similar results were reported by Winnefield et al[13] where they compared non medicated soap with alcohol based handrub and reported that alcohol-based rub was more effective than liquid soap in removing the transient bacterial flora. While comparing the efficacy of two different hand hygiene procedures, average reduction in hand contamination by alcoholic hand rub & handwashing was 80 & 43.16 CFU per five fingertips respectively (Table 3). By two sample t-test with equal variance (p value= <0.000) HH by alcohol-based rub was more effective than unmedicated soap because multidrug resistant pathogens were reduced more effectively by alcohol-based products than handwashing with soap and water. In a study by G. Kac, reduction by hand rubbing & handwashing was 98%

Table 1: Alcoholic hand rub by Health Care Workers.

	N=No. of HCW	Mean (CFU)	SD	95% Confidence Interval
Before	60	94.25	31.58	86.09-102.40
After	60	14.25	10.29	11.59-16.90

By paired t- test, p value=<0.000 which is statistically significant
Reduction in colony count=80 CFU

Table 2: Handwashing by unmedicated soap by Health Care Workers.

	N=No. of HCW	Mean (CFU)	SD	95% Confidence Interval
Before	60	72.93	21.15	67.46-78.39
After	60	29.76	12.58	26.51-33.01

By paired t- test, p value=<0.000 which is statistically significant
Reduction in colony count=43.16 CFU

Table 3: Comparison of efficacy between alcoholichandrub and handwash

	N=No. of HCW	Mean (Reduction in CFU)	SD	95% Confidence Interval
Alcoholic Hand rub	60	80	25.32	73.45-86.54
Hand washing	60	43.16	17.12	38.74-47.58

By two sample t-test with equal variances, p value= 0.000 which is statistically significant

Table 4: Comparison of efficacy between paper towel and cloth towel

	N=No. of HCW	MEAN (CFU)	SD	95% Confidence Interval
Cloth towel	30	37.23	17.30	30.77-43.69
Paper towel	30	49.10	14.97	43.50-54.69

By two sample t-test with equal variances, p value=0.0062 which is statistically significant.

Table 5: Clinically important organisms isolated before and after hand hygiene

Organisms	Hand Hygiene	
	Before	After
Coagulase negative staphylococci	73(60.83)	15
(MRCONS) Methicillin resistant Coagulase negative staphylococci	11	4
Diphtheroids	31(25.83)	6
K. pneumoniae	4	1
E. coli	3	1
Pseudomonas spp	2	0
S. aureus	7	1
MRSA Methicillin resistant staphylococcus aureus	2	1
Total	120	24

& 82% respectively which is due to higher intrinsic activity of the hand disinfectant used for hand rubbing. [1]

The difference in efficacy may be due to duration of handwashing, due to recontamination of hands immediately after handwashing or due to single soap used by whole staff for hand washing and closing of tap by same hands. This was observed in manually turning off the faucet, since most of the hospitals do not have automatic systems for handwashing sinks. Advantage of alcoholic handrub is can be provided each bedside & each nursing station, easier and faster to use since it takes about 30 seconds as compared to 45 to 90 seconds for handwashing with unmedicated soap. However, in some situations like when the hands are visibly soiled handwashing is the preferred method of hand hygiene.

More the wetness or moisture on hands more are the chances of survival and cross transmission of the bacteria so drying of hands is an essential component of hand hygiene. Among the hand drying methods two methods had been compared- Drying hands with cloth towel and drying hands with paper towels. The reduction in bacteria when cloth towels were used for drying the hands was 37.23 CFU per five finger tips while drying by paper towels was 49.10 CFU per five fingertips (Table 4). Cloth towels are not recommended as they become a common-use towels at the end of the day & potential source of pathogen transfer. A similar study by Coates et al [14] reported that for effective removal of bacteria hands should be dried by paper towels.

Hanna PJ et al concluded that the preferred method of hand drying in terms of hand hygiene is disposable paper towels.

One study conducted in Western Australia reported a 13% increase in hand decontamination frequency after the introduction of hand sanitizers in an ICU.[13]

Hands are normally colonized by two types of flora- the resident flora and the transient bacterial flora, according to the layer of the skin they colonize. Resident flora which is the less pathogenic, bacteria are more resistant to remove (e.g., Coagulase negative Staphylococci and Diphtheroids). Transient flora is more likely to cause disease and is less resistant to remove. (e.g: S. aureus, Gram Negative Bacilli). Hands are contaminated by this flora during contact with patients or by the contact of the environment of the patient. Microorganisms isolated from the hands of the HCW were mostly coagulase-negative staphylococci, Staphylococcus aureus, Enterobacteriaceae, Corynebacterium spp and Micrococcus spp. CFU counts for Streptococcus viridans and Bacillus spp and Micrococcus, found in few samples, were very low. Among all CONS are the main type of resident skin flora, they were found on almost every hand.[15] In our study also CoNS were the main bacteria colonising the hands of health care workers. 60% of the health care workers hands were colonised with CONS. Out of total 73 CONS isolated 11 strains were methicillin resistant. Nearly same results were reported of colonization of CoNS in 55.4% of the HCW's Abaza F A et al,[2] where CONS were found to colonize 86.3% of the hands of HCW's. Diptheroids were found to be the second highest bacteria that is 25.83% to contaminate the hands after CONS.[2] In this study transient flora, colonising the hands of HCWs were S. aureus (07) and Gram negative bacilli (09) including Escherichia coli, Klebsiella pneumoniae, and Pseudomonas aeruginosa. (Table 5). Out of seven S. aureus, two were MRSA. All the gram negative bacilli isolated were sensitive strains. Similar results were reported for S. aureus and GNB / gram negative bacilli colonization in HCWs in a recent study by Abdel Rahman AT et al and Cook et al. Bacteria from the ESKAPE group are common causes of life-threatening HCAIs. Since alcoholic hand rub is an effective hand hygiene method as it seems to be, according to the results of this study and other studies,[2] it should be followed as standard method for hand hygiene in the hospital which will help the Infection Control Committee to train the health care workers to reduce HAIs and to prevent the spread of antibiotic drug resistance.

5. Conflict of Interest

The authors have stated explicitly that there are no conflicts of interest in connection with this article.

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None.

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