An Evaluation of Brush, Brushless, and Waterless Surgical Hand Scrubs among Health Care Workers in Operating Rooms at a University Hospital in Thailand *

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Abstract

The surgical hand scrub plays a significant role in preventing nosocomial and surgical site infections, and in most hospitals in Thailand a brush is traditionally used. Brushing may result in damage to the skin leading to increased colonization with gram-negative bacteria and candida species.

Purpose: The aim of this clinical trial was to compare the effects of the traditional hand scrubs (Brush with 4% CHG, Method A), brushless with 4% CHG (Method B), and brushless and waterless with 1% CHG and 61% ethyl alcohol and emollients (Method C) with regard to microbiological data, skin condition, cost and time savings.

Methodology: The study design was 3-treatment, 3-period, cross-over design comparing each type of surgical hand scrubs and skin condition, microbiological data cost and time among 45 health care workers in Thai hospital operating rooms.

Results: There was a statistically significant effect of methods of surgical hand scrubs in healthcare workers. Method C had a higher log reduction of colony count compared to Methods A and B. There was no significant difference between Method A and B. There was no significant difference on skin condition among the methods of surgical hand scrubs. The satisfaction of surgical hand scrubs for Method C was significantly higher than other methods. Lastly brushless and waterless, and brushless with 4% CHG resulted in lower costs and time saving compared with the traditional hand scrubs.

Conclusion and recommendations: The practice of surgical hand scrubs of Thai health care workers in operating rooms should be based on evidence-based practices and brushless and waterless surgical hand scrubs should be recommended for use in operating room.

Key words: surgical hand scrubs, brush, brushless, waterless, colony data, skin condition, operating theatres

Introduction

The surgical hand scrub plays a significant role in preventing nosocomial and surgical site infections. The hands of surgeons and scrub nurses carry microorganisms identified as sources of microbial contamination[1,2]. Common organisms causing nosocomial infection are methicillin-resistant Staphylococcus aureus (MRSA),

Acinetobacter baumannii, Pseudomonas aeruginosa, members of Enterobacteriaceae and enterococci[3]. Staphylococcus aureus and coagulase-negative staphylococci (CNS) are the leading causes of surgical site infections. To help combat this problem, surgical scrubbing is performed to remove or destroy transient microorganisms and reduce resident flora[4]. Unfortunately, the effects of frequent scrubbing and handwashing can also damage the skin integrity. The surgical hand scrubbing in most hospitals in Thailand traditionally use brush in the guideline of surgical hand scrubs. Brushing results in damage to the skin leading to increase colonization with gram-negative bacteria and candida species.[5,6]. Seventy-five percent of nurses reported having problems with their hands including dry, scaly, cracked skin, red blotchy skin, or stinging.

The purpose of this clinical trail is to compare the traditional hand scrubs (Brush with 4% chlorhexidine gluconate (CHG), brushless with 4% CHG and brushless and waterless with 1% CHG and 61% ethyl alcohol and emollients in terms of effectiveness of microbiological data, effect on skin condition, cost and time savings.

Statement of purpose

The purpose of this clinical trial was to examine the effectiveness of surgical hand scrubs among health care workers (HCWs) in operating rooms in Thailand. This was accomplished by comparing microbiological data, skin condition, and cost and time savings of the following 3 hand scrub methods: Method A: traditional hand scrub using a brush containing 4% chlorhexidine gluconate (CHG); Method B: brushless hand scrub containing 4% CHG; Method C: brushless, waterless hand scrub containing 1% CHG, 61% ethyl alcohol and emollients

Hypotheses

1. The microbial log reduction among the 3 methods will not be significantly different after 3 weeks

2. A difference in health care workers' skin condition will be detected after using 1 of the 3 methods listed above for 3 weeks

3. Use of Methods B and C will result in lower costs and shorter scrub times than use of Method A

Statement of significance to nursing:

The Association of PeriOperative Registered Nurses (AORN) guideline was used as the conceptual framework of this study including other evidence-based practice guidelines for hand scrubs. Recommended practices for surgical hand antisepsis/ hand scrubs have been developed by the AORN.7 The current practice of surgical hand scrubs in Thai hospitals include using one or two brushes in the practice of surgical hand scrubs. HCWs need to concern with the best evidences of the types, duration and cost of surgical hand scrubs.

Study design

The study design was a prospective, randomized, 3 treatment, 3 period, cross-over design with 1 week washout period before switching to the next method comparing each type of surgical hand scrubs and microbiological data, skin condition, cost and time among HCWs in the operating rooms. The HCWs used the traditional method during the washout period before switching to the next surgical hand scrub method.

Samples: Eligible HCWs from Head-Neck Surgical, Plastic Surgical, Gastrointestinal Surgical and Urological Department were included in this study. The HCWs were recruited from the operating room department, at a 2500-bed University Hospital, Bangkok, Thailand. This university hospital serves as a major area for surgical patients in Thailand. Criteria for sample selection included Thai male and female adult HCWs who a) were scrub nurses or surgeons working in operating rooms; b) did not have a history of CHG or alcohol allergy ; c) were willing to participate in the study and provided informed consent; d) were expected to be available throughout the course of the study (3 months)

Sample size estimation was based on skin condition as a primary efficacy variable. From the pilot study, SD (residual) was 12.1. Using a SD (residual) = 12.1, power 80%, alpha = 0.05, Tukey/HSD adjustment

given that there are 3 treatment groups and 2 pairwise comparisons, a sample size of 11 per sequence was adequate to detect a difference in hydration scores of 10. Using a drop out rate of 25%, total sample size was 3X11/(1-0.25) = 33/0.75 = 44. Therefore, 15 per sequence.

Study Procedures

The ethical review board of the study institution reviewed and approved the study before the study began. After recruitment, each subject signed a consent form. The data would be reported in an anonymity of the samples.

The first surgical hand scrub technique to be used in each operating room was chosen randomly. The alternative surgical hand scrubs were systematically removed from the services during each period. At the end of each month, the alternative surgical hand scrubs were switched in a multiple operating room crossover design. However, the fourth week of each surgical hand scrub/rub was switched to traditional hand scrubs (brush with 4% CHG) for a week before switching to alternative surgical hand scrubs. Figure 1 shows the overview of the sequences in each operating room and methods of surgical hand scrubs used.

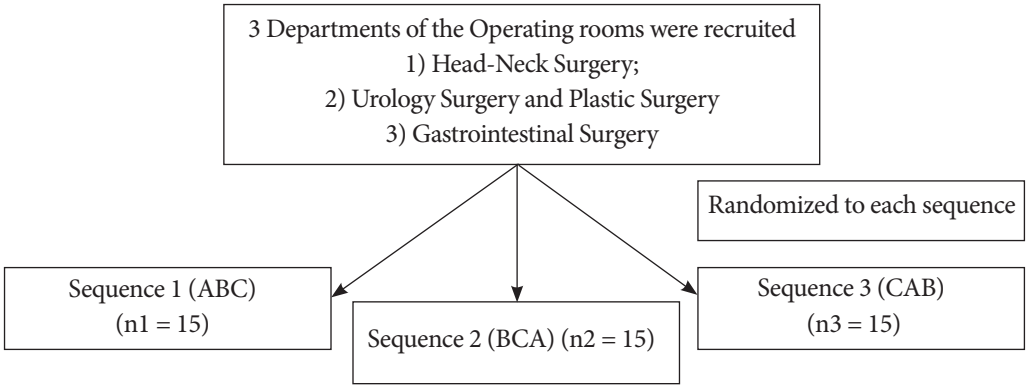

Figure 1 Overview of the sequences in each operating room and methods of surgical hand scrubs used.

Data Collection

Data were collected by trained research assistants. The assessment of skin condition was completed before scrub and postscrub including each week for three weeks. Skin condition assessments were obtained twelve times during the study. Both prescrub and postscrub cultures were collected on day one and the last day of the third week for each regimen. Each subject recorded on daily pocket-sized diary cards to record the number of scrubs and hours in surgery. Regarding the cost, the investigator calculated for the cost of solution recommended per scrub, sterilization cost per pack of towels and brushes. Finally, the HCWs' satisfaction questionnaires were completed by the subjects. Table 1 shows the outcome variables that were measured and data collection points.

Table 1 Treatment group study schedule

Study schedule	Traditional hand scrubs (Brush with 4% CHG)			brushless with 4% CHG			Brushless and Waterless with 61% ethyl alcohol and CHG 1% and emollients		
	Wk 1	Wk2	Wk3	W1	W2	W3	W1	W2	W3
Subject Assessments (HSA)	✓ Mpre			✓ Mpre			✓ Mpre		
	✓ Fri	✓ Fri	✓ Fri	✓ Fri	✓ Fri	✓ Fri	✓ Fri	✓ Fri	✓ Fri
Skin assessment	✓ Mpre			✓ Mpre			✓ Mpre		
[Skin Diagnostic (SD 27)]	✓ Fri	✓ Fri	✓ Fri	✓ Fri	✓ Fri	✓ Fri	✓ Fri	✓ Fri	✓ Fri
	✓ Mpre			✓ Mpre			✓ Mpre		
Prescrub/postscrub culture	✓ Mpo		✓ Fpre	✓ Mpo		✓ Fpre	✓ Mpo		✓ Fpre
	✓ Fpo			✓ Fpo			✓ Fpo		
Daily record card	✓	✓	✓	✓	✓	✓	✓	✓	✓
Cost	✓		✓	✓		✓	✓		✓
Time saving	✓		✓	✓		✓	✓		✓
Healthcare workers' satisfaction		✓			✓			✓	

✓ Mpre (Monday Prescrub)
✓ Mpo (Monday Postscrub)
✓ Fpre (Friday Prescrub)
✓ Fpo (Friday Postscrub)
✓ Fri (Friday)

↕ Traditional hand scrubs (Brush with 4% CHG) for 1 week

Instruments

1. Skin Assessment Tools. This study, all subjects were assessed the skin condition by using 2 tools

1) Skin Diagnostic 27 (SD 27), the hydration measurement, to measure the skin moisture or dryness of the skin. The moisture content of the Stratum corneum can vary very much depending on its storage capacity. The measurement capacitor shows changes of capacitance according to the moisture content of the subjects. Possible range of total scores is 0-100 where 80-100 indicated normal skin dryness. The SD 27 was measured by two research assistances who were trained by the company.

2) Hand Skin Assessments (HSA) form completed by the subjects. Subjects scored hand skin condition on a scale of 1 to 7 in four dimensions. Possible range of total scores is 4 to 28 where 28 indicated totally healthy hands.

Appearance: 1= Abnormal , red blotchy, rash: 7 = Normal, no redness, blotching, rash **Intactness:** 1 = Many abrasions or fissures: 7 = Completely intact, no abrasions or fissures. **Moisture Content:** 1 = Extremely dry: 7 = normal amount of moisture **Sensation:** 1 = Extreme itching, burning or soreness: 7 = No itching, burning, or soreness.

2. Microbiologic techniques. Before surgical hand scrubs, subjects cleaned their hands following the AORN guidelines for general hand hygiene to remove transient dirt and flora. To test for antimicrobial efficacy of each surgical hand scrubs, a modified glove-juice technique was used. The subject inserted the dominant hand into a sterile polyethylene bag containing 50 ml of sampling solution (.075 mol/L phosphate buffer, pH 7.9, containing 3% polysorbate 80, 0.1% t-Octylphenoxy-polyethoxyethanol, and 0.3% lecithin). This solution is suitable for this study in order to neutralize any residual antiseptic on the skin and remove microorganisms counted as colony-forming units (CFUs).[6]

The entire hand of each subject was massaged through the wall of the bag for one minute by the data collector. The bags were transferred to the microbiology laboratory within one hour for microbiology counts. The data were recorded in Microbiology Record Form.

3.Time saving. To compare the time uses for each type of surgical hand scrub, the researchers obtained the average time uses of each subject. In addition, the time based on manufacturers for each product was calculated.

4. Cost saving. To compare the cost of each type of surgical hand scrub, the researchers got the data of product costs from the manufacturers. The amount of

product used was calculated for the cost including the cost of equipments, water and towels.

Results/Findings:

Demographic data and baseline characteristics of the study population were presented as frequency, mean and standard deviation (Table 2 and 3). Forty-six participants initially were recruited. Most of participants were female registered nurses. They usually did not wear nail polish (63%), used lotion once or twice per day (52.2%), put on gloves 1-3 times (47.9%) or 4-6 times per day (43.5%),>4 hrs during a working day (52.1%). The corneum skin problem of their hands included excessive dryness (54.3%) and abrasions or fissures (43.5%). The characteristics of hand skin and nail of the subjects were presented in Table 2. The HCWs stated that these problems were related to frequent scrubbing. Nearly one-third of HCWs were concerned that damaged hand skin may put them at greater risk for infection.

Table 2 Demographic data of the subjects

Demographic Data		%	Mean ± S.D.
Age			32 ± 7.8
Gender:	Male	19.6	
	Female	80.4	
Position:	RN	78.3	
	Surgical Resident	21.7	
Length of time in current position			6.8 ± 5.8
Length of time in this profession:			9.5± 7.7

Table 3 The characteristics of hand skin and nail of subjects

Characteristics	%	Characteristics	%
Nails: Do you wear artificial nails or tips?		Skin: In the past 6 months, have you had any of	
Never	100	the following problems with your hands?	
Do you wear nail polish?		Redness, blotching or rash?	15.2
Never	63.0	Abrasions or fissures?	43.5
Sometimes	34.8	Excessive dryness?	54.3
Routinely	2.2	Itching or sorenes?	10.9
Lotion: How often do you use hand lotion?		How frequently have you had problems with	
Never	19.6	your hands? Never	15.2
Less than once/day	21.7	Rarely, once/year or less	28.3
Once or twice/day	52.2	Occasionally, several times/year	28.3
Routinely, more than twice/day	6.5	Frequently, more than several times/yr	17.4
		Persistently, it doesn't go away	8.7
What is your estimate of the number of		How serious would you rate the problem with	
times you put on gloves during a working		your hands?	
day?	47.9	(0) Not applicable, don't have a problem	21.7
(1) 1-3 times per day	43.5	(1) Not too serious, within normal limits	45.7
(2) 4-6 times per day	8.6	(2) Slightly worse than most, but does not affect	28.3
(3) 7- 10 times per day		my work habits or skin care regimens	
What is your estimate of the total amount		(3) Serious, sometimes affects my work habits	2.2
of time you have gloves on each working		or requires changes in my skin care regimen	
day?	32.6		
(1) 1-2 hrs	23,9		
(2) 3-4 hrs	43.5		
(3) >4 hrs			

The HCWs had problems with your hands due to frequent scrubbing.	35.6%
The HCWs had to modify your scrubbing (e.g. shorter time or not use brush because of poor skin condition)?	41.3%
The HCWs are concerned that damaged hand skin may put you at greater risk for infection?	31%

Microbiology: Data results on microbial counts from each baseline data on each hand were converted to base 10 logarithms, then were averaged to determine hand's baseline count. The primary outcome measure was the total log reduction during each period, calculated by subtracting the end of week 3 log recovery from the baseline log recovery. The effect of method of surgical hand scrubs on log reduction was assessed using a mixed model analysis of variance. Fixed effects in the model were Sequence, Method, Period and the random effect was Subject nested within Sequence. The baseline log count was included as a covariate.

The majority of flora isolated were gram-positive cocci, including Coagulase-Negative Staphylococci, present in all positive cultures. There were 20 isolates of Methicillinsensitive staphylococcus aureus and 72 isolates of gram-negative bacteria. Most frequently isolated were Acinetobacter baumannii (35, 49%), Enterobacter species (5, 7 %), and Klebsiella species (13, 19%). Four individuals had two gram-negative species isolated in a single sample. There was one isolate of Methicillin-Resistant Staphylococcus Aureus (MRSA). By the end of the third week, Method C was associated with significantly lower microbial counts than Method B and A. Table 4 shows the descriptive statistics for the period baseline log counts for each method of surgical hand scrubs. There was no significant difference in baseline log counts among the 3 treatment groups. There was a significant Period effect ($p<0.0045$), with Period 3 having a lower baseline than Period 2. Sequence was not a significant effect.

Table 4 Shows the descriptive statistics for the period baseline log counts for each method of surgical hand scrubs.

		Baseline Log CFU/Hand	
Period	Method	Mean	Std
1	A	5.8	0.72
	B	5.8	0.77
	C	5.3	0.58
2	A	5.3	0.92
	B	6.1	0.6
	C	6.1	0.8
3	A	5.4	0.76
	B	5.3	0.66
	C	5.5	0.76
ALL	A	5.5	0.77
	B	5.8	0.73
	C	5.8	0.81

Table 5 provides descriptive statistics for the log reduction of bacteria after 3 weeks of product use. There was a statistically significant effect of hand disinfection method ($p<0.0001$). Method C had a higher log reduction compared to Methods A and B. There was no significant difference between Methods A and B. The effects of Period and Sequence were not statistically significant. The covariate of baseline log CFU/hand was significant ($p<0.0001$).

Table 5 The descriptive statistics for the log reduction of bacteria after 3 weeks of product use.

		FINAL LOG REDUCTION					
		N	Mean	Median	Std	Min	Max
1	A	15	0.7	0.7	0.81	-0.6	2.2
	B	26	1.4	1.3	0.91	-0.3	3.0
	C	5	1.8	1.9	1.07	0.2	3.0
2	A	5	0.9	1.0	1.23	-1.2	1.9
	B	15	1.8	1.5	1.10	0.5	3.8
	C	25	2.3	2.5	0.93	1.1	4.1
3	A	21	1.1	0.7	0.94	-0.3	3.0
	B	3	0.8	1.2	0.91	-0.2	1.5
	C	15	1.6	1.6	0.76	0.2	2.6
TOTAL	A	41	0.9	0.8	0.92	-1.2	3.0
	B	44	1.5	1.3	0.99	-0.3	3.8
	C	45	2.0	2.0	0.94	0.2	4.1

Hand Skin Condition. Hand Skin Assessment (HSA) and SD 27 change from baseline were calculated for each hand at each time period. Table 6 shows descriptive statistics for the baseline conductance values for each method of surgical hand scrubs by period,

Table 6 The descriptive statistics for the baseline conductance values for each method of surgical hand scrubs by period, method and location.

Period	Locat	Conductance Period Baseline											
		Method A				Method B				Method C			
		N	Mean	Median	Std	N	Mean	Median	Std	N	Mean	Median	Std
1	IF	30	50.4	46.5	21.9	50	40.6	36.5	25.9	10	56.4	53.5	10.3
	IH	30	16.1	12.0	17.5	50	23.0	15.0	24.1	10	30.4	30.0	16.2
	TH	30	39.0	17.0	21.5	50	36.7	34.0	25.6	10	57.8	53.0	16.7
	UH	30	27.0	23.5	16.2	50	26.9	26.0	13.8	10	29.0	27.0	13.9
2	IF	10	46.3	49.0	16.0	30	36.0	34.0	22.7	50	42.5	42.0	24.2
	IH	10	6.4	2.0	12.8	30	8.6	1.5	12.4	50	18.1	16.5	18.2
	TH	10	36.0	37.0	12.0	30	25.2	22.0	20.7	50	31.9	12.0	23.0
	UH	10	21.3	23.0	9.6	30	23.8	26.5	12.3	50	24.9	23.5	17.9
3	IF	46	43.5	46.0	26.3	10	45.7	45.0	10.0	30	44.6	44.0	21.0
	IH	46	17.3	11.0	18.4	10	18.1	16.0	17.3	30	12.8	8.0	15.1
	TH	46	33.4	33.0	24.6	10	30.4	31.5	7.6	30	29.5	29.5	16.3
	UH	46	27.3	23.0	16.6	10	33.2	31.0	12.6	30	30.1	29.5	11.9
TOTAL	IF	86	46.2	46.0	23.8	90	39.6	38.0	23.6	90	44.8	48.0	22.2
	IH	86	15.6	10.0	17.7	90	17.6	8.5	21.0	90	17.7	16.0	17.6
	TH	86	15.7	36.0	22.4	90	32.2	31.0	23.2	90	34.0	34.5	21.9
	UH	86	26.5	23.0	15.8	90	26.6	27.0	13.4	90	27.1	25.5	15.7

Table 7 shows the least squares estimates of the means, after adjusting for all terms in the model. There were significant differences in baseline conductance values among the 3 treatment groups (p=0.0004) and the 3 periods (p<0.0001), indicating the 1 week washout was not adequate to eliminate carryover effects on skin condition. Baseline conductance was highest (moistest) for Method C and lowest (driest) for Method B. Period 1 had the highest baseline and Period 2 the lowest. There were also significant differences in baseline conductance between the right and left hands (p<0.0001) and among the four locations (p<0.0001). The right hand had lower conductance than the left, indicating it was dryer. The palm had the lowest conductance indicating it was the driest location. The highest conductance was on the index finger, indicating this was the moistest area.

Change in conductance after 3 weeks of treatment was calculated by subtracting the period baseline from the week 3 conductance. An increase in conductance would indicate improved hydration. The effect of each method of surgical hand scrubs on change from baseline was assessed using a mixed model analysis of variance with individual data from all four locations on each hand. Fixed effects in the model were Sequence, Method, Period, Hand and Location on the hand, and the random effect was Subject nested within Sequence. The period baseline conductance was included as a covariate.

Table 7 The least squares estimates of the means, after adjusting for all terms

Factor	Baseline Conductance Estimate of Least Squares Means
Period	
1	35.5
2	27.5
3	30.4
Method	
A	31.1
B	28.8
C	33.5
Hand	
Left	32.9
Right	29.4
Location	
Index finger	44.3
Palm	17.8
Thumb	34.8
Upper Hand	27.6

Table 8 The change in hand skin assessment scores after 3 weeks

Period	Method	HSA TOTAL					
		N	Mean	Median	Std	Min	Max
1	**A**	15	23.4	25.0	4.60	14	28.0
	B	26	23.4	25.0	5.18	9.0	28.0
	C	5	27.0	28.0	1.41	25.0	28.0
2	**A**	5	25.6	25.0	2.51	22.0	28.0
	B	15	25.4	26.0	1.96	22.0	28.0
	C	24	25.5	26.0	2.65	19.0	28.0
3	**A**	22	25.3	26.0	3.41	16.0	28.0
	B	5	26.4	26.0	1.14	25.0	28.0
	C	15	25.4	26.0	3.91	13.0	28.0
TOTAL	**A**	42	24.6	25.5	3.83	14.0	28.0
	B	46	24.4	25.5	4.19	9.0	28.0
	C	44	25.6	26.0	3.03	13.0	28.0

The Hand Skin Assessment (HSA) consists of 4 scales and a total score (sum of the 4 scales). Each scale was scored from 1 (negative) to 7 (positive). The total score could range from 1 to 28. The primary outcome measure was the change from baseline to week 3 in HSA Total score, calculated by subtracting the period baseline HSA score from the end of week 3 HSA score. An increase in HSA score would indicate improved skin condition. The effect of method of surgical hand scrubs was assessed using a mixed model analysis of variance. Fixed effects in the model were Sequence, Method, Period and the random effect was Subject nested within Sequence. The baseline HSA score was included as a covariate. The least squares means were estimated and the pair-wise comparisons were adjusted using Tukey's method. The pre-planned analysis assumed no carryover effect was present at each starting period. If carryover effects were seen, an additional analysis was conducted on the raw scores with no baselines included in the model and analyses were also conducted separately for each period. There were no significant differences in baseline HSA among the 3 treatment groups. There were also no significant differences in baseline HSA among the periods or sequences. The change in HSA after 3 weeks is shown in Table 8. Although hands were perceived as improving slightly with Method C, there was not a significant difference among the methods of surgical hand scrubs (p=0.4819). The effects of Period and Sequence were also not statistically significant. The covariate of baseline HSA was statistically significant (p<0.0001).

Time and cost saving

To compare the time uses for each type of surgical hand scrub, the researchers obtained the average time uses of each subject. In addition, the time based on manufacturers for each product was calculated. To compare the cost of each type of surgical hand scrub, the researchers obtained the data of product costs from the manufacturers. The amount of product used was calculated for the cost including the cost of equipments, and towels used.

A one-way analysis of variance (ANOVA) was used to compare the time and cost uses among three methods. There was a statistically significant time and cost saving method (p<0.01). Method C had significantly less time and cost compared to Methods A and B. There was no significant difference between Methods A and B for the cost and time. The cost and time of each method were presented in Figure 2.

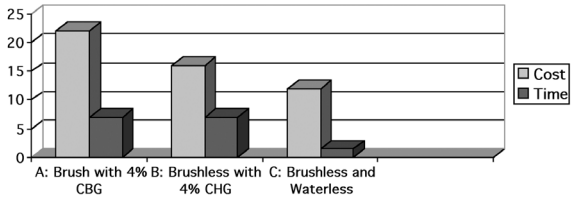

Figure 2 Cost and time of each method

The satisfaction of the methods was shown in Table 9. The percentage of subjects rated more satisfied with method C than method B and A. They reported it as being easiest, fastest and like most excepting in the item of easy to wear glove. It may affect by the hand size and not letting the hand dry after applying the product.

Table 9 The satisfaction of the surgical hand scrub methods

Item	Method
Easiest	C
Fastest	C
Easy to wear glove	B
Like most	C

Discussion

Our study supports the fact that brushing results in damage to the skin leading to increase colonization with gram-negative bacteria and candida species.[5, 6] Eighty percent of participants in this study reported having problems with their hands including : redness, blotching or rash (15.2%), abrasions or fissures (43.5%), excessive dryness (54.3%), and Itching or soreness (10.9%). Skin abrasion are linked to increased bacterial counts. The majority of hand flora after surgical hand scrubs were 20 isolates of methicillin sensitive Staphylococcus aureus and 72 isolates of gram-negative bacteria. Most frequently isolated were Acinetobacter baumannii (35, 49%), Enterobacter species (5, 7 %), and Klebsiella species (13, 19%). Although HCWs did surgical hand scrubs, it did not mean that we cannot find any colonies on their hands. The amount of the colonies is related to the method of surgical hand scrubs. There was a statistically significant effect of surgical hand disinfection method (p<0.0001). Method C (brushless, waterless hand

scrub containing 1% CHG, 61% ethyl alcohol and emollients) had a higher log reduction compared to Methods A (traditional hand scrub using a brush containing 4% CHG) and B (brushless hand scrub containing 4% CHG). There was no significant difference between Methods A and B. This result supports the recommended practices for surgical hand scrub using waterless brushless surgical antiseptics1. In addition, the activity and considerations for surgical hand hygiene agents should be considered a persistent and residual activity. Guidelines for hand hygiene in health-care settings by CDC[7] states that alcohol and chlorhexidine product that is fast drying and has residual effect is preferred.

Regarding skin condition, this study cannot detect the differences among the treatment groups. The 1 week washout was not adequate to eliminate carryover effects on skin condition. In addition, the high number of surgical hand scrubs for each participant is the barrier for restore the skin condition. The scrub nurses and surgeons spent at least 4 times or more per day (52.1%) in scrubbing their hands and wearing gloves more than 4 hours each working day (43.5%). This study group spent more hours in surgery per person than the study group of Larson and team (2001).6 In addition, the long scrub times for Method A and B were 7- minute surgical hand scrubs following the work instruction of the operating room. In contrast, CDC strongly recommends that long scrubs times are not necessary.[7] The duration of surgical hand scrubs using 3-5 minutes scrubbing showed that 3 minutes and 5 minutes surgical hand scrubs are the same effectiveness.[8] Therefore, current practice for surgical hand scrubs that includes prolonged periods of time needs to be reassessed.

The cost and time of Method C (brushless, waterless hand scrub containing 1% CHG, 61% ethyl alcohol and emollients) was significantly less than for the method A and B. We conclude that the Method C could reduce time and save cost because there is a much shorter contact time needed and no need for running water or sterile towels to dry hands. The cost associated with scrubbing is personnel time; therefore, it should be noted that an additional unnecessary cost can be decreased. In addition, Method C also resulted in fewer deviations from guidelines. In this clinical trial, the method of surgical hand scrubs using brushless, waterless hand scrub containing 1% CHG, 61% ethyl alcohol and emollients resulted in significantly greater reductions in microbial counts on hands and reduced time and cost. This study supports the recommended practices for surgical hand scrubs in the perioperative setting which HCWs need to follow guidelines to prevent health care associated infection both for the patients and health care professionals. The traditional surgical hand scrub using brush in most hospitals needs to be considered to change to decrease the damage of the skin leading to increase colonization and increase cost and time savings.

Conclusion

1. Brushless and waterless with 1% CHG and 61% ethyl alcohol and emollients (Method C) was significantly more effective in reducing skin colony counts compared to brush with 4% CHG (Methods A) and 4% CHG brushless (Method B).

2. A carryover effect was present for the conductance data making interpretation of the results problematic. The pre-planned analysis indicated that Method C slightly but significantly reduced the conductance values (reduced moisture) compared to Method B. However, the analysis where baselines were excluded showed no significant difference among the methods. This was also true of the analyses run separately for each period.

3. There was no significant difference among the methods of surgical hand scrubs in the HSA ratings of skin condition. However, the satisfaction scores (easiest, fastest, like most) of Method C were significantly higher than Method B and A.

4. The cost and time for Method C were significantly less than Method B and A.

Recommendations

Brushless and waterless with 1% CHG and 61% ethyl alcohol and emollients should be promoted for the practice. Training or education program on surgical hand scrubs can be developed basis on the recommended practice for surgical hand scrubs to improve surgical hand scrubs compliance.

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การประเมินผลการล้างมือเพื่อผ่าตัด แบบใช้แปรง ไม่ใช้แปรงและแบบไม่ใช้น้ำไม่ใช้แปรง ในบุคลากรทางการแพทย์และพยาบาลที่ทำงานในห้องผ่าตัดในโรงพยาบาลมหาวิทยาลัยแห่งหนึ่ง ประเทศไทย *

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บทคัดย่อ:

การล้างมือเพื่อการผ่าตัดเป็นหัวใจสำคัญหนึ่งในการป้องกันการติดเชื้อที่แผลผ่าตัด การล้างมือเพื่อการผ่าตัด (Surgical Hand Scrubs) ในโรงพยาบาลส่วนใหญ่ในประเทศไทยใช้แปรงในการล้างมือเพื่อผ่าตัด การใช้แปรงเป็นผลทำให้เกิดการทำลายของชั้นผิวหนัง อันนำผลไปสู่การเพิ่มการสะสม และส่งเสริมการเจริญเติบโตของแบคทีเรียชนิดกรัมลบ (gram-negative bacteria) และเชื้อรา (candida species) ได้ 75% ของพยาบาลห้องผ่าตัดรายงานถึงปัญหาของผิวหนังที่มือ โดยพบว่ามีผิวแห้ง เป็นสะเก็ด แตก และมีรอยแดง ถลอก

วัตถุประสงค์: การวิจัยเชิง clinical trial เพื่อเปรียบเทียบการล้างมือแบบใช้แปรง [traditional hand scrubs; Brush with 4% CHG (A)] แบบไม่ใช้แปรง [brushless with 4% CHG (B)] และแบบไม่ใช้น้ำไม่ใช้แปรง [brushless and waterless with 1% CHG and 61% ethyl alcohol and emollients (C)] ต่อประสิทธิผลจำนวนเชื้อโรคบนมือ สภาพของผิวหนัง ค่าใช้จ่ายและเวลาที่ใช้ในการล้างมือเพื่อผ่าตัด

วิธีดำเนินการวิจัย: การศึกษาครั้งนี้เป็นการศึกษาแบบ cross-over design with 3 different scrubs and 3 time periods เพื่อเปรียบเทียบแต่ละวิธีของการล้างมือ ต่อข้อมูลเชื้อโรค สภาพผิวหนัง ค่าใช้จ่ายและเวลา ในบุคลากรห้องผ่าตัด ในหน่วยผ่าตัด Head-Neck Surgery, General Surgery, Urological Surgery, and Plastic Surgery

ผลการวิจัย: 1) การลดลงของเชื้อโรคหลังจากใช้วิธีการล้างมือแต่ละวิธีมีความแตกต่างอย่างมีนัยสำคัญ [Brushless and waterless with 1% CHG and 61% ethyl alcohol and emollients (C) and 4% CHG brushless (B) or the traditional hand scrubs (C); 2) สภาพของผิวหนัง (Skin condition) และการประเมินผิวหนังของมือโดยผู้ล้างมือเพื่อการผ่าตัด (hand skin assessment) หลังจากใช้วิธีการล้างมือแต่ละวิธีนาน 3 อาทิตย์ ไม่พบความแตกต่างอย่างมีนัยสำคัญทางสถิติ; 3) ความพึงพอใจต่อวิธีการล้างมือในวิธีที่ไม่ใช้น้ำไม่ใช้แปรงมากกว่าวิธีการล้างมือด้วยการใช้แปรงและการไม่ใช้แปรงอย่างมีนัยสำคัญทางสถิติ; 4) ค่าใช้จ่ายและเวลาที่ใช้ในวิธีการล้างมือ แบบไม่ใช้น้ำไม่ใช้แปรง(C) น้อยกว่าอย่างมีนัยสำคัญทางสถิติ เมื่อเปรียบเทียบกับวิธีการล้างมือแบบใช้แปรง (A)

สรุปและข้อเสนอแนะ: การล้างมือเพื่อผ่าตัดสำหรับบุคลากรทางการแพทย์และพยาบาลไทย ในห้องผ่าตัด ควรได้ปฏิบัติบนพื้นฐานข้อมูลเชิงประจักษ์ โดยวิธีแบบไม่ใช้น้ำไม่ใช้แปรง ควรได้รับการกำหนดเป็นแนวทางปฏิบัติสำหรับการปฏิบัติในห้องผ่าตัด