EFFICACY OF ETHYL ALCOHOL GLYCERIN 69% HANDRUB IN NEONATAL WARD DR. SOETOMO HOSPITAL. A RANDOMISED CONTROLLED TRIAL

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ABSTRACT

Ethyl alcohol glycerin 80% handrub has been used to overcome the outbreak of neonatal sepsis and cellulitis in the Neonatal Ward of Dr. Soetomo Hospital. However, skin irritation perceived to be a barrier to it use. This randomized controlled trial with cross over design was conducted to determine the efficacy of ethyl alcohol glycerin 69%, compared with Isopropyl alcohol 60% as reference alcohol-based handrub in Europe. ***Methods*** *There were 20 nurses included in this study. Subjects were randomly assigned to each group of antiseptic handrub: ethyl alcohol glycerin 69%, isopropyl alcohol 60%, to be used after doing the following activities: changing diapers, palpation of femoral artery. Culture of finger tips were done before and after handrub. Efficacy of ethyl alcohol glycerin 69% was determined by comparing the mean percentage of reduction of bacteria after hand rubbing using ethyl alcohol glycerin 69% and isopropyl alcohol 60%. Statistical analysis used: Independent samples t test, Mann-Whitney test (for abnormal distribution of the data) with significance (α) = 0.05.* ***Results*** *There was no significant difference in mean percentage of reduction of bacteria between ethyl alcohol glycerin 69% and isopropyl alcohol 60% handrub (p=0.831). There were no significant difference in mean percentage of reduction of S. epidermidis (p=0.912), K. pneumonia (p=0.788), P. aeruginosa (p=0.273), S.aureus (p=1.00) between ethyl alcohol glycerin 69% and isopropyl alcohol 60% handrub.* ***Conclusion*** *Ethyl alcohol glycerin 69% handrub is as effective as isopropyl alcohol 60% handrub in Dr. Soetomo Hospital Neonatal ward, Surabaya.*

Keywords: *ethyl alcohol glycerin, handrub, neonatal sepsis, cellulitis, skin irritation, isopropyl alcohol*

INTRODUCTION

Hospital acquired infection is one of major problems among hospitals causing increased mortality, morbidity, length of hospital stay, and cost of hospitalization. (Teare et al, 2001; Stone SP, 1998; Weinstein RA, 1998; Weinstein RA, 2001; Handwashing Liaison Group, 1999). The incidence of sepsis in NICU (Neonatal Intensive Care Unit) of dr. Soetomo Hospital between 1998 to 2000 is $\pm$ 33.8% from nosocomial infection, with mortality rate 2.2%. In year 2002 there was an outbreak of sepsis and cellulitis which caused further increment in mortality rate (Indarso F et al, 2003). Effective infection control measures were needed to overcome the outbreak such as hand washing, cohorting and antibiotic restriction which affect nosocomial cross-transmission. (Austin DJ et al, 1999) However, due to inadequate handwashing facilities such as shallow sink, inappropriate faucet, and limited available towels caused greater possibilities for recontamination of the hands after handwashing. Insufficient nursing staff, high patient volume, further compromise the infection control measures. In such conditions the use of alcohol based handrub might be appropriate. Since April 2002 ethyl alcohol glycerin 80% (ethyl alcohol 96% 2500mL + glycerin 500mL) has been used as antiseptic handrub in neonatal ward, since then the morbidity and mortality rate due to sepsis and cellulitis was significantly decreased. (Indarso F et al, 2003) However skin irritation (burning sensation), sticky, and difficulty to dry the hands were encountered after its use, hence a new composition of alcohol based handrub was needed to overcome the problem.

This study was conducted to determine the efficacy of ethyl alcohol glycerin 69% (ethyl alcohol 70% 990 mL + glycerin 10 mL) , compared with Isopropyl alcohol 60% as reference alcohol-based handrub in Europe.(Boyce JM and Pittet D, 2002). Alcohol 70% is available even in rural area, affordable, with alcohol concentration acceptable based on the criteria of alcohol based handrub in HICPAC guidelines 2002. (Boyce JM and Pittet D, 2002).

MATERIALS AND METHODS

Study Design

This was a randomized controlled trial with cross over design conducted between December 2003 – February 2004 in the Neonatal Ward of Dr. Soetomo Hospital, supported by Department of Microbiology of Dr. Soetomo Hospital, Surabaya, Indonesia.

Study Populations

All nurses who were on duty in NICU were enrolled in the study. Exclusion criteria were as follows: nurses who had dermatitis, with nail polished; activities during

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patient care where gloves were used , activities less than 1 minute or more than 2 minute , activities which caused contamination of the hands by body fluids.

Antiseptic handrub

Antiseptic handrub used in this study were Isopropyl alcohol 60% and Ethyl alcohol 69% (ethyl alcohol 70% 990 ml + glycerin 10 cc) prepared by the pharmacy. The investigators and subjects of the study were blinded until the end of the study.

Study procedures

20 nurses who fulfilled the inclusion criteria were included in this study, and randomly assigned to each group of antiseptic handrub. All the subjects did the usual routine patient care. Hand washing/ hand rubbing were implied after each direct contact with patients. Hand washing using povidone iodine 10% was done prior the first direct contact with the patient and afterwards using alcohol handrub. After using alcohol handrub for 5 times, all subjects washed their hands using povidone iodine 10 %, hand washing also implied after direct contact with the patients if the hands visibly soiled.

The study was conducted in the middle of the routine activities (about 3 hours working in the nursery). The interval between the last hand washing using Povidone Iodine 10% and antiseptic handrub (Ethyl alcohol 69%, Isopropyl alcohol 60%) was at least 45 minute. Antiseptics handrub were done after the following activities: changing diapers, and palpation of femoral artery. These activities were also randomly assigned to the subjects. The volume of antiseptic used was 3-4 cc for each handrub. Hand rubbing was done for 30 seconds and the hands were dried for 30 seconds – 1 minute. Culture of 3 the finger tips of the dominant hand was done before and after handrub using CLED agar. All agars were sent to Microbiology department of Dr. Soetomo Hospital and incubated at 37^{o}C under aerobic conditions. An initial colony count was performed at 24 hours and a final count was performed after 48 hours of incubation. Bacteria were identified by standard microbiologic procedures. No anaerobic cultures were performed. All procedures were repeated after washout period of 24 hours, and subjects who were previously assigned to Ethyl alcohol 69% antiseptic handrub would be assigned to Isopropyl antiseptic handrub

Statistical analysis

Statistical analysis used: Independent samples t test, Mann-Whitney test (for abnormal distribution of the data) with significance (α) = 0.05.

RESULTS

Activities

Activities done among subjects in each antiseptic group were as follows: 12 subjects (60%) in Ethyl alcohol group palpated femoral artery and 12 subjects (60%) in Isopropyl alcohol group changed the diapers.

Patients

Table 1 showed the diagnosis of the patients who had direct contact with the hands of the subjects.

Table 1. Patients' diagnosis

Patients' diagnosis		Ethyl alcohol group (N=20)	Isopropyl alcohol group (N=20)	Total (N=40)
Sepsis	No of subjects (%)	13 (65)	14 (70)	27 (67.5)
Sepsis + moniliasis	No of subjects (%)	1 (5)	1 (5)	2 (5)
Sepsis + duodenal atresia	No of subjects (%)	1 (5)	1 (5)	2 (5)
Sepsis + burst abdomen	No of subjects (%)	2 (10)	0	2 (5)
Sepsis + MAS	No of subjects (%)	2 (10)	2 (10)	4 (10)
Sepsis + RDS + vestibular fistula	No of subjects (%)	0	1 (5)	1 (2.5)
Pyoderma	No of subjects (%)	1 (5)	1 (5)	2 (5)
Total	No of subjects (%)	20 (100)	20 (100)	40 (100)

MAS= meconium aspiration syndrome
RDS = Respiratory Distress Syndrome

Microorganisms identified

Table 2. Microorganisms identified at the finger tips before antiseptic handrub

Microorganisms		Ethyl alcohol group (N=20)	Isopropyl alcohol group (N=20)	Total (N=40)
S. epidermidis	No of subjects (%)	10 (50)	10(50)	20 (50)
K. pneumonia	No of subjects (%)	1 (5)	2 (10)	3 (7.5)
P.aeruginosa	No of subjects (%)	3 (15)	2 (10)	5 (12.5)
S.aureus	No of subjects (%)	1 (5)	2 (10)	3 (7.5)
S.epidermidis+K .pneumonia	No of subjects (%)	3 (15)	4 (20)	7 (17.5)
S.epidermidis+P.aeruginosa	No of subjects (%)	1 (5)	0	1 (2.5)
S.aureus+E.coli	No of subjects (%)	1 (5)	0	1 (2.5)

Staphylococcus epidermidis was the most common microorganism identified in both groups followed by *Staphylococcus epidermidis* and *Klebsiella pneumonia*, *Pseudomonas aeruginosa*, *Klebsiella pneumonia, Staphylococcus aureus, Staphylococcus epidermidis and Pseudomonas aeruginosa, Staphylococcus aureus* and *Escherichia coli.*

Table 3. Patients' diagnosis correlated with microorganisms identified prior to Ethyl alcohol glycerin handrub

Patients' diagnosis	Number of subjects	Microorganisms (%)	Bacterial count	
			mean	SD
Sepsis	13	*S.epidermidis* (61.54%)	31.00	20.62
		K.pneumonia (15.38%)	13.00	11.32
		P.aeruginosa (23.08%)	6.00	5.20
		S.aureus (15.38%)	26	21.21
		E.coli (7.69%)	5	
sepsis + moniliasis	1	*S.epidermidis* (100%)	71.00	
sepsis + duodenal atresia	1	*S.epidermidis* (100%)	47.00	
sepsis + burst abdomen	2	*S.epidermidis* (50%)	19.00	
		K.pneumonia (50%)	67.00	
		P.aeruginosa (50%)	71.00	
sepsis + MAS	2	*S.epidermidis* (100%)	67.00	5.66
		K.pneumonia (100%)	16.50	12.02
pyoderma	1	*S.epidermidis* (100%)	16.00	

MAS= meconium aspiration syndrome

Table 4. Patients' diagnosis correlated with microorganisms identified prior to Isopropyl alcohol handrub

Patients' diagnosis	Number of subjects	Microorganisms (%)	Bacterial colony count	
			mean	SD
Sepsis	14	*S.epidermidis* (64.29%)	37.89	24.53
		K.pneumonia (28.57%)	27.50	31.77
		P.aeruginosa (7.15%)	10.00	
		S.aureus (14.29%)	16.00	5.66
sepsis + moniliasis	1	*S.epidermidis* (100%)	13.00	
sepsis + duodenal atresia	1	*S.epidermidis* (100%)	73.00	
sepsis + vestibular fistula + RDS	1	*P.aeruginosa* (100%)	4.00	
sepsis + MAS	2	*S.epidermidis* (100%)	33	5.66
		K.pneumonia (50%)	4	
pyoderma	1	*S.epidermidis* (100%)	27	
		K.pneumonia (100%)	11	

MAS = Meconium Aspiration Syndrome; RDS = Respiratory Distress Syndrome

Table 3 and 4 showed the correlation between patients' diagnosis and microorganisms identified on finger tips after having direct contact with the patients. *S. epidermidis* was generally the most common organism identified after having direct contact with all patients except in sepsis and burst abdomen. The most common organisms identified after having direct contact with patients with sepsis were *S. epidermidis* in both groups followed by *P. aeruginosa, K. pneumonia, S. aureus,* and *E.coli* in Ethyl alcohol group; *K. pneumonia, S. aureus* and *P. aeruginosa* in Isopropyl alcohol group. After having direct contact with patients with sepsis and moniliasis, sepsis and duodenal atresia, organism identified in both groups were *S. epidermidis* with colony count 13 – 73 CFU. Following direct contact with patient with sepsis and MAS, the organisms identified were : *S. epidermidis* and *K. pneumonia* in both groups; and following direct contact with patient with pyoderma the microorganisms identified were: *S. epidermidis* in ethyl alcohol group and *S. epidermidis* and *K. pneumonia* in Isopropyl alcohol group. On the other hand, the organisms isolated from the finger tips of those nurses who handled patients with sepsis and burst abdomen were predominantly gram negative organisms, namely : *K. pneumonia* (67 CFU) and *P. aeruginosa* (71 CFU).

Table 5. Comparison of mean bacterial colony count before and after antiseptic handrub

Antiseptic		Bacterial colony count		
		before handrub	after handrub	*p*
Ethyl alcohol glycerin 69%	Mean	39.1	12.25	0.000
	SD	26.115	11.911	
Isopropyl alcohol 60%	Mean	35.15	9.35	0.000
	SD	23.450	9.544	
Total	Mean	37.113	10.80	
	SD	24.580	10.754	

p values were calculated with use of paired t test

Table 6. Mean bacterial colony count before and after antiseptic hand rub; and mean percentage of reduction of bacteria after antiseptic handrub

	Group	Mean	SD	*p*
Bacterial colony count before handrub	Ethyl alcohol glycerin	39.10	26.115	0.618
	Isopropyl alcohol	35.15	23.450	
Bacterial colony count after handrub	Ethyl alcohol glycerin	12.25	11.911	0.401
	Isopropyl alcohol	9.35	9.544	
% reduction of bacteria	Ethyl alcohol glycerin	72.43	23.465	0.831
	Isopropyl alcohol	74.033	23.771	

p values were calculated with use of Independent samples t test

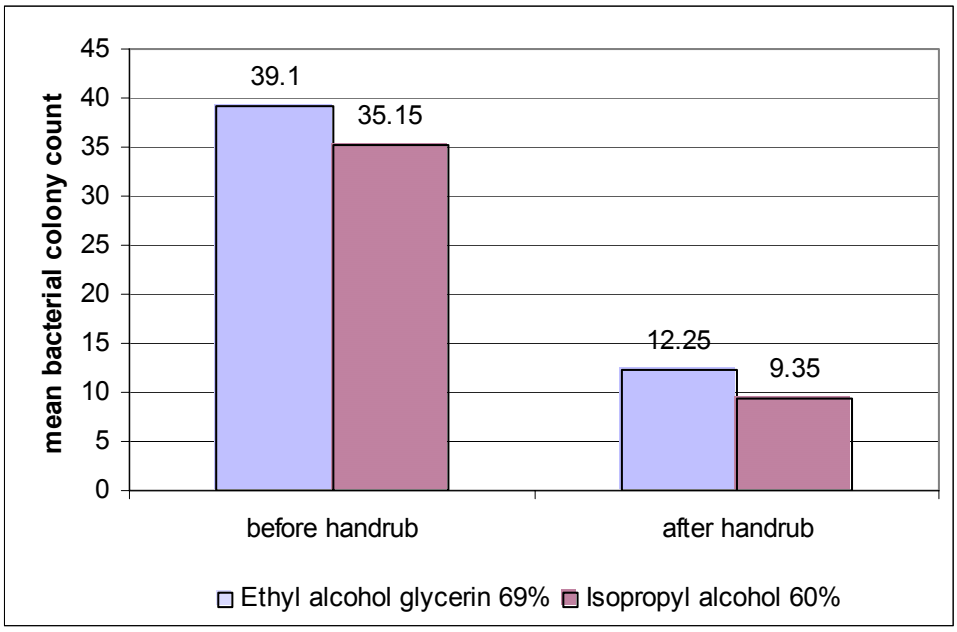

Figure 1. Mean bacterial colony count before and after antiseptic handrub

Table 5, 6 and Figure 1 showed the bacterial colony count and mean percentage of reduction of bacteria after antiseptic handrub. There were no significant differences of bacterial colony count before and after antiseptic handrub between two groups (*p* values 0.618, 0.401 respectively) with a significant decrement of bacterial colony count after antiseptic handrub either using Ethyl alcohol glycerin 69% or Isopropyl alcohol 60% with *p* value = 0.000. The mean percentage of reduction of bacteria after antiseptic handrub approximately the same between both groups with *p* value = 0.831. In this study we also divided microorganisms identified into two groups based on the gram stain, gram-negative and gram positive groups.

Antiseptic used in this study (Ethyl alcohol glycerin 69%, Isopropyl alcohol 60%) appeared had a better bactericidal activity against gram-negative than gram positive bacteria (mean percentage of reduction of gram-positive bacteria 67.02% and 67.41% respectively and mean percentage of reduction of gram-negative bacteria 92.9% and 81.1% respectively), even though statistical analysis showed there was no significance differences between two groups of bacteria (table7,8,9; figure 2).

The bactericidal activity of ethyl alcohol glycerin 69% and isopropyl alcohol 60% revealed by the mean percentage of reduction of the each microorganism identified are as followed : *E. coli* 100%, *K. pneumonia* 93.51% and 73.54% respectively, *P. aeruginosa* 90.52% and 100% respectively, *S. epidermidis* 68.75% and 67.88% respectively, *S. aureus* 54.88% and 64.16% respectively (table 10, figure 3,4). Statistical analysis showed, there was no significant difference of the mean reduction of the bacteria between two groups (table 11).

Table 7. Bacterial colony count before and after handrub and mean percentage reduction of Gram positive and gram negative bacteria after antiseptic handrub

Bacterial colony count	Ethyl alcohol glycerin 69%						Isopropyl alcohol 60%					
	Before handrub		After handrub		% reduction		Before handrub		After handrub		% reduction	
	mean	SD	mean	SD	mean	SD	mean	SD	mean	SD	mean	SD
Gram positive	36.69	22.81	13.13	12.28	67.02	24.08	35.63	21.91	11	8.56	67.41	22.64
Gram negative	21.67	27.44	3.89	7.34	92.90	10.32	18.43	25.22	1.57	3.05	81.10	32.47

% reduction denotes percentage of reduction of the bacteria
Culture (+) for Gram-positive bacteria : Ethyl alcohol group N=16; Isopropyl alcohol group N=16
Culture (+) for Gram-negative bacteria: Ethyl alcohol group N=9; Isopropyl alcohol group N=7.

Table 8. Mean percentage of reduction of gram-positive and gram-negative bacteria after antiseptic handrub

Bacteria	Groups	% reduction of bacteria after antiseptic handrub		
		Mean	SD	*p values*
Gram-positive	Ethyl alcohol glycerin	67.018	24.076	0.962
	Isopropyl alcohol	67.413	22.641	
Gram-negative	Ethyl alcohol glycerin	92.906	10.318	0.385
	Isopropyl alcohol	81.103	32.467	

p values were calculated with use of Independent samples t test

Table 9. Comparison of reduction of gram-positive and gram-negative bacteria after antiseptic handrub

Groups		Bacteria*	Mean bacterial colony count	SD	*p*
Ethyl alcohol glycerin	Before antiseptic handrub	Gram-positive	41.82	22.516	0.595
		Gram-negative	26.75	30.401	
	After antiseptic handrub	Gram-positive	14.73	11.884	0.477
		Gram-negative	6.00	10.033	
	Reduction of bacteria after handrub	Gram-positive	27.09	18.075	0.740
		Gram-negative	20.75	20.565	
Isopropyl alcohol	Before antiseptic handrub	Gram-positive	37.00	25.277	0.772
		Gram-negative	27.25	31.952	
	After antiseptic handrub	Gram-positive	10.42	8.888	0.050
		Gram-negative	0.00	0.000	
	Reduction of bacteria after handrub	Gram-positive	26.58	18.505	0.917
		Gram-negative	27.25	31.952	
Ethyl alcohol glycerin + Isopropyl alcohol	Before antiseptic handrub	Gram-positive	39.30	23.579	0.436
		Gram-negative	27.00	28.874	
	After antiseptic handrub	Gram-positive	12.48	10.418	0.067
		Gram-negative	3.00	7.309	
	Reduction of bacteria after handrub	Gram-positive	26.83	17.883	0.931
		Gram-negative	24.00	25.117	

* Result of finger tip culture : Gram-positive or gram–negative bacteria only; Culture result of combination gram-positive and gram negative bacteria were ignored
Culture (+) for Gram-positive bacteria : Ethyl alcohol group N=11; Isopropyl alcohol group N=12
Culture (+) for Gram-negative bacteria: Ethyl alcohol group N=4; Isopropyl alcohol group N=4.
p values were calculated with use of ANOVA

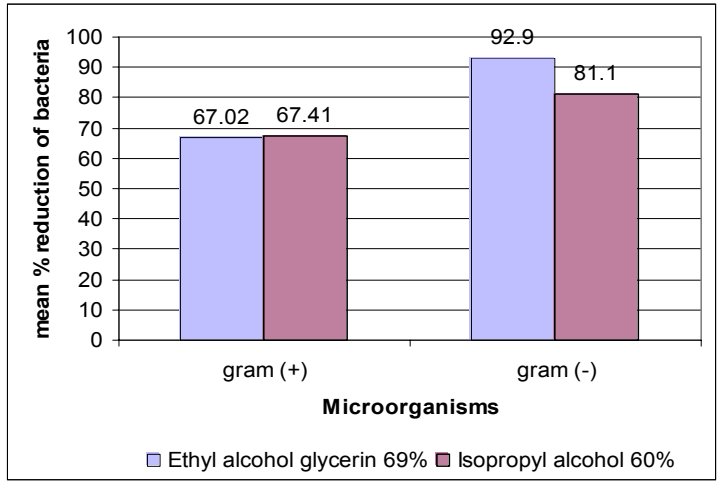

Figure 2. Mean percentage of reduction of gram-positive and gram-negative bacteria after antiseptic handrub

Table 10. Bacterial colony count before and after handrub and mean percentage of reduction of bacteria identified after antiseptic handrub

Bacterial colony count	Ethyl alcohol glycerin 69%						Isopropyl alcohol 60%					
	Before handrub		After handrub		% reduction		Before handrub		After handrub		% reduction	
	mean	SD	mean	SD	mean	SD	mean	SD	mean	SD	mean	SD
S. epidermidis	38.21	23.36	12.36	10.79	68.75	18.16	38.43	22.00	11.64	8.82	67.88	23.09
K. pneumonia	25.25	28.69	3.25	5.25	93.51	8	23	29.30	2.20	3.49	73.54	36.486
P. aeruginosa	22.25	32.78	5.5	10.34	90.52	13.96	7	4.24	0	0	100	0
S. aureus	26	21.21	18.5	26.16	54.88	63.81	16	5.66	6.5	6.36	64.165	27.103
E.coli	5		0		100		0		0		0	

% reduction denotes percentage of reduction of the bacteria
Ethyl alcohol group : culture (+) for *S. epidermidis* N= 14, *S. aureus* N=2, *P. aeruginosa* N=4, *K. pneumonia* N= 4, *E. coli* N=1
Isopropyl alcohol group : culture (+) for *S. epidermidis* N= 14, *S. aureus* N=2, *P. aeruginosa* N=2, *K. pneumonia* N=5

Table 11. Comparison of mean percentage of reduction of bacteria after antiseptic handrub

Bacteria	Groups	% reduction of bacteria after handrub		
		Mean	SD	*p*
S. epidermidis	Ethyl alcohol glycerin	68.72	18.158	0.912
	Isopropyl alcohol	67.876	23.090	
K. pneumonia	Ethyl alcohol glycerin	93.515	8.001	0.788
	Isopropyl alcohol	73.544	36.486	
P. aeruginosa	Ethyl alcohol glycerin	90.523	13.965	0.273
	Isopropyl alcohol	100.00	0	
S. aureus	Ethyl alcohol glycerin	54.880	63.809	1.000
	Isopropyl alcohol	64.165	27.103	

% reduction denotes percentage of reduction of the bacteria
Ethyl alcohol group : culture (+) for *S. epidermidis* N= 14, *S. aureus* N=2, *P. aeruginosa* N=4, *K. pneumonia* N= 4
Isopropyl alcohol group : culture (+) for *S. epidermidis* N= 14, *S. aureus* N=2, *P. aeruginosa* N=2, *K. pneumonia* N=5
p values were calculated with use of Independent sample T test for *S. epidermidis*
Mann-Whitney Test for *S.aureus, P. aeruginosa, K. pneumonia.*

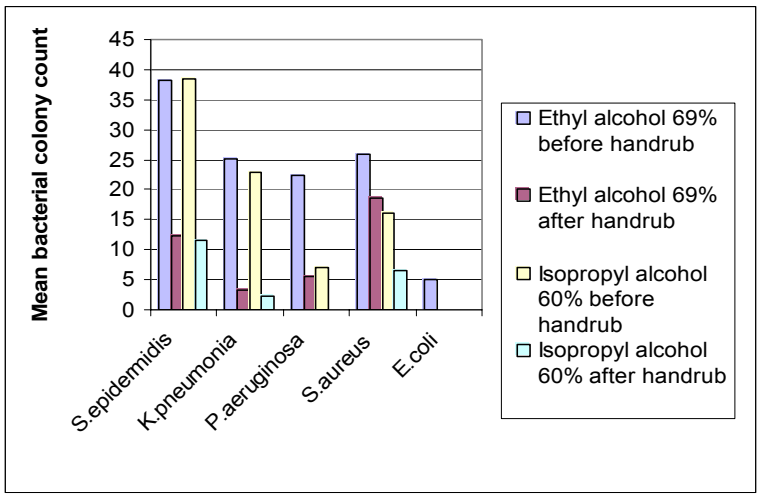

Figure 3. Mean bacterial colony count before and after antiseptic handrub

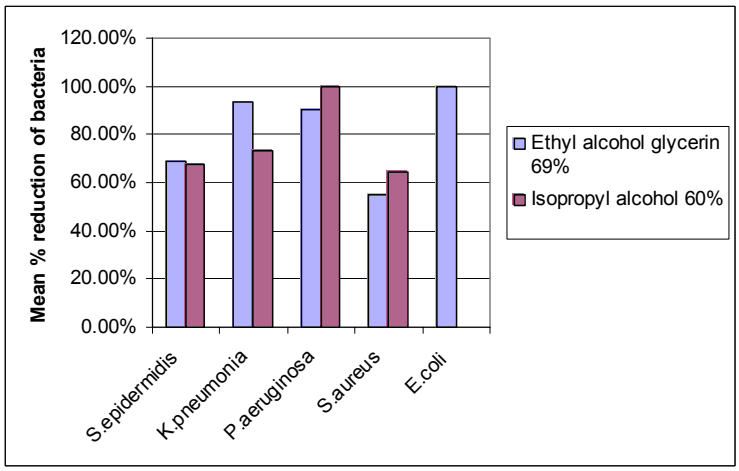

Figure 4. Mean percentage of reduction of bacteria after antiseptic handrub

DISCUSSION

Hand hygiene agents should have antimicrobial efficacy against nosocomial pathogens prior to introduction. In Europe, the state-of-the-art protocols to test their efficacy are referred to as the European norms (EN). EN 1500 is the standard by which the efficacy of waterless products such hand rinses or gels are tested under practical conditions by comparison with the reference disinfectant (isopropyl alcohol 60%, v/v) tested on *Escherichia coli* K12 (NTCC 10538). The tested product should not be significantly less effective than the reference alcohol. (Kramer A, 2002).

In this clinical study showed that the ethyl alcohol glycerin 69% is as effective as isopropyl alcohol 60% as antiseptic handrub, since there was no significance difference in mean percentage of reduction of bacteria after handrub. The procedure used in this study is different with EN 1500, the amount and microorganism used to assess the efficacy depend on the transmission of the microorganisms from the patients to the hands of the subjects after changing diapers/ palpation of femoral artery. The advantage of this study is the study was held under local clinical setting with local pathogens commonly encountered. One potential limitation of our study includes the fact that we assessed bacterial contamination by taking agar fingerprints of the dominant hand and did not use the glove juice technique, which may be more effective in recovering the whole bacterial burden on hands. Our technique may have underestimated the degree of hand contamination, though we are not aware of a direct comparison of the two techniques in terms of assessment of bacterial burden on hands. However, we believe the comparison of the procedures tested, using the same technique for culture, remains valid.

We haven't found any study using this procedure to assess the efficacy of antiseptic handrub. Most of the protocols used to test the efficacy are referred to EN 1500 (tested on *E. coli* K12 NTCC 10538) and FDA TFM (Tentative Final Monograph) tested on *Serratia mascescens* ATCC#14756 (Boyce JM and Pittet D, 2002)..

Kramer et al (2002) investigated the antimicrobial efficacy of ten gels and four rinses alcohol based antiseptic handrub according to EN 1500. No gel with alcohol concentration $\leq$ 70% (v/v) met the EN 1500 requirements within 30 seconds application, whereas all hand rinses did. The hand rinses used in the study were ethanol 75%; ethanol 54% and 1-propanol 10% (total: 64%); 2-propanol 45% and 1-propanol 30%, 2-propanol 45% and 1-propanol 30% plus Mecetromium etilsulfate (0.2%). In terms of bactericidal efficacy, 1-propanol can be regarded as the most effective alcohol, followed by 2-propanol and ethanol. Comparison of 2-propanol with ethanol showed that the efficacy of 2-propanol 60% (v/v) is almost equivalent to ethanol 80% (v/v). However the result of our study revealed that antiseptic handrub using ethyl alcohol glycerin 69% alcohol rinse also as effective as Isopropyl alcohol 60% (2-propanol 60% v/v).

Bacterial contamination of the hands of hospital staff during routine patient care has been studied by Pittet et al (1999) , the duration and type of patient care affect hand contamination. In our study the duration of the activity was limited to 1-2 minutes and the patient care was located at the perineal area by changing diapers and palpation of femoral arteries, hence the microorganisms identified were similar between two groups.

Two major groups of microorganisms may be found on the skin: microorganisms that live in superficial layers of the stratum corneum and in the upper parts of the hair follicles (*transient flora) ;* and microorganisms that reside in the deeper areas of the hair follicles and sebaceous glands (*resident flora)* which beyond the reach of ordinary disinfection procedures. These bacteria are a reservoir for recolonization after the surface bacteria are removed. (Davis CP, 2003). Transient flora has a major role in nosocomial infections resulting from cross transmission mostly by the hands of health care workers. (Pittet D et al, 1999).

The microorganisms identified in our study were *S. epidermidis, K. pneumonia, P. aeruginosa, S. aureus, E. coli* which were "*transient flora"* and most of them are opportunistic pathogens. Prevention of bacterial contamination by transient flora and possible subsequent infection requires effective hand cleansing to killed/ removed these bacteria. In this study the efficacy of hand antiseptics are determined by calculating the mean percentage of reduction of bacteria after handrub.

Alcohol as skin antiseptics kill the bacteria by coagulates protein and dissolves lipids. (White AB, 1989). In our study ethyl alcohol glycerin 69% and isopropyl alcohol 60% appeared had a better bactericidal activity against gram-negative bacteria (*K. pneumonia, P. aeruginosa, E. coli)* than gram positive bacteria (*S. epidermidis, S. aureus),* with mean percentage of reduction of gram-positive bacteria 67.02%, 67. 41% and mean percentage of reduction of

gram negative bacteria 92.9% and 81.1%, even though statistical analysis showed no significance differences between the two groups of bacteria . The possible explanation of this condition are as followed: Most gram-positive bacteria have a relatively thick (about 20 to 80 nm), continuous cell wall which is composed largely of peptidoglycan. In contrast, the peptidoglycan layer in gram-negative bacteria is thin (5-10 nm), the other chemical components of gram-negative bacteria such as lipopolysaccharides (LPS), lipoprotein and porins. (Salton MRJ and Kim KS, 2003). These differences makes gram-negative bacteria more readily destroyed than gram-positive bacteria.

Ethyl alcohol glycerin 69% might be used as hand antiseptic in health care setting since there was no significant difference in mean reduction of bacteria with Isopropyl alcohol 60% as reference alcohol-based handrub. However based on our efficacy data, we do not consider the used of these antiseptics if there is possibility of gram-positive nosocomial infection, because their antimicrobial efficacy may be insufficient to prevent the spread of pathogens. The used of higher concentration of alcohol in such condition to prevent the spread of the microorganisms should be considered.

The other limitation of this study is the possibility of evaporation of the alcohol over time were not estimated. A very recent study demonstrated that evaporation led to a decrease of the volume of alcohol > 20% over 28 days with poor dispensers, compared with < 1% with good dispensers. (Widmer AF, 2000).

CONCLUSION

Ethyl alcohol glycerin 69% handrub is as effective as Isopropyl alcohol 60% handrub in Neonatal ward dr. Soetomo Hospital, Surabaya, Indonesia.

REFERENCES

Austin DJ, Bonten MJM, Weinstein RA, Slaughter S, Anderson RM, 1999. Vancomycin-resistant enterococci in intensive-care hospital settings: Transmission dynamics, persistence, and the impact of infection control programs. Proc Natl. Acad Sci. USA ; 96(12):6908-6913.

Boyce JM and Pittet D, 2002 Guideline for Hand Hygiene in Health-Care Settings. Recommendations of the Healthcare Infection Control Practices Advisory Committee and the HICPAC/SHEA/APIC/IDSA Hand Hygiene Task force. Am J Infect Control; 30(8);S1-46.

Davis CP. Normal Flora . http://gsbs.utmb.edu/microbook/ch006.htm (20 Des 2003)

Handwashing Liaison Group, 1999. Hand washing: A modest measure – with big effects. BMJ; 318: 686.

Indarso F, Harianto A, Etika R, Damanik SM, Hidajat B, Ismoedijanto, 2003. Kejadian Luar Biasa Sepsis dan Selulitis Berulang, Penanganan, Peran Semprot Tangan dan Penggunaan Antibiotika di Ruang Neonatus RSUD dr. Soetomo Surabaya**.** Kongres Nasional Perdana Perhimpunan Pengendalian Infeksi Indonesia (PERDALIN); 2003 Jan. 18-19; Surabaya, Indonesia.

Kramer A, Rudolph P, Kampf G, Pittet D, 2002. Limited efficacy of alcohol-based hand gels. Lancet 359:1489-90.

Pittet D, Dharan S, Touveneau S, Sauvan V, Perneger TV, 1999. Bacterial Contamination of the Hands of Hospital Staff During Routine Patient Care. Arch Intern Med159:821-826.

Salton MRJ, Kim KS. Structure. http://gsbs.utmb.edu/microbook/ch002.htm (20 Des 2003)

Stone SP, 2001. Hand hygiene – the case for eidence-based education. JR Soc Med 94:278-281.

Teare L, Cookson B, Stone S, 2001. Hand Hygiene – Use alcohol hand rubs between patients: they reduce the transmission of infection. BMJ 323:411-412.

Weinstein RA, 1998. Nosocomial Infection Update. Emerg Infect Dis 4(3):416-419.

Weinstein RA, 2001. Controlling Antimicrobial Resistance in Hospitals: Infection Control and Use of Antibiotics. Emerg Infect Dis 7(2):188-92.

White AB, 1989. Sterilization and disinfection in the laboratory. In : Collee JG, Duguid JP, Marmion BP. Practical Medical Microbiology. 13 ed , vol 2. Edinburg: Mackie & Mc Cartney; Chapter 4, hal 86.

Widmer AF, 2000. Replace Hand Washing with Use of a Waterless Alcohol Hand Rub? Clin Infect Dis 31:136-143.