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ORIGINAL PAPER

Comparison between traditional and disposable bed baths in Intensive Care Unit

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ABSTRACT

Introduction and aim. This study aimed to compare the difference in the number of microorganisms (microbial counts) between traditional and disposable bed baths.

Material and methods. This study is quasi-experimental with two groups. The sample consisted of 30 respondents from the traditional bed bath and the disposable bed bath groups. Cultures of the groin were obtained to compare the number of microorganisms before and after bathing.

Results. Bathing with disposable bed baths has proven to be more effective in reducing the number of microorganisms in both the control group and the intervention group on day I and day II with p=0.014 and p=0.033.

Conclusion. Disposable bed baths are more effective in reducing the number of microorganisms on the skin than traditional bed baths.

Keywords. disposable bed baths, number of microorganisms, traditional bed baths

Introduction

Nosocomial infections are associated with increased length of hospital stay, mortality rates and costs. The increased risks of mortality and disability in patients treated in the Intensive Care Unit (ICU) are not only caused by chronic diseases but also secondary causes, namely nosocomial infections.[1,2] Each year, about 1.75 to 3.5 million patients are admitted to hospitals in the United States, and about 5% to 10% of whom, suffer from nosocomial infections.[3] Prevention of nosocomial infections can be done by bathing patients regularly to improve body hygiene and skin integrity and prevent disease.[4] Previous studies have shown a very high contamination rate of basin baths from 62% to 98%.[5]

Patients in the ICU who are sedated and on a mechanical ventilator are too weak to be able to perform personal hygiene measures on their own.[6] Nurses perform personal hygiene measures by using a basin of warm water, soap and washcloths.[7] The use of soap causes an increase in the pH of the skin, stripping the skin of moisture – thus causing the skin to become dry.[8]

Personal hygiene measures aim to keep patients clean, refresh them and make them feel comfortable. Also, it can help reduce body odor, stimulate circula-

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tion, eliminate sweat and reduce the potential for infection. Traditional basin bath has long been the standard in bathing patients in bed, but bed hygiene measures are considered potential workloads on nurses because they are really tiring.[9] The bathing method using disposable bed baths (DBB) eliminates the use of traditional basin baths which have been identified as a significant potential source of waterborne and basin-borne infections.

Aim

Aimed to compare the difference in the number of microorganisms (microbial counts) between traditional and disposable bed baths.

Material and methods

Ethical approval

Ethics committee approval was obtained before starting the study (Universitas Hasanuddin with number 718/H4.B.4.5.31/PP36-KOMETIK/2018).

Study design

This study used a quasi-experimental with a two-group design. Respondents were divided into 2 groups, group I was bathed using the traditional method, while group 2 was bathed using the DBB method, each group was bathed once a day for 1 day. On day 2, cross-over was performed, the first group (traditional method) was bathed using the DBB method and the second group (DBB group) was bathed using the traditional method, each group was bathed once a day for 1 day.

Respondents in this study consisted of 30 patients, namely 15 in the control group and 15 in the intervention group. This study was conducted in the ICU room at RS Universitas Hasanuddin, Makassar from October 22 to November 22 2018; bacterial culture examination was carried out in the Microbiology Laboratory at RS Universitas Hasanuddin, Makassar. Inclusion criteria were respondents who do not have skin problems, agree to participate in the study, have never been bathed in bed with DBB regularly. Meanwhile, exclusion criteria were respondents who were only hospitalized for one day in the ICU, suffered from cervical fractures and burns, infants and had diarrhea - and referred to other hospitals thus had not followed all stages of the study.

The procedure for bathing with the traditional and DBB methods is relatively the same, what makes it different is only the tools and materials used. The traditional method uses a basin, water, soap, lotion and towels to dry, while the DBB method only uses a disposable wash glove. Research assistants involved in this study were trained on procedures and how to bathe using traditional and DBB methods. Cultures of the Skin were obtained in moist areas, namely the groin.[10,11] Swabs of the skin were performed before the patient was bathed and 5-10 minutes after the patient was bathed. Swabs were performed using sterile cotton swabs which were then rubbed on the groin in a circle, then swabs that have been rubbed were put in sterile bottles to be examined in the microbiology laboratory.

Data were analyzed using SPSS 21.0 (IBM, Armonk, New York, United States). Univariate data were data on participants' initial characteristics and bivariate data were to compare the number of microorganisms. Data analysis was done using Paired t-test if the data were normally distributed - and the alternative Mann-Whitney test if the data were not normally distributed.

Results

Table 1 shows characteristics of respondents based on age, gender, type of antibiotic and medical diagnosis.

Table 1. Distribution of Respondents in the ICU at RS Universitas Hasanuddin, Makassar (n=30)

		Control (n = 15)	Intervention (n = 15)	p
Age	Mean (SD)	53.40 (±17.204)	48.60 (±19.508)	0.52
(Min-Max)		12-80	12-87	
Gender	Males	6 (20%)	6 (20%)	1.000
	Females	9 (30%)	9 (30%)	
Types of Antibiotics	Ceftriaxone	8 (26.7%)	9 (30%)	0.908
	Ceftazidime	1 (3.3%)	1 (3.3%)	
	Cefotaxime	2 (6.7%)	1 (3.3%)	
	Meropenem	1 (3.3%)	0 (0%)	
	Ciprofloxacin	0 (0%)	1 (3.3%)	
	Levofloxacin	0 (0%)	1 (3.3%)	
	No Antibiotics	3 (10%)	2 (6.7%)	
Medical diagnosis	Surgery	6 (20%)	8 (26.7%)	0.526
	Non Surgical	9 (30%)	7 (23.3%)	

Table 2. Microorganisms distribution of cultured swabs in the groin (n=30)

		Control (n = 15)	Intervention (n = 15)
Types of Microorganisms Day 1 Bathing			
Resident	*Staphylococcus aureus*	5 (33.3%)	3 (20%)
	Staphylococcus epidermidis	6 (40%)	3 (20%)
	Staphylococcus hemolyticus	0 (0%)	1 (6.7%)
Transient	*Eserichia coli*	1 (6.7%)	2 (13.3%)
	Alkaligenes faecalis	1 (6.7%)	1 (6.7%)
	K. pneumonia	1 (6.7%)	0 (0%)
	A. calcoaceticus	1 (6.7%)	0 (0%)
	Pseudomonas aerogenosa	1 (6.7%)	1 (6.7%)
	Gram Positive Basil	0 (0%)	4 (26.7%)
Types of Microorganisms Day 2 Bathing			
Resident	*S. aureus*	6 (40%)	7 (46.7%)
	S. epidermidis	6 (40%)	2 (13.3%)
	S. hemolyticus	0 (0%)	1 (6.7%)
Transient	*E. coli*	1 (6.7%)	0 (0%)
	K. pneumonia	0 (0%)	1 (6.7%)
	A. calcoaceticus	1 (6.7%)	0 (0%)
	P. aerogenosa	1 (6.7%)	1 (6.7%)
	Gram Positive Basil	0 (0%)	3 (20%)

In the control patients, the average age of the patients was 53.4, while in the intervention group, the average age of the patients was 48.60. The average gender in the control group and the intervention group were

6 females (20%) and 9 males (30%) respectively. The most widely used antibiotic in the control group was ceftriaxone, with as many as 8 people (26.7%), while in the intervention group, the most widely used antibiotic was also ceftriaxone, with as many as 9 people (30%). Medical diagnoses in the control group were more on non-surgical patients, namely 9 people. Furthermore, Table 2 shows the distribution of microorganisms which was more dominant on gram-positive bacteria, namely *Staphylococcus aureus* which percentage on day 1 in the control group was 33.3% while in the intervention group was 20%. Meanwhile, *Klebsiella pneumoniae*, *Acinotobacter calcoaceticus* were less on day 2, both in the control group and the intervention group.

Table 3 shows that on day 1, the control group showed an increase in the number of microorganisms (microbial counts) after bathing with the traditional method with a p-value = 0.221, meaning that there was no difference in the increase in the number of microorganisms before and after bathing with the traditional way. On day 2, the control group patients were bathed in the DBB method and there was a decrease in the number of microorganisms after the bath with a p=0.152. Meanwhile, Table 4 shows that on day 1, the intervention group showed a decrease in the number of microorganisms after bathing with the DBB method with a p=0.007. On day 2, the intervention group patients were bathed in the traditional method and there was an increase in the number of microorganisms after the bath with a p=0.035.

Table 5 shows the average decrease in the number of microorganisms in the control and intervention groups on day 1 with a p=0.014; there was a significant difference between the number of microorganisms after the bath, with the number of microorganisms decreasing greater in the group bathed with the DBB method. Analysis using the Mann-Whitney test on day 2, the traditional and DBB groups obtained a p=0.033, statistically there was a greater decrease in the number of microorganisms in the group that was bathed with the DBB method. Clinically there was a significant difference between the number of microorganisms after bathing with the traditional method and the DBB method with the median value in the intervention group (traditional bed bath day 2) was -110 x 106 while in the control group (DBB day 2) was 1.1 x 106 .

Discussion

Changes in the number of microorganisms (germs) before and after bathing with traditional methods

In this study, it was found several types of microorganisms, there were gram-negative microorganisms and gram-positive bacteria. Gram-negative microorganisms appear more in humid areas than in dry areas.[12,13] Microorganisms found on the skin are classified into 2, namely resident microorganisms and transient microorganisms. Normal flora causes disease when it reaches internal organs through trauma or surgical equipment, for example *S. epidermidis*. The type and number of microorganisms still varied from individual to individual and

Table 3. Measurement of the number of colonization of microorganisms in the control group (n=15)

Day I				Day 2			
Pre Traditional (n = 15) Median (cfu/ml) (Min – Max)	Post Traditional (n = 15) Median (cfu/ml) (Min – Max)	Mean Difference (cfu/ml) (SD)	p	Pre DBB (n = 15) Median (cfu/ml) (Min – Max)	Post DBB (n = 15) Median (cfu/ml) (Min – Max)	Mean Difference (cfu/ml) (SD)	p
20 x 106 (32 x 105 – 59 x 108)	330 x 106 (5 x 105 – 62 x 108)	-210 x 106 (17 x 108)	0.221*	120 x 106 (11 x 103 – 74 x 108)	20 x 106 (17 x 103 – 64 x 108)	160 x 106 (45 x 107)	0.152*

*Wilcoxon test

Table 4. Measurement of the number of colonization of microorganisms in the intervention group (n=15)

Day I				Day 2			
Pre DBB (n = 15) Mean (SD)	Post DBB (n = 15) Mean (SD)	Mean Difference (SD)	p	Pre Traditional (n = 15) Median (Min – Max)	Post Traditional (n = 15) Median (Min – Max)	Mean Difference (SD)	p
1200 x 106 (19 x 108)	820 x 106 (17 x 108)	440 x 106 (54 x 107)	0.007**	160 x 106 (5 x 105 – 13 x 108)	230 x 106 (2 x 106 – 36 x 108)	-330 x 106 (68 x 107)	0.035*

*Wilcoxon Test **Paired Test

Table 5. Differences in the mean number of microorganisms in the control and intervention groups' patients (n=30)

Day I				Day 2			
Control (Traditional Bed Baths) Median (cfu/ml) (Min - Max)	Intervention (DBB) Median (cfu/ml) (Min-Max)	Mean Difference (SD)	p-value	Control (DBB) Median (cfu/ml) (Min – Max)	Intervention (Traditional Bed Baths) Median (cfu/ml) (Min – Max)	Mean Difference (SD)	p-value
-30 x 106 (-36 x 108- 43 x 108)	490 x 106 (-31 x 107 – 18 x 108)	110 x 106 (13 x 108)	0.014*	1.1 x 106 (-59 x 107- 10 x 108)	-110 x 106 (-25 x 108 – 25 x 107)	-84 x 106 (62 x 107)	0.033*

*Mann Whitney test

differred between body regions. Most microorganisms remained harmless.[13] Transient microorganisms consist of non-pathogenic microorganisms that have the potential to become pathogenic. Under conditions of altered balance, transient flora can cause disease. Microorganisms present on the skin become transient such as *S. aureus* concentrated in the nostrils, some Gram-negative bacteria such as *E. coli*.[14]

Traditional basin baths can reduce the number of microorganisms on the patient's skin by scrubbing carefully, using products/soaps containing anti-septic ingredients. Study conducted by has proven that anti-septic soap is effective in reducing microorganisms. Another study conducted by Abbas has also shown that antiseptic soap with a concentration of 50 mg/ml is effective for reducing microorganisms on the skin.[15-17]

In this study, the number of microorganisms after bathing with the traditional method increased, although the increase in the number of microorganisms was not statistically significant, but clinically from 15 patients in the control group who were bathed on day I with the traditional method, 8 patients experienced an increase in the number of microorganisms and only 5 patients experienced a decrease in the number of microorganisms. Meanwhile, the other 2 patients experienced stagnation in the number of microorganisms. Likewise, from 15 patients in the intervention group on day 2 after cross-over, who were bathed using the traditional method, 5 patients experienced an increase in the number of microorganisms and 8 patients experienced a decrease in the number of microorganisms. Meanwhile, the other 2 patients also experienced stagnation in the number of microorganisms with a p=0.035; there was an increase in the number of microorgaisms (germs) before and after bathing with the traditional method.

This study contradict the study conducted by Larson where from 33 patients who underwent culture swabs before and after bathing, there was a decrease in microorganisms cultured in the groin area, from 5.09 to 4.85. Traditional bathing using a bath basin has many weaknesses where according to studies, the bath basin used has proven to be a reservoir of pathogenic microorganisms.[10]

However, this study is supported by the study conducted by Marchaim that the bath basin used for patient care in the ICU, medical surgical ward, and general patient ward has a role as a reservoir of pathogenic microorganisms in various hospitals. 686 basins from various hospitals were tested, as many as 62.2% were contaminated with one or more pathogenic microorganisms.[5] This finding is consistent with study conducted by Johnson, that the bath basin is prone to be contaminated with pathogenic microorganisms up to 98%.[3] Besides that, traditional bathing using a bath basin can cause a potential workload on nurses because the work is tiring - it can cause back pain; musculoskeletal disorders due to strenuous, repetitive activities. Also, preparing water can cause fatigue and impact on the workload of nurses.[20]

Changes in the number of microorganisms (germs) before and after bathing with the DBB method

In this study, from 15 patients in the intervention group, swabs of the skin were performed to measure the number of microorganisms before and after bathing, it was found that there was a decrease in the number of microorganisms with a p=0.007, meaning that there was a difference in the number of microorganisms before and after bathing with the DBB method. The analysis carried out on the control and intervention groups (traditional bathing and DBB) on day I showed that the number of microorganisms decreased in the DBB method was much higher/ greater than in the traditional method with p=0.014; likewise, after the cross-over was carried out on day 2, it showed that the number of microorganisms decreased in the DBB method was much higher/ greater than in the traditional method with p=0.033. This study is consistent with study conducted by Larson, where from 33 patients who were bathed with the DBB method compared to the traditional method, there was a decrease in the number of microorganisms in the groin area from 5.05 to 4.79 with p=0.78.[10]

Bathing with the DBB method is quite practical because it only uses disposable washcloths that contain disinfectant. The product used in this study is the "Docare" brand washcloth bath. One of the ingredients of the wash glove used in bathing with the DBB method is Polyhexamethylene Biguanide (PHMB). PHMB is a disinfectant and preservative used for skin disinfection and cleaning contact lenses; it has very low toxicity to organisms such as human cells. PHMB is not cytotoxic. PHMB kills direct intracellular interactions of MRSA with pathogens in keratinocytes and host cells.[21,22] PHMB is effective in killing Gram-positive (*S aureus*), Gram-negative (*E. coli* and *Salmonella enterica* serovar Typhimurium) and acid-fast (*Mycobacterium smegmatis*) bacteria.[23]

Study limitations

This study period was short, namely only 1 day of intervention and 1 day of cross-over were carried out. Besides, this study only measured the types of microorganisms as well as the number of microorganisms in the control group and the intervention group; there is no specific data on the number of microorganisms in each type of microorganism so that it cannot be known the decrease in the number of microorganisms in each type of microorganism after bathing intervention was given.

Conclusion

The results of this study can be a recommendation for the use of DBB in the ICU because the number of mi-

croorganisms increases after bathing with the traditional method while it decreases after bathing with the DBB method. Disposable bed baths are more effective at reducing the number of microorganisms on the skin than traditional bed baths.

Declarations

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No funding was received for this work.

Author contributions
Conceptualization, H.A. and M.Y.; Methodology, A.M.I. and Y.S.; Software, D.D.C. and R.; Validation, N.K.J.; Formal Analysis, Y.S.; Investigation, Y.S.; Resources, H.A.; Data Curation, A.M.I.; Writing – Original Draft Preparation, M.Y. and H.H.I.; Writing – Review & Editing, R.; Visualization, M.Y.; Supervision, A.M.I.; Project Administration, M.Y.; Funding Acquisition, M.Y.

Conflicts of interest
The authors have no conflict of interest.

Data availability
The datasets used and/or analyzed during the current study are open from the corresponding author on reasonable request.

Ethics approval
The study was approved by the Universitas Hasanuddin with number 718/H4.B.4.5.31/PP36-KOMETIK/2018.

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