Comparison of two hand hygiene techniques in peritoneal dialysis patients

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ABSTRACT

Introduction: Hand hygiene is an important procedure in preventing peritoneal dialysis-related infections. **Objective:** To compare the effectiveness of two distinct techniques for hand hygiene in reducing the number of colony-forming units in patients on peritoneal dialysis. **Materials and Method:** Controlled clinical trial. Thirty patients underwent three collections of microbiological flora from the hands in three different instances: before and after hand washing with glycerin soap and water, and after rubbing 70% glycerin alcohol-based gel. Cultures were obtained by applying the fingers surface directly on agar-blood plates. **Results:** Cultures mean growth were 31, 30 e 12 colony-forming units prior to washing, after washing with glycerin soap and water, and following gel-alcohol, respectively ($p < 0.001$). *Staphylococcus epidermidis* was the predominant germ in culture, occurring in 93.7% of seeded plates. **Conclusion:** Hand rubbing with gel-alcohol was more effective in reducing the number of colonies recovered than the other methods.

Keywords: ethanol, peritoneal dialysis, renal insufficiency chronic, skin care.

INTRODUCTION

Brazil ranks third in the world with respect to the number of dialysis patients, with more than 70,000 people undergoing renal replacement therapy (RRT); 6,500 (9.3%) of these patients undergo peritoneal dialysis (PD), with either continuous ambulatory peritoneal dialysis (CAPD) or automated peritoneal dialysis (APD) systems. Among the PD patients, 40% receive APD.[1] With this modality, the patient or a family member is responsible for his own treatment at home.[2] However, this autonomy allows patients to make changes to their treatment protocol, thereby increasing the risk of technique failure. One such change is inadequate hand hygiene (HH) when performing bag exchanges (dialysis fluid). The maintenance of the patient's commitment to the prescribed treatment and the procedure protocol over time is essential in reducing complications.[3]

Infectious complications, such as peritonitis and exit-site and tunnel infections, are still the "Achilles' Heel" of PD. Abrahão, in 2006, linked the inadequacy of HH as one of the risk factors for increased frequency of peritonitis and hospitalizations.[4] The following are pathways of contamination leading to peritonitis: intraluminal (error in bag connection technique/HH), periluminal (exit-site and tunnel infection), transmural (diarrhea/constipation), hematogenous, and transvaginal. The most prevalent pathogens in peritonitis are *Staphylococcus aureus* and *Staphylococcus epidermidis*, which originate in the skin and cause intraluminal or periluminal contamination.[1]

The BRAZPD, a clinical cohort multicenter study conducted on more than 3,000 patients on PD, showed that the main cause of drop-out of treatment is death (mainly due to cardiovascular disease) of the patients, followed by peritonitis. The prevalence of peritonitis in the study was 1 episode per

30 patients per month caused by *S. aureus* and coagulase-negative *Staphylococcus* in most cases, but with large regional differences; the prevalence of exit site infection was 1 episode per 54 patients per month. Negative cultures were observed in almost 40% of the cases.[5] Peritonitis occurs more often by technique failure, damage to the transfer set or to the catheter, thereby allowing bacterial access into the peritoneal cavity through the catheter lumen.[1]

In order to reduce the risk, during training, the patient is given instructions for the proper use of the HH technique before performing the procedure.[2] Often, patients find it difficult to comply with the technique, especially the recommended duration of hand washing. This factor is one of the most common aspects of non-compliance with the proposed treatment.[6] A previous study[7] indicated that drying hands after washing is important to reduce the levels of microbial contamination since the fingers touch the device catheter during bag exchange. Hands that were washed but not properly dried before contact were found to transport up to 4500 microorganisms to the catheter connector. Drying with hot air reduced these numbers between 95% and 99%.

To prevent transmission of microorganisms through the hands, 3 elements are required: (1) a topical agent with antimicrobial efficacy, (2) appropriate procedure for using the agent (proper technique, for the recommended duration), and (3) indicated moment, reducing morbidity and mortality, as well as the costs associated with the treatment of infectious clinical conditions.[8]

The term "hand washing" was replaced by HH after the publication of an article in 2002.[9] In scientific literature, the HH technique is designed and/or recommended for healthcare professionals. There is no standard technique described, and there is also no specific literature for "hand washing" for PD patients.[9-11] The "Guidelines for Hand Hygiene in Health Care Services," recommend the following techniques for ensuring HH:

Simple hand hygiene (SHH) aims to remove transient flora colonizing the surface layers of the skin, as well as sweat, sebum, and dead skin cells, thereby removing dirt favoring the existence and proliferation of microorganisms.[10,12]

Antiseptic hand hygiene (AHH) is similar to the SHH, but replaces common soap with an alcoholic antiseptic preparation in order to decrease the microbial load, by friction of the hands.[9-11] The use of alcohol gel, preferably at 70% or a 70% alcoholic solution with 1-3% glycerin can replace hand washing with water and soap when hands are not visibly dirty.

Studies comparing the optimum amount of alcohol to be applied for further reduction in the number of colony-forming units (CFU) suggest that 3 ml of the product is sufficient to cover the hands with the friction movement; it lasts for 30 seconds or until evaporation of the alcohol.[13-16]

SHH measures recommended for healthcare professionals are to apply/rub the surfaces of hands with liquid soap, for a duration between 40 and 60 seconds; rinse hands, removing soap residue; and avoid direct contact of the soapy hands with the tap. Dry with disposable paper towels.[10]

To ensure that patients maintain HH at home, the use of glycerin soap for 3 minutes after removing rings, bracelets, and/or wristwatches and folding clothing with long sleeves up to the elbows before washing, is recommended. After washing, a clean towel or disposable paper towels are to be used for drying of the hands.

HH is recognized worldwide as a primary, but very important, measure in the control of infections and is considered one of the key factors in the prevention and control of infections within the health services, thereby reducing morbidity and mortality.[11]

In the literature, no specific and/or in-depth studies were found to address the relationship between HH techniques, time for applying soap/alcohol, rubbing/friction movements, and the materials used in this procedure by patients undergoing PD. PD, which is performed 4 times a day, can be a heavy and time-consuming burden for the patient. Part of this burden is due to the time spent with HH. Reducing the burden of these repetitive and dull procedures will help improve the patients' compliance with the HH techniques and promote their well-being and quality of life.

This study aims to compare 2 techniques of HH with regard to their efficacy in reducing the number of CFUs in PD patients.

Patients and Methods

This was a controlled clinical trial conducted at the Dialysis Unit of the Nephrology service of the HSL/PUCRS after approval by the Ethics Committee of the PUCRS (CEP protocol number 09/04535).

Patients

Currently, about 50 patients have been undergoing PD at the Dialysis Unit of the HSL/PUCRS. Participation of subjects was as per their convenience. A total of 33 participants were enrolled. Patients were invited to participate in the study by approaching then at the time of their out patient appointment. After enrollment, a total of 3 samples were collected from each patient for analysis. The inclusion criteria for the study were as follows: patients of both genders, aged over 18 years, receiving PD treatment for more than 3 months, and who agreed to participate and signed Informed Consent Form.

Method

The samples were collected by impression of the patients' hands on the culture medium, at the Dialysis Unit of the Department of Nephrology of the HSL/PUCRS. Sheep blood gar plate (Biomerieux®) were incubated at 37ºC for 24 hours, and the morphotypes growth was counted.[17] Colonies suspected of being *Staphylococcus* were identified by the tube coagulase test. These procedures were performed in the Microbiology Laboratory of the HSL/PUCRS. Specimens for culture were obtained by touching the fingertips of the right and left hands of patients on the plates of sheep blood agar plates (Biomerieux®), with 3 samples being obtained for each patient.

The first sample was obtained on a day agreed by the patient, without taking any measures for HH.

The second sample was obtained after the patients washed their hands with water and non-antimicrobial glycerin soap for 3 minutes, as per the HH routine the patient is instructed during training. After washing, a sterile gauze was used for drying the hands. This is different from the technique recommended for use at home.

The third sample was collected on a day different from that on which the first 2 samples were obtained. Before sample collection, the HH measure adopted was rubbing the hands with 3 ml of a 70% alcoholic solution containing glycerin, until total evaporation of the product, without prior washing with water and soap.

In the present study, the 70% ethyl alcohol solution (Carbopol 0.25%; Nipagin 0.03%; Essence of fennel 0.12%) with glycerin used was the same as that used by the Committee on Hospital Infection Control (CCIH) of the HSL/PUCRS, formulated by the PUCRS University Pharmacy; the non-antimicrobial glycerin soap bars used were obtained from FORTPEL® Com. Descartáveis Ltda. The sheep blood agar plates (ref 35005) were a donation from the Biomerieux® Laboratories.

Statistical analysis

Statistical analysis was performed using Statistical Package for Social Sciences (SPSS 17.0 for Windows, California, USA). Categorical variables are presented as frequency and percentage; continuous variables with normal distribution, as mean and standard deviation (SD); and variables with asymmetric distribution, as median and interquartile range (IQR). For intergroup comparison, Student's *t*-test and ANOVA with post-hoc Bonferroni was used. A result of $p \leq 0.05$ was considered significant.

Results

The sample population consisted of 33 patients who were initially enrolled in the study; 3 samples each were obtained from 91% (n = 30) of them. There was a predominance of female, comprising 63.3% (n = 19); the mean age of the participants was 52 ± 26 years.

Seeding of plates before hand hygiene produced a mean of 31 ± 21 CFUs, with a median of 25, ranging between 7 to 91 CFUs; the mean obtained after washing with water and non-antimicrobial glycerin soap was 30.7 ± 24.7 CFUs, median 25, ranging between 0 and 118 CFUs; and after rubbing with 3 ml of 70% ethyl alcohol gel with glycerin, the mean was 12 ± 15 CFUs, with a median of 5, varying from 0 to 50 CFUs.

Analysis by ANOVA showed a statistically significant difference between the number of CFUs after rubbing hands with 70% ethyl alcohol gel with glycerin and that observed after washing hands with a non-antimicrobial glycerin soap ($p < 0.001$). The difference between the CFU count before and after washing with water and soap was not statistically significant ($p = 1$). We found a large variety of morphotypes in samples obtained before washing. Among the bacteria in the CFUs, there was a predominance of *S. epidermidis*, which was present in 94% of the cultures in all steps, followed by gram-positive bacilli, which were present in 14%, 10%, and 13% of the cultures.

Discussion

Mean age of the sample population was 52.3 ± 26.2 years, whereas in Brazil, it is 54 ± 19 years, overall. However, both these ages are below the average in Latin America, which is 65 years old or more and includes a potential increase in the risk of peritonitis, as detected in 40% of the population in 2003.[18] In this study, 87% of patients were on CAPD and only 13%, on APD. These data are similar to the percentage of patients using APD in Argentina, which was approximately 25%, while in Mexico only 3% in 2001.[19] In Brazil, nearly 53% of patients undergo APD.[1]

Peritonitis often occur due to an inappropriate technique, whereby bacteria can gain access into the peritoneal cavity through the catheter lumen.[1] In our sample, women were in a majority, at 63.3%, which is more than 55% - the average for PD patients in Brazil. The mean treatment follow-up period was 22 months (median 12.5); this was higher than that in the multicenter study BRAZPD, which with 14 months was similar to the median of this sample.[5] In the cultures obtained, a predominance of *S. epidermidis* was observed, corroborating data obtained in 2004, in which this pathogen was described as the most common organism causing peritonitis in the world.[20] However, in Latin America, studies have reported that *S. aureus* is the most common etiologic agent.[21] In Brazil, in general, in a large percentage of cases, peritonitis is caused by *S. aureus* (24-28%).[5,21] However, this high percentage may be distorted due to the large number of negative cultures (40%).[5] Peritonitis remains a major problem for patients on PD. Certainly, HH measures are important for the prevention of PD-related infections. The use of and compliance with the proper technique are critical to the success of therapy.

Adherence to HH technique may be compromised over time, when some of the steps may be gradually forgotten. The main technical failures occurring primarily are not using antiseptic agents and not rubbing all over the surfaces of the hands, among others. Russo *et al*. showed that 23% of patients were noncompliant with the bag exchange technique, with a significant association between compliance with treatment and incidence of peritonitis.[3] One factor that needs to be assessed is the time required to perform this procedure. Easy access and regular use of topical agents with antimicrobial efficacy is essential for compliance with these recommendations, as well as the choice of the product for HH, which should also be taken into consideration.[8]

A 2004 study comparing the antimicrobial efficacy of alcohol in gel and liquid formulation revealed that the use of alcohol caused a significant reduction of above 99.9% in the transient colonization in hands artificially dirtied with organic matter; this percentage was greater than that reported earlier for the use of non-antimicrobial soap for washing hands.[6,22] Due to the significant presence of bacteria among the resident flora present in the hands after washing with water and soap and thorough drying, the use of alcohol-based gel or liquid is recommended after washing the hands and it is important to remove any ring when following HH techniques.[23]

The finding that the CFU counts before and after hand washing with water and soap were not different was not expected; however, a previous study showed that washing with water and soap reduced the bacterial count in the hands by only 30%, a percentage significantly lower than those reported for different formulations containing alcohol.[24]

In this study, 70% alcohol gel proved to be more effective in reducing the number of CFUs of different morphotypes than the non-antimicrobial soap, as indicated by the cultures read after incubating the sheep blood agar plates

(Biomerieux®) for 24 hours at 37°C. Another study, in which endpoint was peritonitis, showed that the group using alcohol gel for HH had a lower incidence of peritonitis than the control group, which used water and soap, although the intergroup difference was not significant. Therefore, the patients were switched to alcohol gel because it was as effective as water and soap, and the patients found it more comfortable and easier to use.[25]

Conclusion

Among the 2 existing HH techniques, the use of 70% alcohol gel was more effective in reducing CFUs in the hands of PD patients. Therefore, replacement of soap with alcohol gel may be an effective option for PD patients and help minimize the risk of intraluminal contamination.

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