Identification of bacterial contamination in liquid soap for hospital use

IDENTIFICAÇÃO DE CONTAMINAÇÃO BACTERIANA NO SABÃO LÍQUIDO DE USO HOSPITALAR

IDENTIFICACIÓN DE CONTAMINACIÓN BACTERIANA EN EL JABÓN LÍQUIDO DE USO HOSPITALARIO

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ABSTRACT

This study performed a bacteriological analysis of the liquid soap in dispensers that health professionals use for hand washing. This exploratory, cross-sectional study was developed at the hospitalization units of a medium-sized hospital in Fortaleza, Ceará, Brazil. Data were collected between May and July 2007. Fifty-nine liquid soap dispensers were analyzed, of which 33 contained the following microorganisms: Burkholderia cepacia (14), Pseudomonas putidas (9), Pseudomonas aeruginosa (3), Klebsiella pneumoniae (3), Enterobacter clocae (2), and Pseudomonas luteola (2). The units with the largest number of contaminated samples were the surgical (n=7) and the dermatological clinics (n=4). Contamination was also found in an original flask of the same lot of liquid soap used to fill up the dispensers. In conclusion, there is a need to regulate and control the quality of these products in the production lines as well as during use in hospital services, mainly because they are used to prevent hospital infection.

KEY WORDS

Handwashing.
Soaps.
Contamination.
Cross infection

RESUMO

O estudo realizou a análise bacteriológica de sabões líquidos utilizados para lavagem das mãos dos profissionais de saúde. Trata-se de estudo exploratório transversal, desenvolvido nas unidades de internação de hospital de médio porte em Fortaleza/CE. Os dados foram colhidos no período de maio a julho de 2007. Do total de 59 frascos com sabão líquido, 33 continham os seguintes microorganismos: Burkholderia cepacia (n=14), Pseudomonas putidas (9), Pseudomonas aeruginosa (3), Klebsiella pneumoniae (3), Enterobacter cloacae (2), Pseudomonas luteola (2). As unidades com maior número de amostras contaminadas foram a clínica cirúrgica (n=7) e a clínica dermatológica (n=4). A contaminação também foi verificada em frasco original do mesmo lote de sabão líquido usado para abastecer as saboneteiras. Podemos concluir ser necessário disciplinar e controlar a qualidade desses produtos nas linhas de produção tanto quanto nas fases de uso nos serviços de saúde, sobretudo porque sua utilidade se presta à prevenção de infecção hospitalar.

DESCRITORES

Lavagem de mãos.
Sabões.
Contaminação.
Infecção hospitalar.

RESUMEN

El estudio realizó el análisis bacteriológico de jabones líquidos utilizados para lavado de manos de los profesionales de salud. Se trata de un estudio exploratorio transversal, desarrollado en las unidades de internación de hospital mediano en Fortaleza, Ceará, Brasil. Los datos fueron recolectados en el período de mayo a julio de 2007. Del total de 59 frascos con jabón líquido, 33 contenían los siguientes microorganismos: Burkholderia cepacia (n=14), Pseudomonas putidas (9), Pseudomonas aeruginosa (3), Klebsiella pneumoniae (3), Enterobacter cloacae (2), Pseudomonas luteola (2). Las unidades con mayor número de muestras contaminadas fueron la de clínica quirúrgica (n=7) y la clínica dermatológica (n=4). Se verificó también contaminación en frasco original del mismo lote de jabón líquido usado para abastecer las jaboneras. Podemos concluir en que es necesario disciplinar y controlar la calidad de estos productos en las líneas de producción, tanto como en las fases de uso en los servicios de salud, sobre todo porque su utilidad apunta a la prevención de infecciones hospitalarias.

DESCRIPTORES

Lavado de manos.
Jabones.
Contaminación.
Infección hospitalaria.

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INTRODUCTION

Hand washing by health professional before having contact with patients is considered a fundamental hospital infection control measures, as hands are the main vehicle for microorganism transmission in the hospital environment[1], given the skin's capacity to shelter microorganisms and transfer them from one surface to the other, through direct contact, skin to skin, or through indirect contact, through objects[2].

Several scientific publications demonstrate the correlation between hand washing and decreased infection transmission. Well-conducted studies have shown the importance of putting in practice hand washing practices to reduce infection rates[3-5] and the absolute majority of infection control specialists agrees that hand washing is the simples and most effective way to prevent the transmission of micro-organisms in the care environment. The Brazilian government also acknowledged the need for hand washing when it included recommendations for this practice in Attachment IV of Ministry of Health Decree 2.616/98, which instructs on the Hospital Infection Control Program in Brazilian health care establishments. The importance of this theme stands out even more as various international regulations and manuals on hand washing, elaborated by professional associations or international governmental entities[4-5], acknowledge evidence on the value of this basic control action, which can be achieved through the use of soaps, detergents or antiseptic agents.

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In Brazil, the main degerming agents recommended for hand washing in hospital practice are non-medication liquid soap, 70% ethyl alcohol and antiseptic 10% PVP-I and 4% chlorhexidine detergent solutions[7-8].

Due to its intense antimicrobial activity, rapid action, good cutaneous tolerance and easy application, gel alcohol-based products are recommended for hand washing. Further studies highlight the importance of validating the product before its introduction in clinical practice, as not all gel alcohols, even at 1.5-minute intervals, are effective in the disinfection process[9-10].

Soaps are salts formed through the reaction of fatty acids obtained from vegetal and animal fats with metals or basic radicals (sodium, potassium, ammonia etc.)[7] and exert detergent action, i.e. they permit the removal of dirt, remains and viable (non-colonizing) microorganisms. Their action is mechanic and does not have bactericidal effects. Anti-septic agents, then, are germicidal formulation that act on the contaminating and colonizing flora, with low causticity levels[11], and should be kept in closed and sterile recipients before use. Once open, they should be protected against contaminations. Besides, as their validity is limited, they should be labeled, observing standards for weekly, two-weekly or monthly change.

In view of these considerations, this research evaluated the microbial contamination of liquid soap used at a tertiary health unit as, according to the researchers, this kind of studies help to prevent infection and, consequently, to reduce infection rates and costs. Thus, they entail benefits for the institution and patients, whose health status will not be compromised, nor will their hospital stay be prolonged due to a hospital infection.

OBJECTIVE

To accomplish the bacteriological analysis of liquid soap used during health professionals' hand washing process.

METHOD

Study design

Cross-sectio nal exploratory study, carried out to identify the presence of microorganisms in liquid soap and, once identified, to try and relate the origin of this possible contamination.

Place of study

The research was developed at a medium-sized teaching hospital in Fortaleza/CE, with 243 beds, at the surgical clinics (three units), medical clinics (hematology, pediatrics, medical clinic and dermatology), Intensive Care Unit (ICU) and recovery room. Samples were collected between May and July 2007.

Sample selection

All devices (soap dispensers) with liquid soap from the nursing wards, totaling 59 samples, were monitored in the microbiological analysis. Twelve mililiters were collected from each point at three times: at the start of use, during use and at the end of use – within an interval of up to two weeks, depending on the product consumption. In case of bacterial contamination, the product contained in the original bottles that had already been manipulated was analyzed. If that was also contaminated, a sealed (closed) bottle of original soap from the same product lot was sent for evaluation. It should be highlighted that the microbiological analysis was carried out at the Federal University of Minas Gerais.

Microbiological study

The microbiological analysis used particular techniques for each type of anti-septic solution or soap, so as to concentrate, detect and quantify microorganisms (bacteria and fungi)[12].

To concentrate possible microorganisms, centrifugation and filtration in membranes made of material resistant to the products was used, with 0.22ì pores, according to protocols established by the microbiology laboratory[12].

Cultures were accomplished in specific means to isolate gram-positive and gram-negative bacteria and fungi. Besides seeding the concentrated samples, quantitative cultures departed from dilutions, multiples of 10, obtained from the forwarded products, in the range between 10 and 10-6. Isolation and quantitative cultures use blood agar, chocolate agar and MacConkey agar. Cultures for fungus isolation, on the other hand, use Sabouraux agar.

The isolated microorganisms were identified through biochemical tests and in a semi-automated culture and identification system. In those cases when microorganisms were identified in the different steps of the usage process, new samples from the same lot were requested, including both the original solutions, provided by the manufacturer, and the samples from the usage phases.

The PCR test for mycobacteria was based on the DNA extracted from the filter membrane. Primers were used for the synthesis of gen 16s r RNA of the *Mycobacterium* genre. The primers 264 and 285 direct the synthesis as from the 5' extremity, and primers 248 and 285 as from the synthesis of the 3' extremity of gen 16s rRNA[12].

Data analysis

Data were presented in graphs and tables and marked with (+) when bacterial growth was found in the analyzed bottle, or with (-) when there was no growth. The tables include bacterial strains that were isolated and quantified in colony-forming units (CFU/ml), with dilutions that would permit counting the number of CFU. Due to the number of samples at each hospital sector under analysis and the descriptive nature of this study, no statistical tests were performed.

Ethical issues

As the research neither involved medical care, nor patients as a whole or in part, nor patient-related data, it did not fit into projects that should get approval from Institutional Review Boards. Nevertheless, authorization was requested from the institution to accomplish the study.

RESULTS AND DISCUSSION

Fifty-nine liquid soap samples were analyzed. Thirty-three of these contained microorganisms, 24 from wall-mounted soap dispensers, seven from original bottles in use and two from original sealed bottles. Thus, two bottles from the same batch were contamined before their use in the hospital environment, which means a possible contamination during industrial production and the bottling process of the soap. This, however, does not explain all detected contaminations, which included samples obtained from soap dispenses filled with batches that had not been contaminated in the original packing. Open dispenser systems, as practiced at the institution under analysis, and the handling of liquid soaps inside the hospital environment are known risk factors for microbial contamination of these products. These data confirm this risk and also alert to contaminations in the industrial phase.

Bacteria are widely distributed, line the skin, mucous tissue and cover the intestinal tract of men and animals. They are intrinsically connected with the lives of organisms and the wide environments they live in[13]. Many bacteria are harmless. Some are beneficial to their host (man, animal, plants) and provide nutrients or protection against pathogens and diseases, limiting the colonization abilities of harmful bacteria. In the hospital environment, however, bacteria have a different profile, mainly due to the indiscriminate use of antimicrobial agents, as these increase the selective pressure and also the opportunity to acquiring resistance mechanisms, causing the dissemination of antibiotics-resistant bacteria, entailing severe risks for health.

It is naïve to believe that the only influence of hospitalization on the disease should be the reduction or cessation of its progress. The responsibility for infection prevention and control undeniably implies strict attention to the several aspects related with biological risks and unhealthy environmental conditions, which need to be identified and controlled. These include lack of cleaning material, inappropriate use of individual protection equipment (IPE), inadequate cleaning and disinfection routine of the units and collective-use equipment, including soap dispensers and flasks, improper destination of contaminated clothes and materials, among others.

Hence, patients' hospitalization is not a passport for health. On the opposite. Hospitals constitute a powerful infection source. They are true bastions of antibiotics-resistant bacteria. The environment shelters a large variety of microorganisms, mainly bacteria. Many of these bacterial agents, although normally not pathogenic, can rapidly outdo the low resistance of immunodepressive patients and cause infectious diseases[13].

As mentioned, the main microorganisms isolated in the analyzed soap samples were the following: *Burkholderia cepacia* (14); *Pseudomonas putidas* (9); *Pseudomonas aeruginosa* (3); *Klebsiella pneumoniae* (3); *Enterobacter cloacae* (2); *Pseudomonas luteola* (2). The *Burkholderia* genre has been reclassified recently. Before, it was grouped under the *Pseudomonas* genre.

Burkholderia species move through one single polar flagellum, or flagellum cluster. The best-known species is *Burkholderia cepacia*, which is aerobic, gram-negative and rod-shaped, capable of growing even in disinfecting solutions. This species has an extraordinary nutritional spectrum and can degrade more than 100 different organic molecules. This ability results from factors that facilitate equipment, product

and drugs contamination in hospitals[14]; it can colonize a range of humid environmental surfaces and is commonly associated with hospital infections. According to literature[15], infections caused by this microorganism include respiratory tract infections in patients with cystic fibrosis or chronic granulomatous disease; urinary tract infection; urinary tract infection in patients using catheters; and sepsis, particularly in patients with contaminated intravascular catheters. Except for pulmonary infection, in general, *B. cepacia* has a relatively low virulence level, and infections with this microorganism generally do not result in death.

Pseudomonas spp. are straight or slightly curved gram-negative bacilli, which are mobile through polar flagella; they are omnipresent organisms, easily found throughout the hospital environment in humid reservoirs, including food, cut flowers, sinks, toilets, floor cleaning mops, equipment, particularly for respiratory treatment, and even in disinfectant solutions. The large-scale environmental distribution of *Pseudomonas* is guaranteed by its simple requirement for growth. They also have different structural factors and toxins that stimulate their virulence potential, making them resistant to the most commonly used antibiotics. *Pseudomonas aeruginosa* is the most common clinically significant species, causing various infections, as it is typically resistant to most antibiotics. Another species found in the study was *Pseudomonas putida*, little associated with infections in human beings[14].

Klebsiella pneumoniae can cause primary lobar pneumonia, which frequently involves the necrotic destruction of alveolar spaces, formation of cavities and production of bloody sputum. These bacteria also cause infections in wounds, soft tissues and the urinary tract[15]. Another gram-negative bacillus that was found, from the *Enterobacteriaceae* family, was *Enterobacter cloacae*. Infections caused by microorganisms from the *Enterobacter* genre are rare in immunocompetent patients, but common in neonates and immunocompromised patients. The main problem with this bacteria group is resistance to multiple antibiotics[15].

As for the sites with the largest number of contaminated soap samples, these were the surgical (n=14) and dermatology clinics (n=4). With regard to the other sites, the following were identified: medical clinic (n=3), pediatrics (n=2), hematology (n=1). Thus, it can be inferred that the great contamination of these soap dispensers, allied with the patients' characteristics, involving a large number of surgical wounds, make these products more vulnerable to bacterial contamination. This assertion cannot be proved. In this study, one limitation is the lack of identification of the main contamination cause in one sector but not in the other. Therefore, this research turned to the identification of the soap batch in use at the units, although the importance of soap dispensers as an infection source, and the fact that closed dispenser systems and shorter changing times are perceptible control measures cannot be excluded.

A study carried out to determine the role of soap as an infection source made new recommendations: buy discardable dispensers; use smaller soap bottles; limit liquid soap use; provide patients with individual soap and increase disinfection with gel alcohol[16].

Dispensers at the institution are cleaned with water and soap whenever the solution inside them finishes. Although the protocol mentions cleaning once per week, this routine often is not followed regretfully, and dispensers are refilled not when they are totally empty, but when they are somewhat empty, which can favor the growth of microorganisms.

At the nursing station and in two nursing wards of surgical unit III, no bacterial contamination was identified in the soaps (Table 1). At the other wards, bacterial presence stood out, which alerts to the risk of disseminating these pathogens to the patients. It is important to standardize microbiological control of hospital products as early as in the production phase and certify to good use of these products in the hospital environment. This should start with more rigorous training of cleaning staff, besides guaranteeing correct hand washing, hygiene practices, cleaning and disinfection of environments and hospital utensils.

Table 1 - Bacterial analysis in liquid neutral soap samples from soap dispensers used at Surgical Unit III - Fortaleza, CE - 2007

Sample	Positive	Negative	Bacteria	CFU/ml
Nursing station		-		
Procedure room	+		*Pseudomonas putidas*	4,020
Ward 16		-		
Ward 17	+		*Pseudomonas aeruginosa*	55,000
Ward 18	+		*Burkholderia cepacia*	95,000
Ward 19	+		*Burkholderia cepacia*	6,000
Ward 20	+		*Pseudomonas putidas*	2,320
Ward 21	+		*Pseudomonas putidas*	2,200
Ward 22	+		*Pseudomonas putidas*	1,240
Ward 23	+		*Pseudomonas putidas*	105,000
Ward 24	+		*Enterobacter clocae*	75,800
Ward 25		-		
Ward 26	+		*Pseudomonas aeruginosa*	51,300

Note: (-) absence, (+) presence.

As a study on liquid soap dispensers in a hospital environment demonstrated, out of 28 dispensers, 19 (68%) tested positively for one or more bacterial species. The isolated bacteria were: *A. baumannii, P. aeruginosa, Staphy-*

lococcus spp*., Enterobacter cloacae, K. pneumoniae, MRSA, Candida albicans,* and *Bacillus* species. Dispensers in that study were plastic, rectangular and wall-mounted, with a button for soap dispensing. Moreover, they were cleaned weekly. The same study observed that a significant number of soap residues remained close to the distribution hole and in the slits around the dispenser button. This raised discussions on the efficacy of the dispenser cleaning process. To guarantee that the soap dispensers do not turn into reservoirs, a daily external cleaning program was implemented, as well as cleaning with weekly disassembly of the dispensers, so as to avoid the sheltering of microorganisms. Moreover, the use of the pedal was put in practice in high-risk area soap dispensers, as well as gel alcohol[17]. Table 2 shows bacterial contamination in the liquid soap samples used at surgical unit II.

Table 2 - Bacterial analysis in liquid neutral soap samples from soap dispensers used at Surgical Unit II - Fortaleza, CE - 2007

Sample	Positive	Negative	Bacteria	CFU/ml
Nursing station	+		*Pseudomonas aeruginosa*	3,240
Ward 10	+		*Klebsiella pneumoniae ssp*	21,000
Ward 11	+		*Klebsiella pneumoniae ssp*	18,500
Ward 12		-		
Ward 13		-		
Ward 14	+		*Pseudomonas putidas*	2,420
Ward 15		-		

Note: (-) absence, (+) presence.

At surgical unit II, three wards showed negative results and the others positive, with the presence of *Pseudomonas aeruginosa, Klebsiella pneumoniae* and *Pseudomonas putida*. At surgical clinic I, the unit that receives liver transplantation patients, none of the dispensers showed positive results. This may be due to the following facts: at this unit, alcohol use for hand cleaning is common; the use of neutral liquid soap is not very frequent; the circulation of people is more controlled and the number of students and employees is small; the soap batch used showed no contamination in the industrial phase.

At the dermatology sector, bacteria were also present in all soap dispensers. The following bacterial strains were found: *Burkholderia cepacia* and *Pseudomonas putidas* (Table 3). It should be highlighted that, in dermatology, in most cases, patients manifest skin lesion infections with different etiologies, easily transmitting these microorganisms through contact. Hence, professionals are stricter with hand washing.

Table 3 - Bacterial analysis in liquid neutral soap samples from soap dispensers used at Dermatology Clinic - Fortaleza, CE - 2007

Sample	Positive	Negative	Bacteria	CFU/ml
Ward 25	+		*Burkholderia cepacia*	22,400
Ward 26	+		*Burkholderia cepacia*	2,120,000
Ward 27	+		*Pseudomonas putidas*	600,000
Ward 28	+		*Pseudomonas putidas*	16,000

Note: (-) absence, (+) presence.

Although the main causes of hospital infection are related with patients susceptible to infection and with the diagnostic and therapeutic measures used, one cannot ignore the share of responsibility linked with asepsis, hospital environmental hygiene and professional conduct standards. Hand washing is undoubtedly the safest means to prevent infection dissemination, but the product used should act by degermation, without the property of a microorganism-distributing culture broth.

The high CFU levels for bacterial contamination in the analyzed samples evidence favorable conditions for the multiplication of potentially pathogenic agents. Even in non-sterile products like liquid soaps, viable cells of *Salmonella* spp*., Escherichia coli, Pseudomonas aeruginosa* and *Staphylococcus aureus* should be absent. Another unwanted microorganisms in products are the following: *Bacillus cereus, Aspergillus flavus, Acinetobacter* spp*., Staphylococcus* spp*, Enterobacter* spp*., Burkholderia cepacia, Pseudomonas maltophilia, Pseudomonas stutzeri*[18]. Therefore, in non-sterile products, the absence of pathogenic microorganisms should be proven and the number of viable microorganisms should be determined.

As used by the soap industry, the term antimicrobial has a broad sense, and little information is available, mainly on the action and effective concentration spectrum[19]. In general, users feel safe regarding the quantitative aspect of saprophyte microorganisms. This safety is explained by the fact that these microorganisms behave as opportunistic infecting agents[20]. The presence of admittedly pathogenic strains is prohibited, as it represents a potential risk for the acquisition of an infectious clinical condition or for the transference of equally undesirable toxins[21].

The results obtained through the analyses of neutral liquid soap from the soap dispenses used at the other hospital units (Table 4) demonstrated the presence of bacteria like *Pseudomonas luteola* and *Burkholderia cepacia*. A negative result was found at the ICU though, as the soap used

for hand washing is replaced by chlorhexidine antiseptic. In pediatrics, the soap sample was taken from the soap dispenser at the nursing station, which only health professionals use. The presence of *Burkholderia cepacia* was also observed above expected levels. The pediatrics sector faces a distinguished risk factor for hospital infection, which is the age range of its patients. During the initial phases of life, the immune system is not totally mature and, thus, infection risks increase. Therefore, care at the pediatrics sector should be doubled.

Table 4 - Bacterial analysis in liquid neutral soap samples from soap dispensers used at other hospital units - Fortaleza, CE - 2007

Sample	Positive	Negative	Bacteria	CFU/ml
Pediatrics (PE)	+		*Burkholderia cepacia*	1,500,000
Pediatrics	+		*Burkholderia cepacia*	1,510,000
ICU soap dispenser	-			
Medical clinic A	+		*Burkholderia cepacia*	28,000
Medical clinic B	+		*Pseudomonas luteola*	1,560,000
Medical clinic B (PE)	+		*Pseudomonas luteola*	4,200
Hematology	+		*Burkholderia cepacia*	6,000

Note: (-) absence, (+) presence.

In view of the contamination of a significant number of soap dispensers under analysis, the researchers decided to analyze the original neutral soap bottles and, following recommendations by the Brazilian Health Surveillance Agency (ANVISA), open (refill) as well as sealed neutral liquid soap bottles were analyzed from the hematology, dermatology, pediatrics and surgical clinic sectors.

At the hematology unit, *Burkholderia cepacia* and *Klebsiella pneumoniae* were also detected in quantities above expected levels in soap refills, as shown in Table 5. At this unit, the patients' health condition is quite critical, as their immunity commitment is frequently associated with pancytopenia and agranulocytosis, besides coagulation disorders, deriving from the disease and/or treatment. Hence, there is a very high risk of acquiring hospital infection, entailing irreversible deterioration of their vital functions. That is often the cause of death in these patients.

In view of the gravity of the situation, reducing the number of pathogens is a fundamental conduct in case of hematology patients, through the strict use of aseptic techniques, correct handling of contaminated materials, frequent and careful hand washing and education of team members on basic hospital infection control measures, besides guaranteeing the quality of liquid soaps offered in this control.

Table 5 - Bacterial analysis in liquid neutral soap samples from soap refills and sealed bottles used at hospital units - Fortaleza, CE - 2007

Sample	Positive	Negative	Bacteria	CFU/ml
Hematology (refill)		+	*Burkholderia cepacia*	115,900
Hematology (refill)		+	*Burkholderia cepacia*	85,000
Hematology (refill)		+	*Klebsiella pneumoniae*	17,500
Medical clinic A (refill)		+	*Burkholderia cepacia*	7,960
Medical clinic B (refill)	-			
Recovery room (refill)	-			
Dermatology (refill)		+	*Burkholderia cepacia*	19,500
Dermatology (refill)		+	*Burkholderia cepacia*	135,000
Dermatology (sealed bottle)		+	*Burkholderia cepacia*	5,340,000
Pediatrics (refill)		+	*Pseudomonas putidas*	13,700
Hematology (sealed bottle)	-			19,500
Surgery (sealed bottle)		+	*Pseudomonas putidas*	2,640,000

Note: (-) absence, (+) presence.

Contamination was also verified in neutral liquid soap bottles open for use and sealed. The bath number of the soaps used in the soap dispensers could not be identified though, except for the last two bottles sent to ANVISA for evaluation. It could be inferred from the obtained results that the soap was contaminated during the manufacturing/storage process. This demonstrates lack of product quality control. In view of this possibility, the manufacturer was contacted and remained under quarantine until evaluation and release by the Health Surveillance Agency.

In order to guarantee chemical quality and microbiological safety, the Brazilian Health Surveillance Agency[22] should supervise the products used in health, guaranteeing compliance with established standards. A final observation is due on the hospital's purchase procedure, which prioritizes low-cost products. When based on the lowest price only, public tenders can compromise the quality of the purchased products and materials. The use of low-quality raw material and workforce without proper training can decrease initial costs, to the detriment of quality in the final result of the process. A product quality guarantee is a fundamental principle and should be the rule, particularly in view of the large volume and wide range of products a hospital purchases[23].

In a study of soaps at the pediatrics sector, contamination by coliforms was verified, including *Klebsiella pneumo-*

niae, which may have been the transmission source for the pneumonia outbreak, although it cannot be affirmed that this is the only infection cause. According to the same study, contaminated soaps are not included among the most mentioned hospital infection sources, but they are potentially dangerous because, normally, as these products are not considered as such, they are not always analyzed in hospital infection investigations. The risk is even greater in case of neutral soaps, as their pH favors the growth of microorganisms[23].

Microbiological soap quality control standards, mainly in the end product of the manufacturing process, are needed to avoid risks for consumers' health. With this goal, good manufacturing practices need to be put in practice and strictly followed, and correct intra-hospital handling is needed.

CONCLUSION

Based on these research data, it can be concluded that greater supervision is needed in soap quality control, due to the growing informal market of detergents and soaps, whose manufacturing can involve the use of chemically or microbiologically uncontrolled water or raw materials. This entails risks for product users, especially in case of people whose immunological system has been compromised by diseases.

Soaps used in hospitals have a neutral pH, and due to the absence of antimicrobial agents incorporated into their formula, they favor the survival and growth of different microorganisms, as an exogenous infection source. It is highlighted that the incorporation of antiseptics into the formulae would not avoid contamination and can contribute to microbial selection and resistance. Therefore, in view of outbreaks, it is essential to review industrial quality control and perform the microbiological analysis of the soap, as it can be a possible hospital infection transmission agente. As identified in this study, liquid soaps were contaminated with countless isolated microorganisms - *Burkholderia cepacia* (14); *Pseudomonas putidas* (9); *Pseudomonas aeruginosa* (3); *Klebsiella pneumoniae* (3); *Enterobacter cloacae* (2) and *Pseudomonas luteola* (2), which can constitute the origin of hospital infection. Although it cannot be affirmed that these influenced hospital infection rates, as no causal relation was established, some bacteria are known nosocomial infection agents.

In view of these results, it can be concluded that the importance of routinely investigating the products used in hospital institutions, mainly those that serve for hospital infection prevention purposes, like soaps and anti-septic agents. Besides the standardization of the hospital maintenance process and the training of all professional involved, factories need to be supervised through frequent visits, standardization and microbiological assessment of hospital products.

REFERENCES

1. Medeiros EAS, Pereira CAP, Wey SB. Introdução e histórico das infecções relacionadas à assistência à saúde. In: Focaccia RV. Tratado de infectologia. 3ª ed. São Paulo: Atheneu; 2006. p. 1819-22.

2. Bottone EJ, Cheng M, Hymes S. Ineffectiveness of handwashing with lotion soap to remove nosocomial bacterial pathogens persisting on fingertips: a major link in their intrahospital spread. Infect Control Hosp Epidemiol. 2004;25(3):262-4.

3. Nouira A, Ounis H, Khediri M, Helali R, Bannour W, Njah M. Healthcare workers' hand hygiene: compliance of the recommendations. Tunis Med. 2008;86(5):451-6.

4. Boyce JM, Pittet D; Health Care Infection Control Practices Advisory Committee. 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. MMWR Recomm Rep. 2002;51 (RR-16):1-45.

5. Pittet D, Allegranzi B, Boyce J; World Health Organization World Alliance for Patient Safety First Global Patient Safety Challenge Care Group of Experts. The World Health Organization Guidelines on Hand Hygiene in Health Care and their consensus recommendations. Infect Control Hosp Epidemiol. 2009; 30(7):611-22.

6. Brasil. Ministério da Saúde. Portaria n. 2.616, de 12 de maio de 1998. Diretrizes e normas para a prevenção e o controle das infecções hospitalares [Internet]. Brasília; 1998 [citado 2009 ago. 2]. Disponível em: http://www.anvisa.gov.br/legis/portarias/2616_98.htm

7. Brasil. Ministério da Saúde. Programa de Controle de Infecção Hospitalar. Lavar as mãos: informações para profissionais de saúde. Brasília; 1989. (Normas e Manuais Técnicos).

8. Brasil. Ministério da Saúde. Processamento de Artigos e Superfícies em Estabelecimento de Saúde. 2ª ed. Brasília; 1994.

9. Stutz N, Becker D, Jappe U, John SM, Ladwig A, Spornraft-Ragaller P, et al. Nurses' perceptions of the benefits and adverse effects of hand disinfection: alcohol-based hand rubs vs. hygienic handwashing: a multicentre questionnaire study with additional patch testing by the German Contact Dermatitis Research Group. Br J Dermatol. 2009;160(3):565-72.

10. Suchomel M, Gnant G, Weinlich M, Rotter M. Surgical hand disinfection using alcohol: the effects of alcohol type, mode and duration of application. J Hosp Infect. 2009;71(3):228-33.

11. Blom BC, Lima SL. Lavagem das mãos. In: Amaral CFS. Infecção hospitalar. Belo Horizonte: Medsi; 2001. p. 121-31.

12. Serufo JC. Avaliação da dinâmica de contaminação extrínseca de sabonetes líquidos e anti-sépticos no processo de uso em hospitais brasileiros da rede sentinela [Internet]. [citado 2009 ago. 2]. Disponível em: http://bvsms.saude.gov.br/bvs/publicacoes/avaliacao_dinamica_anti_septicos.pdf

13. Santos E, Frias TJN. Atuação da enfermeira no controle de infecção em Unidade de Terapia Intensiva. Rev Bras Enferm. 1980;33(3):369-76.

14. Tortura GJ, Funke BR, Case CL. Microbiologia. 8ª ed. Porto Alegre: Artmed; 2005. Procariotos: domínios bactéria e archaea; p. 304-33.

15. Murray PR. Microbiologia médica. 4ª ed. Rio de Janeiro: Guanabara Koogan; 2002.

16. Sartor C, Jacomo V, Duvivier C, Tissot-Dupont H, Sambuc R, Drancourt M. Nosocomial Serratia marcescens infections associated with extrinsic contamination of a liquid nonmedicated soap. Infect Control Hosp Epidemiol. 2000;21(3):196-9.

17. Brooks SE, Walczak MA, Hameed R, Coonam P. Chlorhexidine resistance in antibiotic-resistent bacteria Isolated from the surfaces of dispensers of soap containing chlorhexidine. Infect Control Hosp Epidemiol. 2002;23(11):692-5.

18. Farmacopéia Brasileira. 4ª ed. São Paulo: Atheneu; 1988.

19. McBride ME. Microbial flora of in-use soap products. Appl Environ Microbiol. 1984;48(2): 338-41.

20. Berthelot P, Dietemann J, Fascia P, Ros A, Mallaval FO, Lucht F, et al. Bacterial contamination of nonsterile disposable gloves before use. Am J Infect Control. 2006; 34(3):128-30.

21. Pinto TJA, Kaneko TM, Ohara MT. Controle biológico de qualidade de produtos farmacêuticos correlatos e cosméticos. São Paulo: Atheneu; 2003.

22. Brasil. Ministério da Saúde. Secretaria de Vigilância Sanitária. Portaria n. 326, de 30 de julho de 1997. Regulamento técnico sobre as condições higiênico-sanitárias e de boas práticas de fabricação para estabelecimentos produtores/industrializadores de alimentos [Internet]. Brasília; 1997 [citado 2009 ago. 2]. Disponível em: http://www.bioqualitas.com.br/arquivos/legislacao/326.pdf

23. Moreira ACA, Carvalho JLM. Ocorrência de Klebisiella pneumoniae e outros coliformes em sabão neutro líquido utilizado em um berçário de hospital. Rev Ciênc Med Biol. 2006;5 (3):245-52.

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