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ORIGINAL ARTICLE

Bacteriological quality evaluation of bedpans in a university hospital

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Abstract

According to the US Centers of Disease Control and Prevention recommendations, it is necessary to restrain the emergence of multiresistant microorganisms in hospitals and control cross-transmission among patients. In this context, one of the main points is the daily strict management of excreta in the care units. We aim to evaluate the safety of reusable bedpans, from a bacteriological point of view, after passing through bedpan washers in our hospital.

The present study was conducted from 15 January 2015 to 27 February 2015 in Strasbourg Hospital University. Twenty-five bedpan washers were selected. Three bedpans per bedpan washer were collected for bacterial analysis after cleaning and disinfection. Samples were performed in real conditions, i.e. patients used bedpans without protective bags before passing them through bedpan washers.

There was no growth (≤1 CFU/25cm2) in 75.3% (55/73) of the samples and 95.8% (70/73) had a result which was below the target value (≤25 CFU/25cm2). Only three samples (4.1%), from different bedpan washers had a result above the target value. A third of the identified bacteria were environmental microorganisms and two thirds were skin flora. No indicator microorganisms were identified (*Staphylococcus aureus*, *Enterobacteriaceae*, enterococci, *Pseudomonas* aeruginosa, *Pseudomonas* sp,p., *Stenotrophomonas maltophilia*, *Acinetobacter* spp., *Candida* spp., filamentous fungi).

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The effectiveness of bedpan washers is quite acceptable regarding the bactericidal activity. Indeed, we expected worse results since a small amount of bedpans are visibly soiled at the end of the cycle. However, it would be of interest to perform a second study evaluating the virucidal and sporicidal activity of the bedpan washers.

Key Words: bedpans, equipment reuse, equipment contamination, disinfection, France

Introduction

According to the US Centers of Disease Control and Prevention recommendations, it is essential that the health facilities implement a program to fight against microorganisms of digestive origin.[1] Indeed, since several years, the emergence and spread of multiresistant (and highly resistant) bacteria — e.g. extended-spectrum β-lactamase-producing *Enterobacteriaceae* (ESBL-E), carbapenemase-producing *Enterobacteriaceae* (CPE) and glycopeptide-resistant enterococci (GRE) — is observed. This phenomenon, called "the new faecal peril", results from the excessive use of antibiotics and the spread of these bacteria, with their resistance genes, due to a lack of compliance with basic hygiene rules (faecal-oral transmission). The daily strict management of excreta in care units is a primordial point to restrain the emergence of these microorganisms and to control cross-transmission among patients at hospital.

Bedpan washers are designed to empty, clean and disinfect reusable bedpans. Therefore, bedpan washers combine thermal and mechanical actions or thermal, mechanical and chemical actions in the presence of detergent. Moreover, the Quebec Healthcare Assessment Agency indicates that bedpan washers are likely sufficient to disinfect bedpans in patient care units without the need to empty them beforehand, which reduces the risk of contaminating the workplace and the staff.[2]

At Strasbourg Hospital University, a first investigation concerning excreta management was organised in several care units within our health facility in August 2014. A self-administered questionnaire was distributed to caregivers to assess how they managed excreta.[3] This investigation allowed the identification of difficulties in the corresponding care units, e.g. bedpans damaged or not always dry and clean after the bedpan washers' cycle. This critical point created anxiety amongst some users. Therefore, we wanted to evaluate the safety, not only from a visual point of view but also bacteriological point of view, of reusable bedpans after passing through the bedpan washers in our hospital.

Material And Methods

Study design

The present study was conducted at Strasbourg Hospital University between 15th January 2015 and 27th February 2015. Twenty-five bedpan washers, corresponding to a representative and homogenous sample, were selected following these criteria:

- belong to the two main suppliers in our hospital
- installed in the last 10 years
- chosen among the care units that participated in the first investigation of August 2014
- installed in different types of care units (i.e. medicine, surgical, geriatric and day hospital departments)

All bedpan washers were programmed with thermal conditions of 80°C for 60 seconds (a0 = 60), as recommended in the standard EN ISO 15883, and had the function of emptying bedpans.[4] Not all bedpan washers were equipped with alkaline detergent and/or a decalcifying product. Our water is very calcareous and this is why we collected this information. A questionnaire was filled out by the operators in order to gather more information on bedpan washers and bedpans in their departments: type of bedpan, presence of alkaline detergent, degree of calcification present at the nozzles and the sprinklers, and if the bedpans were visibly clean and dry at the end of cycle.

Microbiological sampling

Our health facility has two types of bedpans: round bedpans or slipper bedpans. Both are made of resistant plastic to withstand high temperatures. From a microbiological point of view, the slipper bedpans were the most complicated to evaluate, given that

their shape renders access for nozzles more difficult. Therefore, the samples (agar plates) were taken from the most critical places, i.e. in the recesses of bedpans. Three bedpans per bedpan washer and from three different washing cycles were collected after cleaning and disinfection. We performed sampling in "real conditions", meaning that the patients used the bedpans without protective bags, and the bedpans were not emptied before passing through bedpan washers. At the end of the cycle, operators performed bedpan surface samplings with contact tryptic soy agar plates containing neutraliser (Thermofisher – Oxoid®, Reinach, Switzerland) (one agar plate per bedpan), which were then incubated aerobically for two days at 37°C. Colony count and identification, using a mass spectrometry assay (MALDI-TOF-MS), were done by the Hygiene Laboratory.

Practical training, under our department's supervision, was performed to train the staff (giving also written instructions). For each sample, the staff had to wear gloves. If the bedpan was wet on exiting the bedpan washer, the staff had to let it dry in the specific room, named local waste, without particular precautions since they were to work under routine conditions. Moreover, to limit bias about transport conditions and processing time, we recommended they put the samples between 4°C and 8°C (max. 12 hours) if they were not directly incubated at 37°C.

We set a target value under 25 CFU/25cm^2 to define the microbiological quality of bedpans. We also used indicator microorganisms corresponding to the classical environmental hospital flora, to gastro-intestinal flora and to the microorganisms responsible for healthcare associated infections: *Staphylococcus aureus*, *Enterobacteriaceae*, enterococci, *Pseudomonas aeruginosa*, *Pseudomonas* spp., *Stenotrophomonas maltophilia*, *Acinetobacter* spp., *Candida* spp.,[5] filamentous fungi. A non-compliant bedpan was defined by the presence of more than 25 CFU/25cm^2 and/or the presence of indicator microorganisms.

Statistical analysis

We performed descriptive analysis, specifically calculations of percentages and means with 95% confidence interval.

Results

Collected information

At the end of study, we collected 73 samples of the 75 expected. As presented in Table I, 12% of bedpan washers returned a bedpan visibly unclean at the end of cycle and 67% returned a wet bedpan at the end of cycle and necessitated a drying time before sampling.

Microbiological results

We collected 52 samples from round bedpans (71%) and 21 samples from slipper bedpans (29%). The majority of care units are supplied with round bedpans because of their convenience.

As shown in Figure 1, 75.3% (55/73) of the samples showed no microbial growth (≤1 CFU/25cm^2) and 95.8% (70/73) had a result which was below the target value (≤25 CFU/25cm^2). On average, samples presented around 3 CFU/25cm^2 (95% CI 2-4). A third of the identified bacteria were environmental microorganisms and two thirds were skin flora. No indicator microorganisms were identified (*Staphylococcus aureus*, *Enterobacteriaceae*, enterococci, *Pseudomonas aeruginosa*, *Pseudomonas*

Table I. Information about bedpans washers selected for the study

Information about bedpan washers	
Presence of detergent	58%
Presence of decalcifying product	65%
Calcification (nozzles and sprinklers)	38%
Bedpan visibly clean at the end of cycle	88%
Bedpan visibly dry at the end of cycle	33%

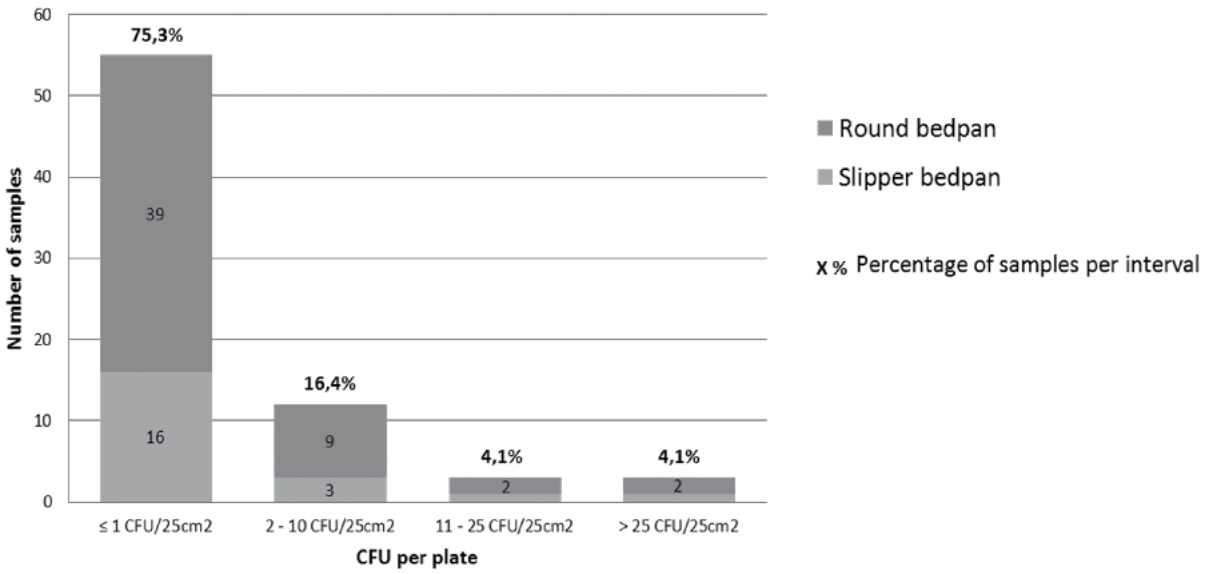

Figure 1. Bedpan samples: results

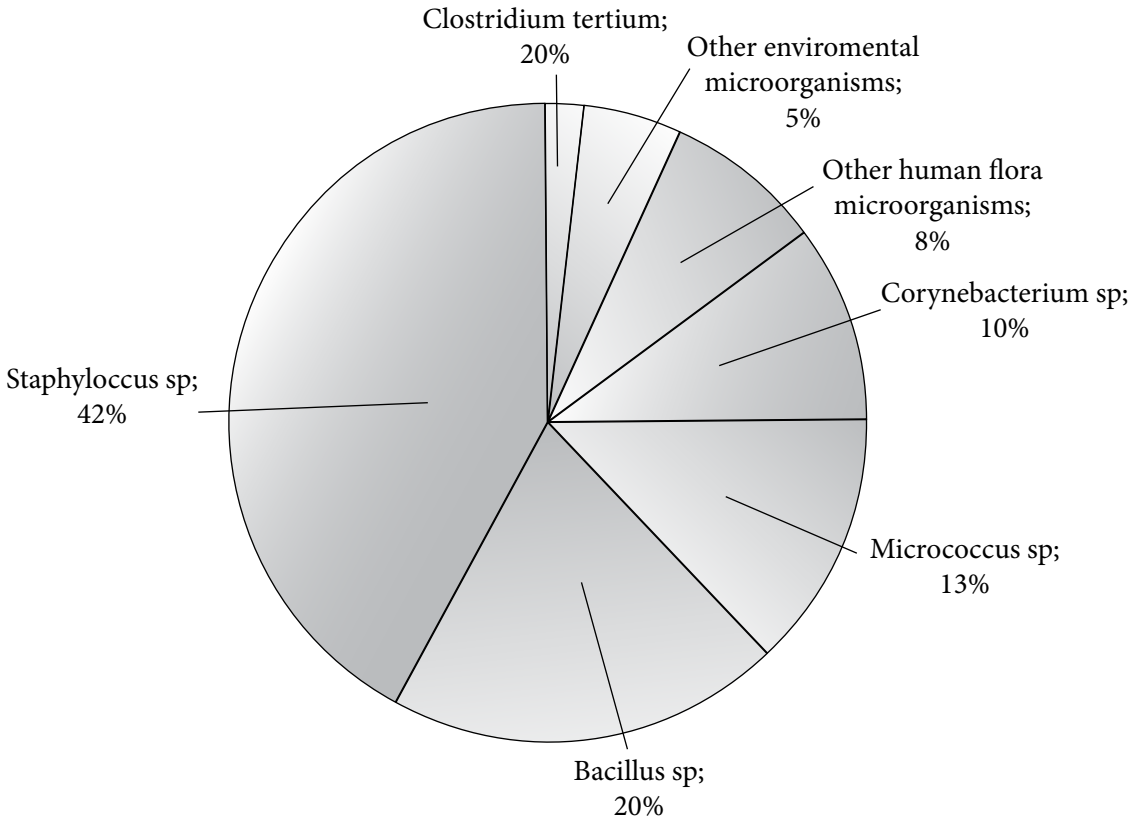

Figure 2. Bedpan samples: identification of microorganisms

spp., *Stenotrophomonas maltophilia, Acinetobacter* spp., *Candida* spp., filamentous fungi (Figure 2).

Only three samples (4.1%) were above the target value. The first one had 43 CFU/25cm^2 and *Rhizobium radiobacter,* an environmental microorganism, was identified. The second sample had 36 CFU/25cm^2 and we identified typical skin flora organisms - *Micrococcus* spp. and *Staphylococcus haemolyticus*. The third sample had 35 CFU/25cm^2 with *Staphylococcus hominis*, *Staphylococcus epidermidis* and *Cupriavidus gilardii,* i.e. skin flora and environmental bacteria. Of note, these three samples came from different bedpan washers.

Discussion

Facing the anxiety of some users, the main objective of our study was to evaluate the bacteriological quality of bedpans after a bedpan washer cycle. According to Spaulding's classification system, bedpans belong to the category of non-critical medical devices if they are in contact with intact skin only. Therefore, they require low-level disinfection. For a process of low-level disinfection, a value A0 of 60 is established, corresponding to a hold time of 60 seconds at 80°C, in order to make non-critical medical devices safe to reuse. While some state that the transmission of infectious agents from non-critical devices to patients remains a theoretical risk, others consider that bedpans should undergo intermediate-level or high-level disinfection.[7,8]

In this study, the samples were only incubated in aerobic conditions, and consequently we did not check for anaerobic growth. Indeed, it would be of great interest to seek the presence of *Clostridium difficile*. A bacterium in the same genus was identified, *Clostridium tertium*. This is an environmental bacterium and it was able to grow because of its aero-tolerant characteristic. However this result highlights the necessity to evaluate the effectiveness of bedpan washers' treatment on spores, as they are able to tolerate extreme conditions.[9] Alfa *et al.* tried to determine the ability of such bedpan washers to kill *C. difficile* spores.[8] The cleaning efficiency of a bedpan washer disinfector was evaluated by using various cycle parameters and detergent. The results revealed that the regular intensive cycle, with thermal conditions of 85°C for 60 seconds plus the addition of an alkaline detergent, was sufficient to eradicate *C. difficile* spores. However, these thermal conditions alone, without detergent, were not adequate.[8] In fact, the currently accepted thermal decontamination parameters for all bedpan washers (i.e. 80°C for 1 minute) are not adequate to eliminate *C. difficile* spores from bedpans.[10] Thus, it is essential to determine if our bedpan washers are effective against *C. difficile* spores. This point will be assessed in another project and for the moment the procedure in place will remain unchanged; i.e. systematically place a bag in the bedpan when a patient is infected with *C. difficile*, because some bedpan washers are not equipped with detergent in our healthcare facility. Moreover, we didn't collect data about patients colonised or infected with multidrug resistant organisms (MDRO) but we assume that if we do not find any gastrointestinal bacteria, especially in the resuscitation unit, dialysis unit and infectious diseases unit, the bedpan washers could be effective on MDRO.

In the absence of specific recommendation for bedpans, and according to the values published in EN ISO 16442 named "controlled environment storage cabinet for processed thermolabile endoscopes", we chose a threshold of 25 CFU/25cm^2 to define the microbiological quality of the bedpans. We also used indicator microorganisms corresponding to the classical environmental hospital flora, to the gastrointestinal flora and to the microorganisms responsible for healthcare associated infections to define the microbiological quality of bedpans: *Staphylococcus aureus*, *Enterobacteriaceae*, enterococci, *Pseudomonas aeruginosa*, *Pseudomonas* spp., *Stenotrophomonas maltophilia*, *Acinetobacter* spp., *Candida* spp.,[5] filamentous fungi. In EN ISO 16442, it is recommended to perform samples from the storage cabinet for processed thermolabile endoscopes. The storage is compliant if ≤ 25 CFU/25 cm^2 and no indicator microorganisms are detected.[5] We can observe the same kind of germs for gastric endoscopes or for bedpans. So, the value applied to storage cabinets for processed thermolabile endoscopes could be applied to bedpans.

Our results are quite satisfactory with a mean around 3 CFU/25cm^2 (95% CI 2-4). A third of the identified

bacteria were environmental microorganisms and two thirds were skin flora. No indicator microorganisms were identified. We can hypothesise that the skin and environmental organisms were possible contaminants associated with bedpan storage in the local waste area at the end of reprocessing.

Finally, a number of human factors and equipment design features compromised the bedpan washers' ability to function adequately. The proper use and the preventive maintenance of bedpan washers have an impact on the service life of the equipment. Even if some calcified bedpan washers have presented favourable results, this scaling has an impact on the service life of the equipment. The possibility to operate the machine only when a detergent or a descaling is present should be integrated to the bedpan washer design. Additional interesting research would be to evaluate the efficiency of bedpan washers on viruses such as norovirus, adenovirus, rotavirus and hepatitis A virus, the main microorganisms responsible for epidemic gastroenteritis.

Conclusion

Infection prevention and control are part of the most challenging issues faced by healthcare organizations when considering the quality of care, safety and costs. The prevention of infections includes especially the excreta management via bedpan washers. By conducting our study we tried to assess some limits of these bedpan washers.

With these first bacteriological results, we updated our institutional procedures. In fact, before this study, we used protective bags on the bedpan if multi-resistant bacteria, hepatitis A virus, hepatitis E virus and *C. difficile* were identified from stool samples in order to reduce the microbiological load before passing through bedpan washers. Now, this recommendation does not apply any more to the multi-resistant bacteria. The effectiveness of bedpan washers is quite acceptable regarding the bactericidal activity. Indeed, we expected worse results since a small amount of bedpans are visibly soiled at the end of the cycle. Nevertheless, our study did not demonstrate a link between information collected on the bedpan washers (detergent, scaling, etc.) and the bacteriological results. Finally, it would be interesting to perform a second study evaluating the virucidal and sporicidal activity.

Acknowledgments

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