Original Article

Microbiological evaluation of the cell phones of professionals from a surgical center in a beneficent Hospital

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RESUMO

Justificativa e Objetivos: A infecção hospitalar tem sido um problema frequente e crescente em todo o mundo. Tentar determinar fatores que possam contribuir com a disseminação de bactérias dentro do ambiente hospitalar faz parte da estratégia de controle deste mal. Os telefones celulares, dispositivos presentes no cotidiano de qualquer ambiente, incluindo os estabelecimentos de saúde, podem servir de reservatórios de patógenos, e, em seu manuseio, ajudar na disseminação de infecção nos hospitais. Essa preocupação se eleva ao se tratar de aparelhos pertencentes a funcionários de ambientes potencialmente colonizados por bactérias resistentes. O objetivo deste trabalho foi avaliar o grau de contaminação dos aparelhos celulares dos funcionários de um bloco cirúrgico de um hospital, verificando se há diferença entre as funções destes profissionais, tais como cirurgiões, anestesistas, perfusionistas, enfermeiros e instrumentadores. **Métodos:** Foram colhidos *swabs* umedecidos em caldo enriquecedor de 50 telefones celulares de funcionários do bloco cirúrgico. Esses swabs foram encubados e semeados, tendo suas leituras sido realizadas em 24 e 48h, tendo os resultados separados de acordo com cada especialidade. **Resultados:** Dos 50 aparelhos celulares avaliados, 88% (44) estavam colonizados. A bactéria mais comum foi o Estafilococos coagulase-negativa, seguido do *Bacillus subtillis* (15,9%) e *Micrococcus sp.* (9,1%). Não houve diferença estatisticamente significativa do grau de contaminação entre as especialidades avaliadas. **Conclusões:** Assim como mostra a literatura, os telefones celulares estão contaminados por bactérias potencialmente infectantes, e por isso, medidas para regulamentar seu uso e antissepsia devem ser estipuladas pelas instituições.

DESCRITORES: Cirurgia Torácica. Telefone celular. Infecção. Infecção hospitalar.

ABSTRACT

Background and Objectives: Hospital infection has been a frequent and growing problem worldwide. Trying to determine factors that might contribute to the spread of bacteria in the hospital environment is part of the control strategy for this problem. Mobile phones, which are devices found in everyday life in any environment on the planet, including health facilities, can act as pathogen reservoirs and their handling might help to spread infection in hospitals. This concern increases when it is related to devices belonging to employees working in environments potentially colonized by resistant bacteria. The objective of this study was to evaluate the degree of contamination of mobile phones belonging to hospital employees working in a surgical unit, assessing whether there are differences between these professionals, such as surgeons, anesthetists, perfusionists, nurses and scrub nurses. **Methods**: We used swabs moistened in enrichment broth to collect samples from 50 mobile phones belonging to surgical unit staffs. These swabs were incubated and cultured, and subsequently read after 24 and 48 hours, with results being separated according to each professional category. **Results:** Of 50 evaluated devices, 88% (44) were colonized. The most common bacteria were coagulase-negative staphylococci, followed by *Bacillus subtilis* (15.9%) and *Micrococcus* sp. (9.1%). There was no statistically significant difference regarding the degree of contamination among the evaluated professionals. **Conclusion:** As shown in the literature, cell phones are contaminated with potentially infectious bacteria, and therefore, measures to regulate their use and antisepsis should be defined by the institutions.
KEYWORDS: Thoracic Surgery. Cell phones. Infection. Cross infection.

INTRODUCTION

More than 100,000 heart surgeries are performed per year in Brazil.[1] In Recife, only in Real Hospital Português de Beneficência in Pernambuco (RHP) 1,400 cardiac procedures are performed annually, demonstrating the importance of cardiac surgery in our country.[2]

Many patients have complications that affect the results in the postoperative period of cardiac surgery, increasing the morbimortality and overloading the health system due to the increase in hospital length of stay. Among the main complications are cerebrovascular accidents, transmural myocardial infarction, deep infection of the surgical site, bleeding, sepsis, endocarditis, gastrointestinal complications, renal and respiratory failure.[2,3]

Nosocomial infections are the most common complications affecting hospitalized patients and, therefore, the most often studied ones.[4] Especially in cardiac surgeries, the surgical site infection is quite feared. Deep involvement of the operative wound, also called mediastinitis, accompanied by sternal dehiscence after sternotomy is still a feared and challenging complication. It has a reported incidence of 1 to 5% and it is a very costly morbidity event, associated with an increase in hospital length of stay, with the use of broad-spectrum antibiotics and special dressings, such as vacuum dressing. Additionally, it can be an important determinant of psychological stress and may also be related to high mortality, varying from 10 to 50%. [5-7]

The microbial etiology of sternal infection is wide-ranging and includes Gram-negative and Gram-positive bacteria, as well as fungi. However, the most common causative pathogens involved in sternal wound infection are *Staphylococcus epidermidis*, a coagulase-negative staphylococcus (CNS) and *Staphylococcus aureus*, both found in the normal skin microbiota. Previously, the finding of CNS in the wound could be considered as contamination in the culture sample collection, as this type of bacteria was considered relatively benign. With the evolution of research, *S. epidermidis* has been recognized as one of the most important health infection agents, especially when some type of foreign material is implanted, such as heart valve and joint prostheses, peritoneal and intravascular dialysis catheters, as well as steel wires used in almost all cardiac procedures for sternal synthesis. CNS have emerged as the most important pathogens in mediastinitis, accounting for 43% to 64% of all cases in recent studies.[5]

Considering the importance of heart surgery, as the main cause of death in Brazil and worldwide is of cardiac origin, as well the potentially devastating effects of infection associated with the surgical procedure, not only in terms of morbidity and mortality but also in the increase of costs for the Health System, it is necessary to evaluate the importance of apparently harmless habits, such as one's personal cell phone into the surgical center, in the risk of increasing the incidence of postoperative infection in cardiac surgical procedures.[8]

The objective of this study was to evaluate the existence and the degree of contamination of cell phone devices belonging to professionals working in the surgical unit of Real Hospital do Coração of RHP, in addition to determining whether the identified microbiota is different between the different medical specialties and the other health professionals involved in procedures performed in the surgical unit, such as perfusionists, scrub nurses, nurses and surgical room assistants.

MÉTODOS

Samples were collected from 50 cell phone devices belonging to health professionals working at the surgical unit of Real Hospital do Coração of RHP.

The sample was obtained randomly by convenience, between June 1 and 30, 2015. The cell phone's owner profession was one of the analyzed variables and considered as follows: surgeon, anesthesiologist, nurse, perfusionist, and surgical unit assistant, which is the

professional responsible for supplying the surgical room with the necessary materials for the surgical procedure.

This is an observational, descriptive and analytical study of a population that works in the same environment. The study was approved by the Research Ethics Committee of the Hospital Geral Otávio de Freitas, designated by CONEP, through the Brazil Platform under number 497,464. All participating cell phone owners signed the Free and Informed Consent form (FICF).

The surgical unit employees of Hospital do Coração of RHP were approached at random. Those who accepted to participate in the research signed the FICF and then the samples were collected. These were collected using a sterile swab, which is used to collect clinical specimens. It consists of a small high-absorption cotton wad wrapped around one or both ends of a plastic rod.

The swab tip was soaked in BHI (brain heart infusion) broth. This broth is a generally used culture medium, suitable for the growth of a wide variety of microorganisms, including bacteria, yeasts and filamentous fungi from clinical samples.

The wet swab was rubbed on the surface of the cell phone devices and then were placed in an identified sterile tube containing the same broth. The material was transported to the laboratory immediately after collection. In the laboratory, the swabs were seeded in Petri dishes containing Blood Agar and MacConkey Agar. After that, they were incubated in an oven at $35\,ºC \pm 1\,ºC$ (1st seeding). The tubes containing the swabs with the sample and the BHI enrichment broth were also incubated in an oven at $35\,°C \pm 1\,°C$.

After 48h of incubation, the growth in the Petri dishes (1st seeding) was assessed. In the same manner, the incubated BHI broth was also seeded in petri dishes containing Blood Agar and MacConkey Agar (2nd seeding) and were re-incubated in an oven at $35\,°C \pm 1\,°C$. After 48h, the growth in these dishes (2nd seeding) was also assessed.

The results were observed and compared according to each professional category. Due to the small number of samples per category, an analytical study of this variation was not possible.

RESULTS

The sample included all professional categories working at the surgical unit. Surgeons contributed with more than 80% of the samples, as shown in Table 1. The high percentage of

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sample contamination was demonstrated in the second seeding and there was no difference in the frequency of culture positivity among the different professional categories participating in the study (Table 1).

Table 1 - Distribution of culture results by professional category.

Professional category	Total	Contamination 1st seeding	Contamination 2nd seeding
Anesthesiologist	7	1 (14.2%)	7 (100%)
Surgical room assistant	9	2 (22.2%)	7 (77.7%)
Surgeon	23	0 (0.0%)	22 (86.9%)
Nurse	2	1 (50.0%)	2 (100%)
Perfusionist	4	0 (0.0%)	4 (100%)
Scrub nurse	5	0 (0.0%)	4 (80.0%)

Negative-coagulase staphylococci were the most prevalent bacteria in both the first and second seedings. Only 4 samples were positive in the first seeding (8%), with this agent being identified in three of the four studies (75%). Eighty-eight percent of the samples were positive in the second seeding. Similarly, coagulase-negative staphylococci were the main isolated agent (70.5%). Seven samples were positive for *Bacillus subtillis*, four samples were positive for *Micrococcus* sp. and only one sample was positive for *Acinetobacter radioresistens*. Negative-coagulase staphylococci were found concomitantly with *Bacillus subtilis* in one sample (Table 2).

Table 2 - Bacteria isolated on the 1st and 2nd seeding.

IDENTIFIED BACTERIA	1st seeding N	%
	04	8%
CNS*	03	75%
Bacillus subtillis	1	25%

*CNS = coagulase-negative staphylococci

IDENTIFIED BACTERIA	2nd seeding N	%
CNS*	31	70,5%
Bacillus subtillis	7	15,9%
Micrococcus sp	4	9,1%

Acinetobacter radioresistens	1	2,3%
CNS* + *Bacillus subtillis*	1	2,3%

*CNS = coagulase-negative staphylococci

DISCUSSION

Several studies worldwide have tried to demonstrate the possibility that cell phones might act as contamination sources, whether in hospital settings or not. [9-13] This study, in line with others, showed that 88% of the analyzed cell phone devices were colonized by potentially infectious bacteria. [9-14]

Microbiologists argue that the combination of constant handling associated with the heat generated by the devices creates an ideal breeding ground for many microorganisms that are normally found on the skin. Staphylococci, especially *S. epidermidis*, are members of the normal human microbiota. Nasal transport of *S. aureus* occurs in 20-50% of humans. Staphylococci are also found regularly in common clothes, bedding and other human environments. [15]

Historically, while coagulase-positive species have been considered as opportunistic pathogens, coagulase-negative species have been generally considered as non-pathogenic. However, this view is changing, especially as there has been growing evidence that some of these species may be potentially pathogenic to humans through the production of enterotoxins, causing nosocomial infections. [16]

The second most common microorganism (15.9%) was *Bacillus subtilis*. These are saprophytic bacteria that are ubiquitous in nature, present in soil, water, air and especially in decomposing plant material. Under most conditions, it is not biologically active and is found in the form of spores. [17]

Healthcare-associated infection rates continue to be a growing concern for health professionals. Several guidelines have been developed regarding hand hygiene, surface decontamination and cleaning of instruments used in clinical practice. However, there is little information on the safe use of mobile phones within healthcare settings.[18] Compelling evidence suggests that mobile communication devices act as a reservoir of nosocomial infection-causing bacteria within the hospital environment and in sensitive clinical areas, such as surgical unit environments.[12]

Studies have shown that most physicians are aware of the risks of bacterial contamination caused by cell phones, but that few effectively clean their devices. Similarly, they also show that there is an effective reduction in detected bacteria after the establishment of a simple and practical means of decolonization with 70% isopropyl alcohol. However, they failed to establish an association between bacteria found on the mobile phone surface and clinical infection.[12] A Thai study carried out in 2010 was the first to suggest that cleaning mobile phones with gauze soaked in alcohol could eliminate microorganisms from their surfaces. Although previous reports identified health workers' cell phones as a reservoir for several multiresistant bacteria, to date none of them had shown that alcohol cleansing could reduce the detection of these bacteria.[13]

An Iranian study, which evaluated 150 health workers, investigated the contamination of mobile phones by bacteria and found that most of the isolated microorganisms were from the normal skin microbiota. However, 16.7% of the samples were positive for pathogens known to be associated with nosocomial transmission, such as *Enterococcus spp.*, *S. aureus* and *K. pneumonia*. Enterococci resistant to vancomycin and methicillin and methicillin-resistant *S. aureus* (MRSA) were not isolated.[18]

It is imperative that infection prevention and control programs be actively involved in the health care service provided by hospital workers, offering guidance and education on how to decrease the risk of bacterial contamination of their mobile devices.[9,20-22]

In addition, while most patients are aware that cell phones can harbor bacteria, only a small number actually tries to decontaminate their phones. Most of those who try use methodologies that would be considered ineffective for surface decontamination of devices. This situation is probably sustained both by the lack of knowledge and the lack of education of individuals about these issues.[22]

Even though this is an observational study with a small sample size, to the best of our knowledge it is the first Brazilian study carried out in a surgical unit focused on cardiac surgery, which characteristically involves many professionals and of which consequences of deep infections have alarming results, not only regarding morbidity and mortality but also concerning hospital costs. In agreement with other studies, bacteria were found in many cell phone devices, and they are often the main microorganisms found in surgical site infections.[5,12] Therefore, device use and hygiene control measures must be established for

each service, so that cell phones will not constitute another means of contamination for patients undergoing surgical procedures.

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