

Bacterial Contamination of Mobile Phones of Health Care Providers in a Teaching Hospital in Hamadan Province, Iran

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Background: The use of mobile phone by clinical staffs enhances transmission of pathogens and therefore, might intensify the hardship of interrupting infection spread.

Objectives: The aim of this study was to determine bacterial colonization on the mobile phones used by clinical staffs in hospitals.

Patients and Methods: We randomly selected and examined 250 mobile phones from their users. The phones were obtained from the following study groups: Group A, 125 clinical staffs including physicians, nurses, residents, and interns; and group B, 125 university headquarters staffs. Isolated microorganisms were identified using biochemical tests such as Gram stain, morphology, catalase, and oxidase reaction, and all isolates were allocated to appropriate genera. Antibiotic sensitivity test was done using the Kirby-Bauer disc diffusion method.

Results: In total, 99.2% of mobile phones in clinical staffs group demonstrated growth of bacterial species. The most common isolate were consecutively coagulase-negative staphylococci (82.4%), *Staphylococcus aureus* (20.0%), and *Pseudomonas aeruginosa* (12.0%). Among controls, 93.6% of mobile phones demonstrated growth of bacterial species. For eradication of coagulase-negative staphylococci, the highest resistance rate was detected to oxacillin. For inhibition of *S. aureus*, the highest resistance was detected to Oxacillin. For eradicating *P. aeruginosa*, considerable resistance rate to ampicillin was detected in both study groups.

Conclusions: Mobiles contamination with different pathogens is extremely common among our health care staffs compared with other societies, and resistance of these isolates to various antibiotics is also detectable. Thus, quick assessment of this issue to prevent the spread of these infectious agents is critical for the authorities in our health care systems.

Keywords: Mobile Phone; Bacterial Infection; Healthcare; Iran

1. Background

Nowadays, mobile phone is being widely used as one of the indispensable accessories and its usage has increased dramatically worldwide. Despite the potential benefits of mobile in facilitating communications, this device has been considered as one of the most important factors that threatens human health, e.g. transmitting microbial germs from one person to another (1, 2). This is especially important in health centers because the constant handling of the mobile phones by hospital staffs facilitates gathering various types of nosocomial germs that can become an important source for transmission of these infections (3). In fact, the use of mobile phone by clinical staffs can enhance pathogen transmission and might intensify the hardship of interrupting infection spread (4). Furthermore, colonization of potentially pathogenic organisms on phones may lead to the rise of antibiotic resistance. Nosocomial infections and their transmission are important health prob-

lems in almost all hospitals (5). Despite the highest hygiene standards in hospital wards, bacterial transmission to the patients by the contaminated hands of health care workers commonly occurs (6). On the other hand, therapeutic settings are now considered as favorable environment for the spread of infections transmitted through hand contact (7). In Iran, there has been a considerable increase in the use of mobile phones among the general population, and the use of this communication tool, especially in unnecessary times, is common in certain areas where the rate of bacteria presence is likely high, i.e. hospitals. According to recent reports, in terms of mobile provision, Iran now surpassed most of the countries in the world and over 45 million Iranians have access to personal mobile phones (8). According to these reports, high contamination with nosocomial infections in the hospitals through the frequent use of mobile phones in our country is expectable.

2. Objectives

The present study was conducted to determine bacterial colonization on the mobile phones used by clinical staffs in hospitals and compared it with other headquarters staffs. Moreover, we assessed the antibacterial resistance patterns of different isolates from these phones in a referral hospital in Hamadan, Iran.

3. Patients and Methods

This cross-sectional study was conducted at the Besat Hospital in Hamadan province, Iran, from 2010 to 2011. The Besat Hospital is a governmental, referral, and specialized hospital with 26 section included 540 bed. A total of 250 mobile phones were randomly selected and examined. The phones were obtained from the following study groups: Group A, 125 clinical staffs including physicians, nurses, residents, and interns; and group B, 125 university headquarters staffs as the control. The following exclusion criteria were applied: the staffs who were receiving immunosuppressive drugs or antibiotics within the preceding two weeks. In addition, the history of hospitalization during the preceding month in staffs or one of their family members was another exclusion criterion. Before commencing the study, the proposal of this project was approved by the ethical review committee of Hamadan University of Medical Sciences (code, 89051277600; date, 15/05/2010). Study participants were informed of the study and only volunteers were participated in the study. The informed consent was obtained from enrolled individuals. During the study period, 145 health professionals had direct contact with patients. From these individuals 125 volunteered to participate and were included in this study. For sampling the staffs' mobile phone, sterile moistened swab (dipped in sterile saline) was fully stretched on the mobile phone keyboard and was inoculated in the TSB medium (Merck, Germany) for transport, immediately sealed, and transferred to the microbiology laboratory at the Medicine Faculty. All samples were collected by one person. The TSB media were incubated at 37°C for 12 hours aerobically, then they were inoculated onto blood agar and MacConkey agar plates and incubated at 37°C for 24 to 48 hours. Isolated micro-

organisms were identified using biochemical standard methods such as gram stain, morphology, catalase, and oxidase reaction, and all isolates were allocated to the appropriate genera. Antibiotic sensitivity test was done using the Kirby-Bauer disc diffusion method on Mueller-Hinton agar according to the guidelines of Clinical Laboratory Standards Institute (9). Data were entered and analyzed using SPSS 16 (SPSS Inc. Chicago, Illinois, the United States), summarized in frequencies and percentages, and presented in tables. Chi square test was used to assess the association between groups and P value < 0.05 was considered as statistically significant.

4. Results

Among 125 clinical staffs, 15 (12.0%) were physicians, 10 (8.0%) were residents, 31 (24.8%) were interns, and 69 (55.2%) were nurses. Table 1 shows the number of mobile phones from which we isolated bacterial organisms in the target and control population. In total, 99.2% of mobile phones in clinical staff group demonstrated growth of bacterial species. The most common isolated bacteria were consecutively coagulase-negative staphylococci (82.4%), *Staphylococcus aureus* (20.0%), and *Pseudomonas* species (12.0%). Among controls, 93.6% of mobile phones demonstrated growth of bacterial species; the most common isolated bacteria were coagulase-negative staphylococci (77.6%). As presented in Table 1, most of the isolates were more prevalent in the case group than the control group, but isolated *Pseudomonas* species in phones of clinical staffs were more frequent in the latter. Regarding type of grown bacteria, in target group, 76.0% grew one bacterial species and 23.2% grew two species, while these rates in the control group were 84.8% and 8.8%, respectively. Antimicrobial susceptibility tests for the isolates in both groups (Table 2) revealed that for eradication of coagulase-negative staphylococci, the highest resistance rate was detected for oxacillin that was higher in the case than in the control group. In addition, for inhibition of *S. aureus*, the highest resistance was detected for oxacillin that was slightly lower in the former group. However, for eradication of *Pseudomonas* species, considerable resistance rate to ampicillin was detected in both study groups.

Table 1. Common Isolated Microorganisms in the Case and Control Groups ^a

Isolates	Case Group (n = 125)	Control Group (n = 125)	P Value
Coagulase-negative Staphylococci	103 (82.4)	97 (77.6)	0.791
<i>Staphylococcus aureus</i>	25 (20.0)	20 (16.0)	0.493
<i>Pseudomonas</i> species	15 (12.0)	3 (2.4)	0.006
<i>Salmonella paratyphi</i>	10 (8.0)	3 (2.4)	0.053
<i>Corynebacterium</i> species	4 (3.2)	1 (0.8)	0.370
<i>Acinetobacter</i> species	1 (0.8)	0 (0.0)	0.999
<i>Bacillus</i> species	1 (0.8)	0 (0.0)	0.999
<i>Escherichia coli</i>	0 (0.0)	3 (2.4)	0.247

^a Data are presented as No. (%).

Table 2. Resistance to Antibiotics in the Detected Microorganisms in Case and Control Groups ^a

Isolates	Case Group (n = 125)	Control Group (n = 125)
Coagulase-negative Staphylococci		
Ampicillin	25 (20.0)	24 (19.2)
Oxacillin	75 (60.0)	50 (40.0)
Cephalothin	10 (8.0)	4 (3.2)
Clindamycin	27 (21.6)	15 (12.0)
Vancomycin	0 (0.0)	0 (0.0)
Staphylococcus aureus		
Ampicillin	0 (0.0)	10.0
Oxacillin	35 (28.0)	43 (34.4)
Cephalothin	0 (0.0)	0 (0.0)
Clindamycin	0 (0.0)	0 (0.0)
Vancomycin	0 (0.0)	0 (0.0)
Pseudomonas		
Ampicillin	125 (100)	125 (100)
Ceftazidime	16 (12.8)	41 (32.8)
Amikacin	0 (0.0)	0 (0.0)
Gentamicin	0 (0.0)	0 (0.0)

^a Data are presented as No. (%).

5. Discussion

The current study showed a high prevalence of bacterial colonization in mobiles of both clinical and university headquarters' staffs with higher prevalence in the former group. Among different isolates, coagulase-negative staphylococci species were the commonest pathogen detected in 77.6% of mobile phones. The healthcare workers' mobile phones can provide a reservoir of bacteria known to cause nosocomial infections and due to optimal preventing transmission of infection to patients, accurate determination of the different types of isolates is necessary. According to the recent recommendations of the United Kingdom National Health Service, regular cleaning of phones and hand hygiene have been introduced as main factors for prevention of spreading mobiles-related pathogens in hospital environments (10). According to the observation by Morioka et al. (11) while all the nurses were aware of hand washing with water or alcohol after regular work, 33.6% of the nurses were not conscious of hand washing with water or alcohol after using a mobile phone. Therefore, because hand washing with water or alcohol prevents the contamination of the mobile phones, nurses should take standard precautions after using mobile phones. Our obtained bacterial contamination rate of staff's mobiles, as a main source of nosocomial infections, seems to be higher than that previously reported from other countries. In a similar study by Saxena et al.

(12) 42% of mobile phones carried by health care workers and 18% carried by the general public were found to carry one or more organisms. In addition, in another study by Singh et al. only the results of culture was positive for pathogenic bacteria in 34% of studied mobiles (13). In Sadat-Ali et al. study, 43.6% of health care providers carried infective organisms on their cell phones (14). Akinyemi et al. (15) showed that the rate of contaminations was 30.6% and 15.3% among lecturers/students and also health workers, respectively (11). In Ulger observation, 94.5% of phones demonstrated evidence of bacterial contamination with different types of bacteria (16). Similar observations were reported in other studies (17-21). High rate of contamination reported in our study is an important alarm and warning for our healthcare managers to fast track appropriate protocols of prevention and universal education to patients and staffs. In spite of different rate of contamination observed in our study and other similar studies, similarity in the types of isolated pathogens was observable between our findings and others. According to our results, the most common isolates were consecutively coagulase-negative staphylococci, *S. aureus*, and *Pseudomonas* species. In Morioka study, *S. aureus* was detected on 68.6% of mobiles (11). Akinyemi et al. showed that coagulase-negative staphylococci were the most prevalent bacterial agents from mobile phones, followed by *S. aureus*. *Staphylococcus aureus* was also the most common isolate in Datta et al. study (22).

In this context, there are two important points in our study. An important part of the isolated pathogens in our samples was detecting *Pseudomonas* species that was rarely reported in other studies; moreover, high resistance to ampicillin and ceftazidime was detected in our study cases. These two features distinguish our study from other studies, which might be another warning for our managers in health systems. In conclusion, mobiles contamination with different pathogens is extremely common among our healthcare staffs compared with other societies, and resistant of these isolates to various antibiotics is also detectable. Thus, quick assessment of this issue to prevent the spread of this infection is critical for the authorities in our health care systems.

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