Identification of bacteria isolated from mobile phones of three medical and teaching hospitals administrative and medical staff in Ahvaz

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Abstract

Background: Health care worker's (HCW) mobile phones are one of the most important vehicles which transfer nosocomial infection agents. The aim of this study was identification of bacteria existing on HCW's mobile phones in three Jundishapur university teaching hospitals in Ahvaz. It was in two groups: clinical and administrative staff.

Materials and Methods: Samples were collected from 170 HCW's mobile phones in Golestan, Emam Khomeini and Taleghani teaching hospitals. The samples consisted of two groups: group 1) Clinical personnel and group 2) Administrative personel. In each group 85 mobile phones were investigated and bacterial isolates were identified with gram and spore staining and standard biochemical tests consisting of catalase, oxidase, coagulase, manitol fermentation, TSI and other tests.

Results: Bacteria were isolated from 90% of the examined mobile phones: coagulase negative *Staphylococci* (69%), *Bacilli* (20.6%), *Acinetobacter spp.* (6%), *Klebsiella pneumonia* (1.8%), *Pseudomonas aeruginosa* (1.2%), *Staphylococcus aureus* (1.2%) and *Ecsherishia coli* (0.6%). From 18 isolated pathogenic bacteria, 13 bacteria isolated from group one and five were related to bacteria isolated from group two.

Conclusion: The results of this investigation show that HCW's mobile phones reserve nosocomial infection agents. The number of pathogenic bacteria in group one was significantly more than that of the group two. Therefore, the health care workers should be trained the effective methods to prevent the bacterial transmission through this way in order to control transmissible infections.

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Introduction

Nosocomial infections associated with hospital staff are considered as one of mortality factors in patients of hospitals that are acquired from 5 to 10 percent of accepted patients in hospitals and has been of special consideration all over the world. Reports indicate that these types of infections are increasing in hospitals. (1, 2) Hands of health care workers are a major cause in transmission of hospital infections which are in contact with personal belongings. These types of devices, such as wristwatches, mobile phones, etc., play an important role in spreading infection to patients or out of the hospital if they become infected with pathogenic bacteria. (3, 4, 5) Regarding that hospital staff use their mobile phones in clinical departments and laboratories, and in many cases washing hands may not be sufficiently done, the probability of contamination increases in the items which are in the hands of the staff. Therefore, the probability of contamination increases and pathogenic bacteria in hospital transmits from personnel's hands to their mobile phones. This device acts as a vector spreading pathogenic bacteria to different parts of the hospital and also out of it. (1, 6, 7, 8 & 9)

There are several reports from various countries regarding the role of mobile phones in transmission of hospital infections. In these studies, bacteria such as coagulase-negative Staphylococci that are normal flora of the skin, Staphylococcus aurous, Klebsiella species, and many other bacteria causing opportunistic infections such as bacillus have been isolated. (2) It seems that existing flora on the mobile phone of health center staff are different from others concerning the frequency and type of bacteria. (7)

Since there were not any information about the risk of contamination of mobile phones in teaching hospital staff of Ahvaz, and the importance of the role of this device in transmission of these infections

has not been indicated, the purpose of this study was to examine the probable role of doctors', nurses' and staff's mobile phones in transmission of pathogenic and non-pathogenic bacteria in three teaching hospitals of Ahvaz and also determining the pattern of antibiotic-resistance of the identified bacteria. On the other hand, concerning that it appears that the microbial flora of clinical staff's mobile phones that are associated more closely with the patients and infectious agents is different from those who are not working in these departments. The second purpose of this study was identification of bacterial agents isolated from these staff's mobile phones and comparing them with the first group.

Materials and Methods

Samples were collected from three teaching hospitals: Imam Khomeini, Golestan and Taleghani in medical university of Ahvaz.

The study population: in this study, two groups were examined: official and medical staff. The first group was working in the clinical department and in close relationship with patients (including doctors, nurses, medical students, and health workers) and the second group was working in the official department of the hospital. On the whole, samples were collected from 170 mobile phones (belonging to volunteers for sampling) from departments of General Surgery, Nephrology, Pediatrics, Internal Medicine, Intensive Care, Urology, burn, and Administrative Section.

Sampling procedure: for sampling the staff's mobile phone, sterile moistened swab was fully stretched on the mobile phone keyboard and was inoculated in the TSB medium (Merck, Germany) as the nutrient ambient of transport and was transferred to the microbiology laboratory. (2)

Identification of bacteria: samples from the transport TSB medium were inoculated

after 18 to 24 h of incubation at 37^0C in blood agar and Mac Conkey agar (Merck, Germany) and plates were placed for 18 to 24 hours at 37^0C. After this period, grown colonies were examined in terms of size and shape and gram staining was performed for each of the grown colonies. In the next stage, biochemical tests were performed namely catalase, mannitol fermentation, desoxy ribonuclase , coagulase, fermentation and oxidation of glucose in order to identify and differentiate gram positive cocci and also catalase tests, growth on the Mac Conkey agar, TSI and MR-VPmedium, production of indole, motility, citrate, lysine decarboxylase, malonat and oxidase with the purpose of detection and differentiation of gram-negative bacilli and spore staining were performed to detect Bacillus and bacteria were identified. (2)

Antibiotic susceptibility testing: antibiotic susceptibility testing of samples that had the highest frequency was performed by the disk diffusion method for antibiotic amikacin (gµ 30), vancomycin (gµ 30), oxacillin (gµ 1), kanamycin (gµ 30), gentamicin (gµ 10) and ciprofloxacin (gµ 5) (purchased from Padtan Teb company - Iran). Moreover, antibiotic susceptibility of *Staphylococcus aureus* strains was assessed compared to oxacillin antibiotic.

Statistical analysis: the data resulted from this study were analyzed by using statistical software SPSS17 and were presented as descriptive statistics.

Results

Of the whole 170 samples collected from mobile phones of clinical and administrative staff in three hospitals of Golestan, Taleghani and Imam Khomeini, 75 cases belonged to clinical staff of Golestan hospital, 10 cases belonged to

the men, women, children and intensive care in Taleghani burn hospitalized. 85 samples belonged to the administrative staff of Imam Khomeini and hospital of Ahvaz, of which: 154 (%90) of samples were culture positive. Seven genera of bacteria were identified from positive cultures. in a number of examined mobiles, one and in some others more than one species of bacteria were found. In this study, coagulase-negative Staphylococci, *Bacillus spp., Acinetobacter spp., Klebsiella pneumoniae, Pseudomonas aeruginosa, Staphylococcus aureus and Escherichia coli* were the most frequently detected. (Table 1)

106 isolates from 85 observed mobile phones belonging to the staff of clinical departments, and 60 isolates from 85 mobile phones belonging to the administrative staff, were separated and identified. On the whole, 18 bacteria were identified, among which 13 isolates belonged to the clinical and 5 cases belonged to the administrative section. In Table I, the number of Identified bacterial isolates and the number of each in examined groups have been demonstrated (Group I: clinical staff, group II: administrative staff). In Table II, the frequency of identified opportunistic pathogens is shown separately for each segment and the frequency of each bacterial agent is shown in figure one.

Susceptibility and antibiotic resistance testing on the coagulase-negative Staphylococci isolates showed that there is a maximum resistance to Amikacin and a minimum resistance to Ciprofloxacin. The resistance against other studied antibiotics is given in table two. The susceptibility of *S. aureus* strains to Oxacillin was studied and it showed that these strains were susceptible to Oxacillin.

Table 1. The number of bacterial isolates identified

| Type of bacteria	Total	The first group number	The second group number
Coagulase negative Staphylococci	114	72	42
Staphylococcus aureus	2	1	1
Klebsiella pneumoniae	3	1	2
Acinetobacter spp	10	9	1
Escherichia coli	1	1	0
Pseudomonas aeruginosa	2	1	1
Bacillus spp	34	21	13
Complete bacteria	166	106	60

Table 2. The frequency opportunistic pathogenic bacteria obtained in clinical isolates from the sections

Type of bacteria	Section	Number	Frequency (Percent)
Acinetobacter spp.	Surgery	3	8/5
	Burns Unit	3	
	Nephrology	3	
	ICU	1	
Klebsiella pneumoniae	Burns Unit	1	0.9
Escherichia coli	Burns Unit	1	0.9
Pseudomonas aeruginosa	Burns Unit	1	0.9

Chart Title
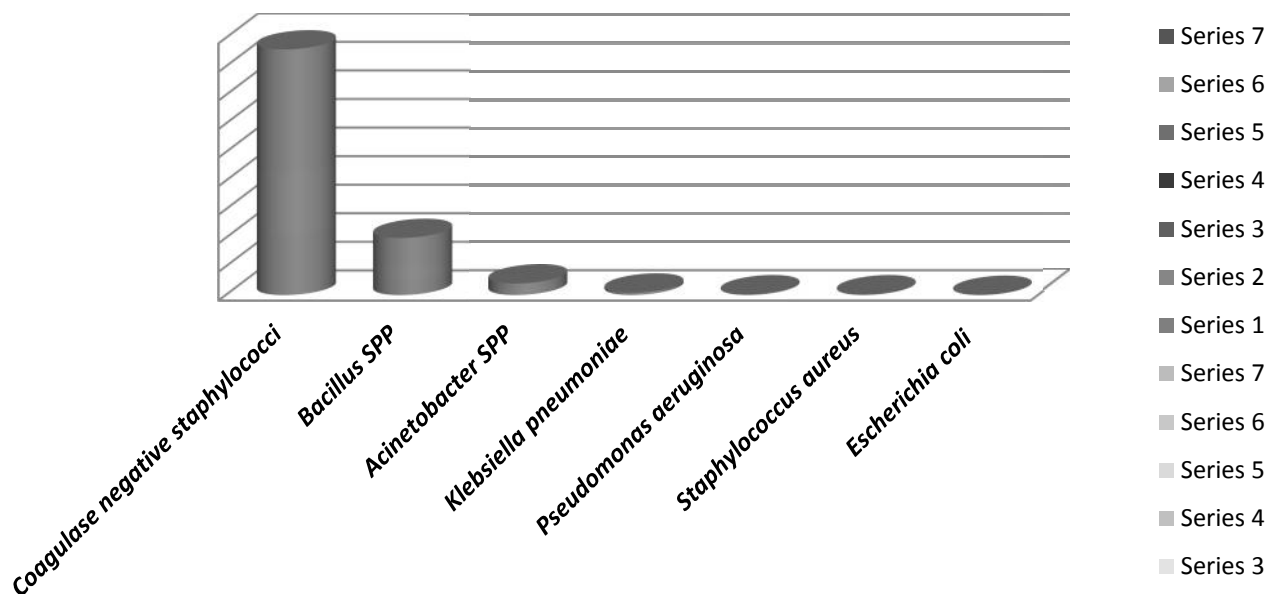
Graph 1: The prevalence of bacterial agents detected in both groups of mobile phone
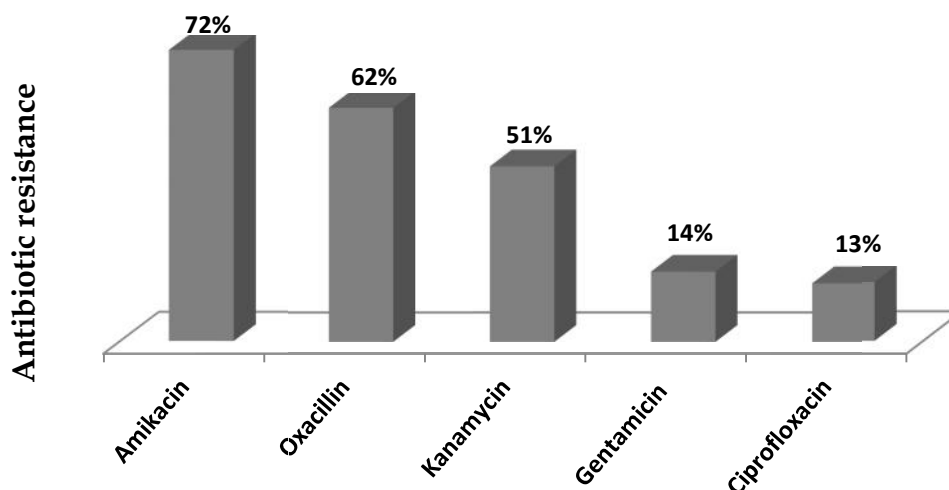
Graph 2. Antibiotic resistance patterns in coagulase negative Staphylococci

Discussion

Using mobile phone as a communication device is growing in Iran. Doctors and health care workers use this device in many cases in the workplace. It is inevitable to use mobile phones for faster communication and also in emergency situations. (5)

In this study, 90 percent of examined mobile phones were carriers of the bacterial agents. In the study of kynymy in Nigeria, Tambkar in India and Karabay in Turkey, respectively 36, 95, and 90 percent of the examined mobile phones were contaminated with bacteria. These mobile phones carry pathogenic bacteria and opportunistic pathogens and in case they are not disinfected, they are considered as the exogenous source of nosocomial infections for patients. (1, 3, 5, and 7)

Opportunistic pathogens such as bacteria, viruses and fungi can survive on inanimate surfaces for long periods of time and items such as watches, pens, and mobile phones are permanent surfaces for transmission of these types of infections. (4)

Our study showed that mobile phones may be infected with gram-negative bacilli such as *Acinetobacter, P.aeruginosa, Klebsiella* and *E. coli* and act as vectors of hospital infection. Since mobile phones are used both in the hospital and outside the hospital, they can be very important in the spread of endemic bacteria from each of these environments to other environments and even be a factor in the spread of nosocomial infections in the society and vice versa.

In the present study, most bacteria isolated were coagulase negative Staphylococci, *Bacillus spp.*, *Acinetobacter spp.*, *K. pneumoniae*, *P. aeruginosa*, Escherichia coli, and *S. aureus*. Examining results of the antibiotic susceptibility of coagulase-negative Staphylococci, was indicative of a relatively high resistance against the examined antibiotics. Coagulase-negative Staphylococci are bacterial agents that are isolated with the highest frequency from mobile phones of health center workers. This has been confirmed by the study of Karabay, Sepehri, Kynymy and Ganaskaran. (2, 3, 4, and 7)

In Karabay study in Turkey, the most frequent bacteria were identified respectively as coagulase-negative Staphylococci, *Bacillus*, methicillin-sensitive *Staphylococcus aureus*, *E. coli*, *Enterococcus faecalis, Pseudomonas fluorescens, K. pneumoniae*.(7) The result

of this study is nearly similar to the result of our study regarding the type of isolated bacteria. That can somewhat indicate a similarity in the bacterial flora of the personnel's mobile phones.

In the study of Tambkar et al in India, the most frequent isolated bacteria from the personnel's mobile phones in various parts of hospital are respectively such as the following: *S. aureus, Micrococcus luteus, P. aeruginosa, E. coli, Proteus mirabilis, K. pneumoniae, Enterobacter aerogenes*, and *Salmonella typhi*. (1) The type of identified bacteria indicates the high contamination of mobile phones in this study and the high risk of transmission of very dangerous infectious agents through this way to the hospital patients is being studied.

In the study of Sepehri in Kerman, *S. epidermidis* was also the most isolated bacteria; after that, *S. aureus, Bacillus subtilis, K. pneumoniae* and *Enterococci* were the most frequent. (2)

In Nigeria, Kynymy et al showed that the isolated bacteria respectively included *S. aureus*, coagulase-negative Staphylococci, *E. faecalis, E. coli, K. pneumonia , Bacillus* and *P. aeruginosa*. (3)

In the present study, most of the pathogenic bacteria were isolated from mobile phones of burn ward staff, including *P. aeruginosa, Acinetobacter spp., K. pneumoniae* and *E. coli.* This result indicates the higher contamination of these staff's mobile phones comparing to the other parts on the one hand and the risk of transmission of these agents to other patients on the other hand, because the risk of this type of infection is much greater in the patients of these parts due to weakened immune system, resulting in a loss of skin defensive barrier.

The opportunistic *Acinetobacter* pathogen was not isolated from the mobile phones in any of the above studies. In this study, we have identified 9 of them in the clinical part and one in the administrative part. This bacterium is one of the most important factors of hospital infection that has a high resistance to antibiotics. The results of this study showed that personnel's mobile phones, especially in the clinical parts, have a high potential in storing this pathogen bacterium.

In our study, 18 pathogen bacteria were isolated from the mobile phones of the subjects. 13 isolates belonged to clinical staff and 5 isolates belonged to administrative staff of the hospital. This result shows that the number of pathogens isolated from the mobile phones of clinical staff is significantly higher than that of the administrative staff. The presence of these bacteria is very important for two reasons: on the one hand they play an important role as a carrier of pathogenic bacteria outside the hospitals and on the other hand, they are important as a storage for infections associated with staff and its transmission to patients.

In Conclusion Given that today mobile phone is an important communication device for physicians and nurses, the restrictions on the use of this device is not a practical solution to prevent the spread of infectious agents and it is necessary to perform effective methods of prevention. Using hand disinfectants, more monitoring and surveillance during the contact with patients, using mobile phone handsfree, and appropriate disinfectants for mobile phone surface, and frequent hand washing are effective practical techniques to control transmission of these infections through mobile phones.

It is suggested to inform doctors and staff about the role of mobile phones in transmitting hospital infections and train them the effective preventive techniques in order to control hospital infection, and there should be further studies on effective ways to disinfect mobile phones properly with alcohol or disinfectant in hospitals. It is also recommended to take samples from further parts of the hospitals.

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