BioCore Exploring Scientific Community

International Journal of Biotechnology and Bioengineering

Research Article ISSN 2475-3432

Mobile Phones is a Source of Spreading Bacterial Diseases in (Rawalpindi – Pakistan)

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Abstract

Mobile phones are used in daily life professionally and socially by every community in an environment prone to several bacterial pathogens. This study was conducted to prove that the mobile phones are the major vehicles for the transmission of bacterial pathogens. For this 350 swabs were taken from the mobile phones of the owners and were divided into the 4-group as follow: Group A was composed of 90 food handlers, group B, 102 taxi drivers, group C, 77 medical staff and group D, 81 students. The samples were culture and their antimicrobial sensitivity was conducted by the standard procedure. The results showed a high percentage (64.57%) of bacterial contamination. Mobile phones of group A had the highest level of contamination (70, 77.77%) followed by group B (76, 74.50%), group C (42, 54.54%) and group D (38, 46.91%). Staphylococcus aureus was the most dominant bacterial agent in all groups followed by E. coli. Other bacterial agents isolate were Enterococcus feacalis, Klebsiella pneumoniae, Bacillus Spp and P. aeruginosa. There was no statistical significance difference ($P < 0.05$) in the occurrence of S. aureus, the most frequently identified pathogenic bacterial agent isolated from the mobile phones in the study groups. Ceftriaxone was found to be effective (181, 80.08%) against most isolates followed by Ciprofloxacin (177, 78.31%). It is concluded that mobile phones may serve as a vehicle of spreading bacterial diseases of both community and hospital acquired. Adherence to infection control such as using of antiseptics and hand washing is advised

Keywords: Mobile Phones, Swabs, Antimicrobial Sensitivity, Bacterial Agents, Ceftriaxone, Contamination

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Citation: Sayed Zaheer Abbas et al. (2018), Mobile Phones is a Source of Spreading Bacterial Diseases in (Rawalpindi – Pakistan). Int J Biotech & Bioeng. 4:5, 113-116.

Received: April 13, 2018

Accepted: April 23, 2018

Published: May 30, 2018

Introduction

Nowadays, portable phones have become one of the most essential accessories of professional and public life. Although they are typically kept in bags or pockets, mobile phones are held commonly and adjacent to the face. Today more than 1.5 billion people are using mobile phones worldwide, about 400 million people of them in Europe **(Neubauer et al., 2005; Sowah, 2008).**

The habit of cell phones usage frequently occurs in hospitals, by patients, companions and health care providers, and this is the environment where hospital-associated infections are most ubiquitous. Moreover, tourists who go to third world countries where drinkable water and moral hygiene are imperfect are exposed to the hazard of infectious bacteria as these individuals carry cell phones, and the role of such accessories in the spread of bacterial infection is not yet clear **(Brady et al., 2006; Fleming and Randle, 2006).**

It is well known that diarrhoeal disease is one of the leading causes of illness and death in young children in developing countries **(Umesh et al., 2006).** With an annual mortality rate of around five million people globally, enteric pathogens are the most common cause of diarrhoea **(Kosek et al., 2003).**

The first study of bacterial contamination of mobile phones was led in a teaching hospital in Turkey with a bed capacity of 200 and one ICU **(Karabay et al., 2007).** The possible causes of hospital infections could spread through the hands of healthcare workers, thermometers,

stethoscopes and even toys in the pediatric intensive care units of hospitals **(Fleming and Randle, 2008).**

In Pakistan about 9% of the population between the age group of 10-20 years, 77% between the age group of 21-30 years, 12% between the age group of 31-40 years and 1% between the age group of 41+ years use mobile phones in their daily life **(www.pas.org.pk).** Hence the present study was led to determine that whether the mobile phones could play any potential role in spreading bacterial diseases and to give any possible precautionary measures to avoid the expected spread of the infection.

Methods and Materials

Subjects

Total 350 mobile phones randomly sampled from the different ages group of 10-40+ years volunteers and were studied. The phones were obtained from the following study groups for four months from May to August, 2016. Group A, 90 food handlers, group B, 102 taxi drivers, group C, 77 medical staff and group D, 81 students. The purpose of the study was described to all subjects and their permission was pursued.

Sample collection and bacteriological analysis

Samples were collected aseptically using sterile cotton swab (Lot No. 20151008) moistened in sterile normal saline solution by rotating the swabs on mouth piece, keypad and ear piece of the mobile phones. Samples were then inoculated in brain heart infusion medium and were transported to the laboratory and incubated at 37°C aerobically for 24 hours. Moreover subcultures were done on nutrient agar plates and were incubated aerobically at 37°C for 24 hours. Plates were then studied for bacterial growth and morphology. The isolates were then gram stained. Furthermore bacterial isolates were then identified by biochemical tests using API kit. API Strep (Biomerieux, marcy L'etoil, France) was used to identify gram positive cocci and API 32 E (Biomerieux, marcy L'etoil, France) was used to identify Gram negative bacilli **(Kabir et al., 2009).**

Antibacterial susceptibility testing

Susceptibility of the bacterial isolates to different antibiotics were studied on Muller-Hinton agar by the disk diffusion method **(Bauer et al., 1966).** Colonies of each bacterial isolates were suspended in 3 ml of sterile 0.9 % saline solution in a test tube. Sterile cotton swab was dipped in the bacterial suspension and the excess fluid was removed by turning the swab against the walls of the test tube. The swab was streaked across the surface of the solidified Muller-Hinton agar plates. The plates were then set aside for drying for 4-5 minutes before each of the following antibiotic discs (Oxoid, U.K) was placed on the inoculated plates: Ceftriaxone (30 µg), Ciprofloxacin (5 µg) and Gentamycin (10 µg). The plates were incubated aerobically at 37°C for 18-24 hours. The diameters of the zones of inhibition were measured with a vernier caliper **(Bauer et al., 1966).** Escherichia coli ATCC 25922 was used as control.

Results

Out of 350 samples tested, bacterial agent was observed in 226 and 124 samples were free from bacterial agent. This study showed a high percentage of bacterial contamination (64.57%) was observed on mobile phones. Out of the mentioned groups (A to D) examined, group A (food handlers) had the highest rate of contamination (70; 77.77%), group B (taxi drivers) had the next highest level (76; 74.50%) group C (medical staff) had the next highest level (42; 54.54%) and group D (students) had the lowest level (38; 46.91%) of contamination on their mobile phones (Table 1). In this study it was examined that the Staphylococcus aureus was the most prevalent bacterial agent frequently found on mobile phones i.e. 57.14% in group A, 61.84% in group B, 28.57% in group C and 50.0% in group D. Results were followed by E. coli i.e. 17.14% in group A, 22.36% in group B, 14.28% in group C and 15.76% in group D. Other bacterial agents that were isolated in the study was Enterococcus feacalis, Klebsiella pneumoniae, Bacillus spp. and Pseudomonas aeruginosa. The prevalence of Pseudomonas aeruginosa was least i.e. 0.0% in group A, 1.31% in group B, 28.57% in group C and 0.0% in group D. Antibacterial activity of the identified bacterial agents showed that Ciprofloxacin, Gentamycin and Ceftriaxone inhibited 78.31%, 45.57% and 80.08% (average values) of isolated bacterial agents respectively. (Table 2).

Groups	No. of samples collected	No. of positive samples	Bacterial agents isolated					
			S. aureus	*Enterococcus feacalis*	*E.Coli*	*Klebsiella pneumoniae*	*Bacillus Spp.*	*P. aeruginosa*
Group A Food Handlers	90	70 77.77%	40 57.14%	4 5.71%	12 17.14%	5 7.14%	9 12.85%	0 0.0%
Group B Taxi Drivers	102	76 74.50%	47 61.84%	2 2.63%	17 22.36%	8 10.52%	1 1.31%	1 1.31%
Group C Medical Staff	77	42 54.54%	12 28.57%	2 4.76%	6 14.28%	6 14.28%	4 9.52%	12 28.57%
Group D Students	81	38 46.91%	19 50.0%	4 10.52%	6 15.78%	2 5.26%	7 18.42%	0 0.0%
Total	350	226 64.57%	118 52.21%	12 5.30%	41 18.14%	21 9.29%	21 9.29%	13 5.75%

Table 1: Bacterial agents isolated in the study

Bacterial Isolate	Number of Isolate	Antibiotic disc used		
		Ciprofloxacin	Gentamycin	Ceftriaxone
S. aureus	118	96 (81.35%)	49 (41.52%)	86 (72.88%)
Enterococcus feacalis	12	9 (75.0%)	7 (58.33%)	10 (83.33%)
E.Coli	41	37 (90.24%)	29 (70.73%)	39 (95.12%)
Klebsiella pneumoniae	21	14 (66.66%)	17 (80.95%)	20 (95.23%)
Bacillus Spp.	21	8 (38.09%)	1 (4.76%)	13 (61.90%)
P. aeruginosa	13	13 (100.0%)	0 (0.0%)	13 (100.0%)
Total	226	177 78.31%	103 45.57%	181 80.08%

Table 2: Antibacterial Activity of isolated bacterial agents against selective antibiotics

Discussion

In the present study we found that 64.57% of 350 mobile phones samples which were sampled from different age group of different community categorized in group A to D were contaminated by bacterial agents. Bacteria isolated from different portable electronic devices has shown that this may be one of the possible vehicle for the transmission of bacterial infection among specified community **(Bures et al., 2000).** A study conducted in Queen Elizabeth hospital in Barbados, West Indies showed that 40% of the mobile phones of 266 medical staff and students were contaminated with bacterial agents **(Ramesh et al., 2008).** In a study carried out in New York and Israel Ulger et al. **(Ulger et al., 2009)** examined that 94.5% of 200 health care workers mobile phones were contaminated with various type of bacterial pathogens. The present study agrees with their findings that these portable devices that were contaminated with bacterial pathogens could serve as a vehicle of bacterial infections. In this study group A had the highest rate of contamination (70, 77.77%) followed by group B (76, 74.50%) group C (42, 54.54%) and group D (38, 46.91%). The high dominance of bacterial pathogen contamination from group A mobile phones might be due to the poor hygienic conditions and less awareness among the food handlers compare D where there might be good awareness of using disinfectants. Likewise poor handling conditions might be a factor of high level of contamination observed in group B. Staphylococcus aureus was the most dominant bacterial agent isolated from 118 (52.21%) mobile phones in the study. This result validates the conclusions of Karabay et al. **(Karabay et al., 2007),** in which Staphylococcus aureus was the most prevalent bacterial agent isolated from 68.4% of the subjects assessed. Brady et al. **(Brady et al., 2006)** had shown that the constant usage and heat generating by mobile phones creates a very good environment for the growth of bacterial pathogen because mobile phones are kept warm in the pockets, handbags, and brief cases. S. aureus, P. aeruginosa, K. pneumoniae, E. coli, and Enterococcus feacalis were also isolated in this study. These bacteria are the agents of hospital acquired infections. These bacteria can transfer from hand to mouth during circadian unintentional activities **(Rusin et al., 2002).** This study showed that mobile phone may act as a vehicle for transmitting diseases such as diarrhoea, pneumonia, boils, and abscesses. P. aeruginosa has also been reported in a study in United States conducted by the Centre for Disease Control and Prevention. They stated that this was the most prevalent (10.1%) nosocomial pathogen and is responsible for gastrointestinal infection in an individual with compromised immune system **(Todar, 2004).** It is interesting to note that there was no statistical significant difference ($p > 0.05$) in the occurrence of S. aureus, the pathogenic bacterial agent most commonly isolated bacteria from the mobile phones of all the study groups, occurring in 40 (57.14%), 47 (61.84%), 12 (28.57%) and 19 (50.0%) of Groups A to D respectively (Table 1). It is suggested by this study that the likelihood of being infected with bacterial pathogens simply by using other people's mobile phones is high. It was revealed in the study that 78.31%, 45.57% and 80.08% of the bacterial isolates were susceptible to Ciprofloxacin, Gentamycin and Ceftriaxone respectively. Studies conducted in Nigeria stated that third generation cephalosporin are effective against a wide range of bacteria, and are expensive and less abused **(Akinyemi et al., 2007).** Mobile phone is the basic need of this generation and it is very impractical to restrict the usage of mobile phones in places like slaughter houses, groceries, bakeries, class rooms, medical wards and toilets etc. Hence it is recommended that the mobile user should use antiseptics and wash their hand regularly to wipe the bacterial agents off their hands to prevent themselves from bacterial infections of both community and hospital acquired.

Acknowledgments

The authors are very much obliged to the Microbiology department of Agror Pharmaceuticals for their support and assistance.

hospital acquired.

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