Isolation and Identification of Bacteria from Cell Phones of Health Care Workers from Central India

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ABSTRACT

Introduction: The telecommunications market in India is currently the second-largest in the world. Cell phones have been shown to pose a health threat with tens of thousands of microbes residing on every square inch of the phone. It has been observed that pathogenic bacteria exist on around 40 percent of patient-related cell phones and about 20 percent of hospital staff-related mobile phones. Cell phones are difficult to clean and therefore have the potential for contamination with multiple bacterial agents. Doctors and health care workers (HCW) serving in intensive care units (ICUs) or operating units are widely exposed to deadly micro-organisms. HCWs often become carriers and may act as vectors and spread microorganisms wherever they are taken.

Material And Method: A total of 60 HCW cell phones were tested for their bacterial contamination at Datta Meghe University of Medical Sciences. Consent was obtained from all persons whose mobile phones had been included in this study. Swabs were soaked in the tube containing peptone water. The cell phones analyzed were obtained at random from four departments: laboratory, Surgical Intensive Care Unit, surgical unit, and Operation theater T area. The specimen was obtained using a sterile cotton swab moistened with sterile peptone water. After 24 hours of incubation, plates were examined for the growth of microbial colonies.

Results: A total of 60 mobile phones were included and samples were collected. This study enrolled the mobile phones of 15 (25%) nurses, 15 (25%) Doctors, 15 (25%) attendent, and 15 (25%) laboratory technicians. All cellphones were touch screens having back cover. Coagulase negative Staphylococci (CoNS) was isolated from 24 (40%) cellphones. Methicillin sensitive Staphylococcus aureus (MSSA) and Methicillin resistant Staphylococcus aureus (MRSA) were isolated from 21 (35%) and 15 (25%) cells respectively. Isolation of Diphtheroids, Coagulase negative Staphylococci (CoNS), Pseudomonas aeruginosa, Esherichia coli, Micrococci, Acinetobacter species and ESBL Klebsiella was 18(30%), 24(40.0%), 22 (36.6%), 7(11.7%), 11(18.3%), 5(8.3%), and 3(5.0%) respectively.

Conclusion: Mobile phones can serve as a potential carrier for the nosocomial infection spread. Therefore regular screening of mobile phones, proper sterilization and hand hygiene is recommended for all health care workers.

Key Words: Cell phone, Mobile, HCW, Microbial contamination

INTRODUCTION

There is a tremendous increase in the use of cell phones in India. Now India has become 2nd largest telecommunications market in the world. Due to cell phones, there is convenience in contact between people, either by calling, texting, or by email. Today, cell phones come up with a range of apps, internet browsing, e-mails, gaming, accessing social networking sites, music and video apps, radio, E-books, dictionary, etc. The majority of consumers are in the 15 to 25 age group[1].

Regardless of the cell phone's accomplishments and advantages, it is easy to underestimate its health hazard; this is against the backdrop that many consumers can ignore personal hygiene, and the number of people who may be using the same cell-phone. Continuous cellphone handling by users exposes it to a range of microorganisms, rendering it a good carrier for organisms. Cell phones have been shown to pose a health threat with millions of microbes residing on every square inch of the phone[2]. It has been observed that pathogenic bacteria exist on around 40 percent of patient-related cell phones and about 20 percent of hospital staff-related mobile phones[3]. Constant handling of cell phones in hospitals (patients, their relatives, and health care workers, etc.) makes it an open breeding ground for the transmission

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of micro-organisms, and healthcare associated infections (HAI)[4]. The heat created by cell phones helps to harbor bacteria on the device at alarmingly highlevels[5].

Cell phones are difficult to clean and therefore have the potential for contamination with multiple bacterial agents[6]. Doctors and HCW serving in intensive care units (ICU) or operation theaters are widely exposed to these pathogenic micro-organisms. HCWs often become carriers and may act as vectors and spread microorganisms wherever they are taken[7]. Colonized micro-organisms in health-care workers can be transmitted to patients, though patients do not have direct cell phone contact. Nosocomial infection can occur in patients with a weak immune system, but in patients with a strong immune system, microorganisms may not cause serious harm[8].

The present study was therefore conducted with the goal of screening healthcare personnel's cell phones for the presence of microorganisms and to isolate and identify microorganisms on them.

MATERIAL AND METHODS

The present study was a cross-sectional study conducted in Datta Meghe Medical College, Nagpur in collaboration with Jawaharlal Nehru Medical College, Sawangi Meghe, Wardha (DMIMS) over a period of two months. A total of 60 HCW cell phones were identified and tested for their bacterial contamination at the Department of Microbiology. Consent was obtained from all persons whose mobile phones had been included in this study. Swabs were soaked in the tube containing peptone water.

The cell phones analyzed were obtained at random from four departments: laboratory, SICU, surgical unit, and OT area. The specimen was obtained using sterile cotton swab dipped insterile peptone water. The swab was rotated on the sides, back and over the screen of cell phones. All swabs were surface streaked immediately on the Blood agar and MacConkey agar. Inoculated blood and MacConkey's agar plates were quickly transferred to the microbiology laboratory along with the inoculated peptone water tubes. Blood and MacConkey agar plates were aerobically incubated at 37°C for 24 hours.

After 24 hours of incubation, plates were examined for growth of microbial colonies. Gram staining of all the isolates was performed for the identification of the bacteria. Isolated bacterial colonies were then identified according to the standard microbiological, biochemical methods[9]. On Mueller Hinton agar plates, Staphylococcus aureus and coagulase-negative staphylococci (CoNS) isolates were further

verified by Kirby- Bauer disc diffusion method[10] for their methicillin resistance using cefoxitin (30 μg) disks.

Gram-negative bacteria were identified on the basis of their lactose and non-lactose fermenting colonies, gram stain, oxidase, catalase, triple sugar iron agar (TSI), methyl red, indole, citrate, Voges Proskauer, (IMViC) and urease tests. The extended spectrum beta-lactamase (ESBL) was tested by using the double disk diffusion process, as per the recommendation of CLSI. The discs used were ceftazidime 30 μg, ceftazidime-clavulanate 30/10 μg, cefotaxime 30 μg, and cefotaxime-clavulanate 30/10 μg. An increase of about 5 mm in zone diameter for either antimicrobial agent tested in combination with clavulanate vs. the zone diameter of the agent when tested alone was confirmed as ESBL producer[11].

Using SPSS (version 16.0) software data were analyzed[12], P-value of >0.05 was used as the cut off value for statistical significance. For summarizing qualitative data counts and percentage were used. For normally distributed quantitative data Mean and standard deviation (SD) were used as measures of central tendency and dispersion, respectively.

RESULTS

A total of 60 mobile phones were included and samples were collected. This study enrolled the mobile phones of 15 (25%) nurses, 15 (25%) Doctors, 15 (25%) attendant and 15 (25%) laboratory technicians. All cellphones were touch screens having back cover.

Table 1: Cell phone enrolled from different HCW

Cell phone enrolled	Number	%
Doctors	15	25%
Nurses	15	25%
Attendants	15	25%
laboratory workers	15	25%

Of the 15 doctors, mixed growth was observed in 10 (66.67%) and single growth was seen 5 (33.33%) cellphone. In nurses' cellphone, 9 (60%) showed mixed growth and 4 (26.67%) showed single growth. In 2 cases no growth was observed. 12 (80%) attendants mobile showed mixed growth and 3 (20%) showed single growth. In laboratory workers, cell phones mixed growth was observed in 13 (86.67%) and single growth was seen in 2 (13.33%). Overall out of 60 samples 44 (73.33%) mixed growth, 14 (23.33%) single growth, and 2 (3.33%) no growth was observed.

Table 2: Bacterial contamination in HCW

HCW	Mixed (2 or more organisms)	Single growth	No growth	Total	Mean	SD
Doctors	10 (66.67%)	5 (33.33%)	0	15	2.27	1.0
Nurses	9 (60%)	4 (26.67%)	2 (13.33%)	15	2.00	1.26
Attendants	12 (80%)	3 (20%)	0	15	2.27	0.85
laboratory workers	13 (86.67%)	2 (13.33%)	0	15	2.60	0.88
Total	44 (73.33%)	14 (23.33%)	2 (3.33%)	60	2.28	0.46

Table 3: Isolation of organisms

Organisms	Number (n=60)	%
Methicillin sensitive Staphylococcus aureus	21	35.0%
Methicillin-resistant Staphylococcus aureus (MRSA)	15	25.0%
Diphtheroids	18	30.0%
Coagulase negative Staphylococci (CoNS)	24	40.0%
Pseudomonas aeruginosa	22	36.7%
Escherichia coli	7	11.7%
Micrococci	11	18.3%
Acinetobacter species	5	8.3%
ESBL Klebsiella	3	5.0%

Coagulase negative Staphylococci (CoNS) was isolated from 24 (40%) cellphones. Methicillin sensitive Staphylococcus aureus (MSSA) and Methicillin-resistant Staphylococcus aureus (MRSA) were isolated from21 (35%) and 15 (25%) cells respectively. Isolation of Diphtheroids, Coagulase negative Staphylococci (CoNS), *Pseudomonas aeruginosa, Esherichia coli, Micrococci, Acinetobacter* species and ESBL *Klebsiella* was 18(30%), 24(40.0%), 22 (36.6%), 7(11.7%), 11(18.3%), 5(8.3%), and 3(5.0%) respectively.

DISCUSSION

Societies should adapt microbiological and hygiene practices for a healthy life. Constant mobile handling by multiple users exposes it to a range of organisms and also serves as a carrier for microbes. Mobile phones may pose a health hazard with millions of microbes living on every square inch of the cell phone[2].

Staphylococci are commonly present on clothes, bed sheets, and other human environments. *S epidermidis* is a common flora of human skin. *S aureus* exists in about 20-50% of human being a nasal carrier [13].

In our study, it was observed that of the 15 doctors, mixed growth was observed in 10 (66.67%) and single growth

was seen 5 (33.33%) cellphone. In nurses' cellphone, 9 (60%) showed mixed growth and 4 (26.67%) showed single growth. In 2 cases no growth was observed. 12 (80%) attendants mobile showed mixed growth and 3 (20%) showed single growth. In laboratory workers' cell phones mixed growth was observed in 13 (86.67%) and single growth was seen in 2 (13.33%). Overall out of 60 samples 44 (73.33%) mixed growth, 14 (23.33%) single growth, and 2 (3.33%) no growth was observed.

Pseudomonas aeruginosa, *Escherichia coli*, and *Klebsiella pneumoniae* which cause hospital infections and can serve as a vector for the spread of nosocomial pathogens as reported by Karabay et al. They also observed that most of the isolated organisms were skin flora, 16.7% of the samples were positive for pathogens which were known to be associated with nosocomial infection, like *Enterococci* species, *S. aureus* and *K. pneumonia* but in contrast to our study Methicillin-Resistant *S. aureus* (MRSA) were not isolated[14]. Cell phone users are everywhere: in the community, in the workplace, in the hospitals, and in schools. Hence, they may be the cause of the community spread of the infection[15]. Jeske et al. also reported that in the operating theatre, bacterial contamination of the hands of anesthetists by personal cell phones (38/40 doctors, 4/40 with human pathogenic bacteria) occurred[16]. Intensive care unit patients and patients with burns are very vulnerable to infectious diseases, thereby raising the risk of transmission of nosocomial infections in these cases through computer keyboards[17]. In a study by Singh P et al. 18 *K. pneumoniae* strains, isolated in Clinical Microbiology Laboratory should be tested phenotypically for ESBL production as it can pose a major threat to patient care and incidence of ESBL producing *K. pneumoniae* was detected and observed that 55 (45.8%) strains were ESBL producers.

Pseudomonas aeruginosa is a metabolically active proteobacterium in terrestrial, marine, insect, human and plant-host environments which is responsible for nosocomial infections. In our study, it was isolated in 36.7% of the cellphones of the health care workers [19].

MRSA and MSSA isolated in our study were 35.0% and 25%, respectively. The principal reservoir of *S. aureus* is the hand and can be introduced in the food causing food poisoning as well as wound infections[20].

In our study, *Escherichia coli* and *Klebsiella pneumoniae* isolated were 11.7% and 5%, respectively. Deotale et al. in their study observed the biofilm production for these organisms and found that they are multi drug resistant if they are isolated from the urine and produces biofilm[21]. In a study by Mudey G. and Munjal R., it was observed that nasal carriage of *Staphylococcus aureus* among undergraduate medical students 16% and the prevalence of MRSA and inducible clindamycin resistance was 5% and 3.5% [22].

CONCLUSION

Mobile phones of Heath care workers are highly contaminated with micro-organisms. These can serve as a potential carrier for the nosocomial infection spread. Therefore regular screening of mobile phones, proper sterilization, and hand hygiene is recommended for all health care workers. Also, care should be taken while handling the mobile in health care settings so that transmission of infection can be reduced.

Conflicts of Interest: Nil

Source of Funding: Nil

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