Mobile Phones Use among Health Care Workers and it's Possible Role in Spreading the Hospital Acquired Infections in Medical College Hospital, Rajnandgaon [C. G.], India

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In recent years, the use of mobile phones in the course of a working day has made mobile phones potential agents of microbial transmission. The increase use of mobile phones is seen as responsible for rise in community infection rates reported by ecological findings. Several etiologic agents of nosocomial infections (which contaminate mobile phone) are of various genera and species of bacteria, virus, fungi including *Staphylococcus aureus, E-coli, Klebsiella species, Enterococcus species*, and *Proteus* species have been identified. So the present study was planned to assess the possibility of hospital acquired infection due to use of mobile phone in health care persons. The present cross sectional observational hospital based study has been conducted in Government Medical College, Rajnandgaon (Chhattisgarh) India, during the study period from January 2017 to October 2017. Sample size was fix at 110. Procedure was performed as per standard protocol. Data was compiled in MS-Excel and checked for it's completeness and correctness, then it was analysed by using suitable software. Present study shows that 63.636% of HCW's dominant hand and 56.36% of their mobiles phone had bacterial contaminations mostly with *S. epidermidis*. The sensitivity of gram negative bacilli towards ciprofloxacin, erythromycin, tetracycline and gentamycin were in the range of 32-85 %. All gram positive organisms were sensitive to vancomycin and sensitivity to ciprofloxacin, erythromycin and tetracycline was in the range of 91-98%. We also found that 50 % isolated *Staphylococcus aureus* were methicillin resistant *Staphylococcus aureus* (MRSA). It can be concluded from present study that mobile phones can act as source of hospital acquired infections and there is need to form definite policies for use of mobile phones in health care settings.

Introduction

The global system for mobile telecommunication was established in 1982 in Europe for the improvement in communication system. The first use of mobile phone in India was in 1995 and today 1033.20 million (May 2016) mobile phone users are in India[1]. In recent years, the use of mobile phones in the course of a working day has made mobile phones potential agents of microbial transmission. The increase use of

mobile phones is seen as responsible for rise in community infection rates reported by ecological findings[2]. Since, hand washing may not usually be performed often enough and many people may use personal mobile phone in the course of a working day, the potential act of mobile phones as a source of microbial transmission is considerable[2.] Mobile phones are continuously used all day long but never cleaned, and there are no guidelines for proper disinfection and decontamination of mobile phones, further keeping them in pockets, handbags, and snug pouches increase the possibility of bacterial proliferation due to warmth and ideal condition[3.] Research has shown that the mobile phone could constitute a major health hazard. Microbiologists say that the combination of constant handling and the heat generated by the phones create a prime breeding ground for all sort of microorganism that are normally found on our skin[4]. The adult human skin has surface area of approximately $2m^2$ which is constantly in contact with environmental microorganisms and become readily colonized by microbial species of about 10^{12} bacteria[5,6]. Despite the tremendous advancement in modern medicine, nosocomial infections still cause a risk of increased mortality and morbidity to the hospitalized patient. The pathogens causing infections in patients also affects health care staff and visitors. Nosocomial infections caused by multidrug resistant gram positive organisms such as *Staphylococcus aureus* and Enterococcal species are a growing problem in many health care institutions[7,8,9].

Several etiologic agents of nosocomial infections (which contaminate mobile phone) are of various genera and species of bacteria, virus, fungi including *Staphylococcus aureus*, *E. coli*, *Klebsiella* species, *Enterococcus* species, and Proteus species have been identified.

During every phone call the mobile phone come into close contact with strongly contaminated human body areas with hands to hands, and hands to other areas like mouth, nose and ears[10]. Mobile phones act as perfect habitat for microbes to breed, especially in high temperature and humid conditions[11]. HCWs' mobile phones may serve as reservoir of microorganisms that could be easily transmitted from the mobile phones to the HCWs' hands and therefore facilitate the transmission of bacterial isolates from one patient to another in different hospital wards. The wide spread use of mobile phones among medical personnel in hospitals is a matter of controversy. The question of concern is how to use the mobile phones sensibly getting their benefits and minimizing their risks[12].Another point of view argues that, if mobile phones are used carelessly in surgical wards or intensive care units (ICU), they may act as a source of infection to patients while handling them, such as during dressing of surgical wounds[13]. Besides, there are no guidelines for disinfection of mobile phones that meet hospital standards. Moreover, the mobile phones are used routinely all day long and the same phones are used both inside and outside the hospital plying a possible role in spreading infections to the outside community[14].

The present study was therefore planned to assess the possibility of hospital acquired infection due to use of mobile phone in health care persons in a tertiary care hospital of Rajnandgaon city (C.G.).

Materials and Methods

The present cross sectional observational hospital based study has been conducted in Government Medical College, Rajnandgaon (Chhattisgarh) India, during the study period from January 2017 to October 2017. Permission was taken from institutional ethics committee and informed written consent was taken from the subjects prior to conduction of the study.

Inclusion criteria

Informed concent of HCW's.

Exclusion criteria

Non-willing HCW's.

As per available previous research, rate of mobile phone contamination was ranged from 70 to 95%. So, P=50 (rate of mobile phone contamination for over study) was taken.

$$n = 4 \, pq \, / l^2$$

p=50, q=50, l is allowable error that is 20% of p.[15]

All the value was put and n =100 was obtained (n= sample size) but as per need, more sample size for study was taken, that is, sample size of 110 (110 from mobile & 110 from hands).

Before taking samples, both hands were washed thoroughly with soap and water and disinfected with alcohol.

From each individual, two swab samples (one from hand and other from mobile phone at the end of duty) with the help of sterile cotton swabs, moistened with normal (0.85%) saline was taken.

In case of hand sample, palmar creases and interdigital spaces were also swabbed along with the tip of finger and palm of dominant hand, and sample was collected by gently rolling the swab stick over the areas for 6-7 seconds. Mobile phone swab was collected by rotating it on overall surface of the mobile phone. Swab was collected with all aseptic precautions.

The collected swabs were immediately transported to microbiology laboratory (Government medical college & hospital) and inoculated on 5% sheep blood agar and MacConkey Agar, streaked and incubated at 37°C for 24 hours and observed for the growth. After incubation the plates were observed for colony morphology and suitable tests like Gram stain, catalase, Coagulase and a panel of biochemicals (Indole production, Citrate utilization, motility using semisolid agar stab, Urease and TSI) were put up for identification. For example, if Gram positive cocci in clusters was recovered, catalase and slide coagulase along with mannitol fermentation (using 1% w/v Andrade's indicator) were performed. If Gram negative bacilli were found, biochemical tests were carried out (sugars, indole test, MR test, urease test, citrate test). Then, according to Clinical and Laboratory Standards Institute (CLSI) guideline for isolation of organisms, antibiotic sensitivity test was performed by Kirby- Bauer Method. Antibiotic susceptibility test was performed by Kirby-Bauer disk diffusion method as per CLSI protocol using the following antibiotic disks: Cotrimoxazole (25 µg), Amikacin (30 µg) and Levofloxacin (5 µg) disks (Hi Media Labs, New Delhi, India); Cefoxitin disk (30 µg) was used to detect MRSA.[4]

Data was compiled in MS-Excel and checked for it's completeness and correctness, then it was analysed by using suitable software.

Results and Discussion

Types of bacterial organism isolated were shown in Table 1 and 2. Present study shows that 63.636% of HCW's dominant hand and 56.36% of their mobiles phone had bacterial contaminations mostly with *S. epidermidis*. Contamination with other nosocomial species (*Staphylococcus aureus*, *Klebsiella pneumoniae*, *Enterococcus* spp *E.coli*, *Actinobecter, Pseudomonas* Candida spp.) was 28.26% in dominant hand and 21.80 % in mobile phones.

Table 3 shows antibiotic sensitivity pattern of Gram negative organisms. The sensitivity of gram negative bacilli towards ciprofloxacin, erythromycin, tetracycline and gentamycin were in the range of 32-85 %.

Table 4 shows antibiotic sensitivity pattern of Gram positive organisms. All gram positive organisms were sensitive to vancomycin and sensitivity to ciprofloxacin, erythromycin and tetracycline was in the range of 91-98%. We also found that 50 % isolated *Staphylococcus aureus* were methicillin resistant *Staphylococcus aureus* (MRSA).

Table.1 Types of organisms isolated from mobile Phones of HCWs

S.N.	Organisms	No (%)(n=110)
1	*Staphylococcus epidermidis*	62(56.36%)
2	*Staphylococcus aureus*	3 (2.72%)
3	*E. coli*	3 (2.72%)
4	*Klebsiella*	2 (1.82%)
5	*Acinetobacter*	5 (4.54%)
6	*Pseudomonas*	6 (5.45%)
7	*Enterococci*	2 (1.81%)
8	*Candida albicans*	3 (2.72%)

Table.2 Types of organisms isolated from hands of HCWs

S.N.	Organisms	No.	%
1	*Staphylococcus epidermidis*	70	(63.636%)
2	*Staphylococcus aureus*	1	(0.9%)
3	*E.coli*	2	(1.818%)
4	*Klebsiella*	10	(9.09%)
5	*Acinetobacter*	9	(8.181%)
6	*Pseudomonas*	3	(2.722%)
7	*Enterococci*	5	(4.545%)

Table.3 Sensitivity pattern of gram negative organisms from mobile phones and hands of HCWs (%)

Drug	*E.coli*	*Klebsiella*	*Acinetobacter*	*Pseudomonas*
Amoxicillin-Clavulanic acid	68.5	78	66.4	49
Co-trimoxazole	54.7	52.8	42.5	32
Cefepime	59	62	43.6	40
Ciprofloxacin	75.8	83	80.2	72.4
Erythromycin	75.5	74.8	38.4	33.3
Tertracyclin	69.5	68.6	58	49
Gentamycin	77.4	75.6	65	62.5
Amikacin	82.6	83.3	72	70.6

Table.4 Sensitivity pattern of gram positive organisms from mobile phones and hands of HCWs (%)

Drugs	*Staphylococcus epidermidis*	*Staphylococcus aureus*	*Enterococci*
Amoxicillin- Clavulanic acid	99	90.6	95.5
Co-trimoxazole	91.6	70.6	96.2
Cloxacillin	94.6	58.6	94.4
Cefoxitin	98.6	80.6	95
Ciprofloxacin	98	97.6	98
Erythromycin	94.6	94.6	91.2
Tertracyclin	95.6	96	95
Vancomycin	100	100	100

In concordance with our results, Ulger *et al.,* stated that 94.5% of phones showed evidence of bacterial contamination and the isolated microorganisms were similar to hand isolates [16]. Jeske *et al.,* found that the rate of bacterial contamination of HCWs' hands was 95% while that of mobile phone was 90%[17]. Tambekar *et al.,* stated that 95% of mobile phone showed bacterial contamination and among *S. aureus* isolates 83% were methicillin resistant[13]. Brady *et al.,* showed that 89.7% of mobile phones were contaminated by bacteria[4]. Present study shows that 90.87% of HCW's dominant hand and 78.14% of their mobiles phone had bacterial contaminations. Although it is a normal skin flora it is responsible for a large number of hospital acquired infections and often proves difficult to treat because of the bacterium's genetic characteristics and growing resistance to high powered antibiotics[18]. Other isolated organisms were *Staphylococcus aureus*, *Klebsiella* pneumonia, *Enterococcus* spp, *E.coli Pseudomonas* spp, Candida spp etc. which are comparable with the findings of above mentioned studies.

The isolated microorganism from dominant hands correlated with the isolated ones from mobile phones in 63.36% of participants. We found that 50% isolated *Staphylococcus aureus* were Methicillin Resistant *Staphylococcus aureus* (MRSA). Methicillin resistant *Staphylococcus aureus* is a multidrug resistant and responsible for several difficult-to-treat infections in humans. Methicillin resistant *Staphylococcus aureus* is especially troublesome in hospitals where patients are with open wounds, invasive devices and weakened immune systems. It is a well-known fact that organisms like *Staphylococcus aureus* and coagulase negative staphylococci resist drying and thus can survive and multiply rapidly in the warm environments like mobile phones. *Pseudomonas* and *Acinetobactor* species isolated in the study showed multi drug resistance to commonly used antibiotics. Their ability to contaminate mobile phones is expected as they are multi drug resistant water and soil organisms and are responsible for infection in predisposed patients in the hospital.

In present study, organisms isolated from mobile phones are *Staphylococcus epidermidis*, *Staphylococcus aureus*, *E.coli*, *Klebsiella*, *Acinetobacter*, *Pseudomonas*, *Enterococci, Candida albicans* and all these microorganisms are established causes of Hospital Acquired Infections So, mobile

phone can act as a source for spreading Hospital Acquired Infections.

The conclusion of the study are as follows:

1) Organisms isolated from mobile phones and hands of HCW'S are *Staphylococcus epidermidis*, *Staphylococcus aureus*, *E. coli*, *Klebsiella*, *Acinetobacter*, *Pseudomonas*, *Enterococci Candida albicans*.

2) Percentage of *Staphylococcus epidermidis* isolated from mobile phones is 56.36% and that from hands of Health Care Workers is 63.63%. Contamination with other nosocomial species (*Staphylococcus aureus*, *E. coli*, *Klebsiella*, *Acinetobacter*, *Pseudomonas*, *Enterococci Candida albicans*) is 28.26% in hands of Health Care Workers and 21.80% in mobile phones.

3) The antibiotic sensitivity pattern of microorganisms isolates showed that most of them are sensitive to routinely used antibiotics but some of the isolates showed resistance to routinely used antibiotics eg MRSA.

It can be concluded from present study that mobile phones can act as source of hospital acquired infections and there is need to form definite policies for use of mobile phones in health care settings.

Recommendations

As restriction of using mobile phone while working hours is not the practical solution of the problem, ultrasonic cleaner is not available at most of places and HYGreen system is too new to install, we recommend simple measures like hand washing, cleaning of mobile phones with 70% isopropyl alcohol, using hand free mobile phone while working hours, well controlled infection control plan and regular training to HCWs to reduce the rate hospital acquired infection.

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