

Role of Mobile Phone in Spreading Hospital Acquired Infection: A Study in Different Group of Health Care Workers

Dr Harish R Trivedi*, Dr Kairavi J Desai **, Dr Lopa P Trivedi ***, Dr Saklainhaider S Malek ****,
Dr Tanuja B Javdekar *****

*Associate professor, Deptt. Of Ophthalmology, **Associate professor, Deptt. Of Microbiology, ***Associate professor, Deptt. Of Anaesthesia, ****Tutor, *****Professor, Deptt. Of Microbiology, Govt. Medical College & Sir T Hospital, Bhavnagar

Abstracts: Background: Use of mobile phones by Health Care Workers (HCWs) in the operation theatre (OT), Intensive Care Unit (ICU) and Critical Care Unit (CCU) may have serious hygiene consequences as these patients are more vulnerable to hospital acquired infection. This study will assess possibility of spreading hospital acquired infection due to usage of mobile phone by HCWs working in OT, ICU and CCU, their causative microorganisms and antibiotic sensitivity pattern. Methods: After institutional ethics committee approval, this observational study was carried out in government teaching hospital. After written informed consent, three groups (doctors, nurses and other health care personnel) each of 50 participants were selected. From each participant two samples were collected, one from the dominant hand and another from the mobile phone. The samples were tested for the identification of microorganism and antibiotic sensitivity. Results: It was found that 58.66% of hands and 46.66% mobile phones were contaminated by bacteria. Staphylococcus epidermidis was isolated as most common causative organism with infection rate of 42% in hand and 32.66% in the mobile phone. Contaminations with other organisms were 16.66% in hand and 14% in mobile phone. We found that 50% isolated Staphylococcus aureus were methicillin resistant Staphylococcus aureus (MRSA). Pseudomonas and Acinetobacter species isolated in the study showed multi drug resistance to commonly used antibiotics. Conclusion: We recommend simple measures like hand washing, cleaning of mobile phones with 70% isopropyl alcohol, using hand free mobile phone while working hours and well practiced infection control plan to bring down the rate of hospital acquired Infection. [Trivedi H R et al NJIRM 2011; 2(3) : 61-66]

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Author for correspondence: Dr. Harish R Trivedi, Associate Professor, Department of Ophthalmology, Govt. Medical College & Sir T Hospital, Bhavnagar. E-mail: trivedi_harish@yahoo.co.in

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 287 million mobile phone users in India which account for 85% of all the telecommunication users.¹ With the advancement in technology, mobile era has evolved and the world is on the tip of finger.

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 creates a prime breeding ground for all sorts of microorganisms that are normally found on our skin.² The adult human skin has surface area of approximately 2 m² which is constantly in contact with environment microorganism and become readily colonized by microbial species of about 10¹² bacteria.^{3,4}

Hospital acquired infection caused by multi-drug resistant gram-positive organisms such as staphylococcus aureus and enterococcal species are a growing problem in many health care institutions.⁵⁻⁷ Hands, instruments, mobile phones etc. used by HCWs may serve as vectors for the nosocomial transmission of microorganisms.^{2, 5, 7, 8, 9-11}

In this mobile era, the increased use of mobile phones by HCWs in OT, ICU, CCU and burn wards may have more serious hygiene consequences, because unlike fixed phones, mobile phones are often used in these areas close to the patients and these patients are more vulnerable to hospital acquired infection^{12, 13, 14} tempted us to investigate possibility of hospital acquired infection due to usage of mobile phone.

Material and Methods: After the institutional ethics committee approval this observational study was carried out in government teaching hospital during the year 2010.

After written informed consent, three groups (doctors, nurses and other health care personnel) each of 50 participants working in the OT, ICU, and CCU were selected. Group A consisted of doctors, group B of nurses and group C of other health care personnel who are engaged with shifting/handling of patients and cleaning of OT/ICU/CCU. In each group of 50 participants, 25 were randomly selected from OTs and 25 from ICU/CCU. Current practice of hand hygiene in our OT is to get scrub with soap and water for 5 to 7 minutes and disinfectant is applied afterwards. In ICU/CCU hand hygiene is maintained by washing hands for two minute before and after duty hours.

During working, 30 second wash is done after contact with patients who are not grossly contaminated and 60 second wash if patients are grossly contaminated from each participant two samples were collected, one from the dominant hand and another from the mobile phone at the end of duty. Before taking samples, technician washed both hands thoroughly with soap and water and disinfected with alcohol. Total 300 samples were collected, 150 from rotating the swab over palm and tip of fingers of the dominant hand and 150 swabs from the surface of both sides and key pad of the mobile phone. The collected samples were immediately transferred to microbiology laboratory and inoculated on Blood and MacConkey Agar.

The plates were incubated at 37°C for 48 hours and observed for the growth. Gram stain was performed from different types of colonies. Identification of bacterial organism to species level was carried out on the basis of various biochemical reactions. **Image 1** shows Pink mucoid colony of klebsiella on MacConkey agar. **Image 2** shows Black colony of enterococci on potassium tellurite blood agar.

Antibiotic sensitivity testing of isolate was done by modified Kirbey-Beaur method in accordance to Clinical and Laboratory Standards Institute (CLSI) guideline.¹⁵

Data were collected, entered in computer and statistical analysis was done with Epi info version 3.5.1 using Chi square tests. P value of less than 0.05 was considered as statistical significant.

Image1: Pink mucoid colony of klebsiella on MacConkey agar



Image2: Black colony of enterococci on potassium tellurite blood agar



Result: Table 1 shows frequency of bacterial contamination of hands and mobile phones in all the three groups. Out of all the study groups, group C shows highest bacterial contamination of hands (80%) and mobile phones (52%).

Table 1: Frequency of Bacterial contamination of hand and mobile phone in different groups of HCWs.

Groups	Bacterial contamination	
	Hand (%)	Mobile (%)
Group A (n=50)	18 (36%)	19 (38%)
Group B (n=50)	30 (60%)	25 (50%)
Group C (n=50)	40 (80%)	26 (52%)
X ²	20.01	2.3
dF	2	2
P	< 0.0001	0.316

Types of bacterial organism isolated were shown in Table 2. Present study shows that 52% of HCW's dominant hand and 40% of their mobiles phone had bacterial contaminations mostly with *S. epidermidis*. Contamination with other nosocomial species (*Staphylococcus aureus*, *Klebsiella pneumoniae*, *Enterococcus spp* etc.) was 16.65% in dominant hand and 13.97% in mobile phones.

Table 2: Types of bacterial organism isolated

Bacteria	Hands (%) (n=150)	Mobile (%) (n=150)
<i>Staphylococcus epidermidis</i>	78(52%)	60 (40%)
<i>Staphylococcus aureus</i>	5(3.33%)	10 (6.66%)
<i>Klebsiella</i>	2(1.33%)	3 (2%)
<i>E coli</i>	8(5.33%)	2(1.33%)
<i>Bacillus</i>	3(2%)	2(1.33%)
<i>Enterococci</i>	2(1.33%)	1(0.66%)
<i>Acinetobacter</i>	2(1.33%)	1(0.66%)
<i>Pseudomonas</i>	3(2%)	2(1.33%)

Table 3 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 85-90%. We also found that 50% isolated *Staphylococcus aureus* were methicillin resistant *Staphylococcus aureus* (MRSA) and Table 4 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 75–85%.

Table: 3- Sensitivity pattern of gram positive organisms (%)

Drug	<i>Staphylococcus epidermidis</i>	<i>Staphylococcus aureus</i>	<i>Enterococci</i>	<i>Bacillus</i>
Amoxicillin-Clavulanic acid	97	88.7	92.2	100
Co-trimoxazole	93.2	63.5	94.6	100
Cloxacillin	90.5	47.6	92.7	100
Cefalexin	94.7	83.4	94.7	100
Ciprofloxacin	96.8	96.8	98.5	100
Erythromycin	95.7	95.7	95.7	100
Tetracyclin	91.3	91.3	91.3	100
Vancomycin	100	100	100	100

Table: 4- Sensitivity pattern of gram negative organisms (%)

	<i>Klebsiella</i>	<i>E. coli</i>	<i>Acinetobacter</i>	<i>Pseudomonas</i>
Amoxicillin-Clavulanic acid	72.6	70.5	62.3	45.2
Co-trimoxazole	55.3	53.6	35.8	33.5
Cefalexin	65.4	61.6	40.5	39.2
Ciprofloxacin	85.2	81.6	76.9	68.3
Erythromycin	76.8	72.4	32.5	30.2
Tetracyclin	69.6	67.1	56.3	45.2
Gentamycin	78.5	75.6	61.8	58.9
Amikacin	85.5	84.2	69.2	65.5

Discussion: The hospital environment plays a critical role in the transmission of microorganisms associated with hospital acquired infections. Microorganisms can be transferred from person to person or from inanimate objects (such as stethoscopes, bronchoscopes, pagers, ballpoint pens, patient hospital charts, computer keyboards, mobile phones and fixed telephones) to hand and vice versa.^{8, 9, 11, 16-18} In a study it was discovered that average cell phone is dirtier than either a toilet seat or the bottom of your shoe.¹⁹ A study showed 40% of mobile phones of 266 medical staff and students were culture positive.²⁰ Another study showed that 40% of HCW's dominant hands and 32% of their mobiles phones had bacterial contaminations mostly with *S.epidermidis*.²¹

In this study, 58.66% of hand samples and 46.66% of mobile phones from all the study groups were found to be contaminated by bacterial agents. The contamination of hands in group A, B and C were 36%, 60% and 80% respectively which shows statistically significant contamination in group C ($p<0.001$). This may be due to poor hygienic and sanitary practice associated with the low level of education in other health care personnel. The contamination of mobile phones in group A, B and C were 38%, 50% and 52% respectively which was not statistically significant ($p>0.05$). This may be due to lack of awareness of cleaning of mobile phones in all the groups. It also proves that although better hand hygiene in group A, due care was not taken in none of the group while using mobile phones.

Present study shows that most common organism isolated was *S. epidermidis* (40%). Although it is a normal skin flora 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.²² Other isolated organisms were *Staphylococcus aureus*, *Klebsiella pneumonia*, *Enterococcus spp* etc.

The kind of isolated microorganism from dominant hands correlated with the isolated ones from mobile phones in 78% 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 with open wounds, invasive devices and weakened immune systems are at greater risk of infection than the general public.

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 *Acinetobacter* 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.

Currently in India, there are no rules restricting medical staff to carry mobile phones into the sterile environment of the OT, ICU or CCU. A study showed that mobile or fixed phone use by anaesthetists working in the operation theatre demonstrated a 10% rate of contamination with human pathogenic bacteria and a high contamination rate with non-human pathogenic bacteria.¹² There are also no cleaning guidelines for mobile phones of HCWs. People tried many ways to clean and sterilize their mobile phones but the best way is ultrasonic cleaning by an ultrasonic cleaner which clean the mobile phones thoroughly and safely.²³

There are a number of reports of successful educational initiatives, such as mandatory hospital-wide training programs²⁴ that have been associated with methicillin resistant *Staphylococcus aureus* acquisition. Recently a system called HYGreen²⁵ has been developed that monitors HCWs' hand hygiene by detecting sanitizer or soap fumes given off from their hands.

Conclusion: 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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