Original Article

A study of microbial flora and MRSA harboured by mobile phones of health care personnel

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Abstract

Mobile phones are increasingly being used by health care workers in day today life. They come in contact with various surfaces while carrying out health care activities and are thus likely to get contaminated by variety of organisms. This study was carried out to know the microbial flora harboured by mobile phones of health care personnel and to know the antibiotic resistance patterns of pathogenic bacteria. Mobile phones of health care personnel were swabbed and inoculated on enriched and selective media, incubated for 24 hours and a variety of biochemical tests were carried out to know the bacterial and fungal species. Antibiotic sensitivity tests were done for pathogenic bacteria using K irby Bauer disc diffusion method. It was found that out of 120 mobile phones of health care personnel, 99(82.5%) were contaminated, while 85(70.8%) harbored pathogenic bacteria. Out of 120 mobile phones; 65(54.16%) harbored S. aureus, 25(20.83%) Micrococci, 9(7.5%) Diphtheroids, 5(4.1%) Enterococci, 4(3.3%) each] Pseudomonas, Citrobacter and Bacillus,2(1.6%) each Acinetobacter, Enterobacter and Streptococcus viridians. S. aureus was resistant to methicillin, amoxicillin, augmentin, erythromycin and lincomycin.11/65 (16.9%) Methicillin Resistant Staphylococcus Aureus were isolated from health care providers. Fungi isolated were Candida 8(6.66%), Aspegillus 6(5%), Mucor 1(0.8%) and Trichophyton 1(0.8%).

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Received Date: 08/02/2015 Revised Date: 24/12/2015 Accepted Date: 20/10/2016

Access this article online	
Quick Response Code:	Website: www.medpulse.in
	DOI:

INTRODUCTION

India hits 261 million mobile users at the end of March 2008 ranking it second in terms of mobile market behind China. Increasing technological applications have led to increased use of these devices to provide better communication. This increased use of mobile phones is seen against a background rise in nosocomial infection. The HOSPITAL INFECTION SOCIETY, INDIA states that 10 to 30% of patients admitted to hospitals and nursing homes in India, acquire nosocomial infections as against an impressive 5% in the west. 28% of nosocomial infections are urinary tract infections, 19% surgical site infections, 17% pneumonia and 7-16% blood stream infections. Due to increased antibiotic resistance and host susceptibility, there is change in bacterial and fungal spectrum in hospital environment. Various antibiotic resistant bacteria like methicillin resistant Staphylococcus aureus (MRSA), vancomycin resistant enterococci (VRE) and multi drug resistant tuberculosis (MDRTB) have developed in hospital settings. An article in DAILY MAIL, UK stated that 'Mobile phones harbor more micro-organisms than toilet seat'.[1] The warm environment surrounding mobile phones coupled with its constant handling creates a prime breeding ground for growth of microorganisms. Hence they are rightly called as 'technological Petri-dish for thousands of worms' Mobile phones are often touched during activities related to health care like- examining the patients, providing nursing care, processing the samples, etc. Hence mobile phones are likely to get contaminated by various micro-organisms, some of which could very well be pathogenic in nature. Despite being used on a continuous basis, these mobile phones are seldom cleaned. They can also act as fomites for transmission of pathogenic organisms like Staphylococcus aureus,

Escherichia coli, Pseudomonas, Acinetobacter, Candida, etc. Screening of mobile phones have been carried out in several studies.[2, 3, 4, 5] Most of the studies have shown bacterial contamination of mobile phones of health care personnel. Paucity of such studies from hospitals in Navi Mumbai made us carry out this study. Brady et al in January 2006 came up with the first study ever, addressing the incidence of bacterial contamination of mobile phones. 96.2% of phones demonstrated evidence of bacterial contamination, and 14.3% of mobile phones sampled, grew bacteria that are known to cause nosocomial infections. Usha et al from Coimbatore, India reported that 91.6% mobile phones were found contaminated and that the efficacy of decontamination of mobile phones with 70% isopropyl alcohol was 98%.Several other studies across the globe have shown high contamination rates of mobile phones with many of the isolated bacteria known to cause nosocomial infections.[4,5,6]

AIM

The study was carried out with an aim to screen the mobile phones of health care personnel for various bacteria and fungi, identify the likely pathogens with special reference to MRSA and to determine the antimicrobial susceptibility patterns of the bacterial isolates. The cross sectional study was carried out by sampling the mobile phones of 120 health care personnel categorized into doctors (n=30), nurses(n=30), technicians(n=30) and ward boys (n=30). After getting ethical approval from the institute and informed consent of the health care workers, sterile swabs moistened with sterile saline were used to swab various surfaces of the mobile phones. The swabs were placed in sterile containers and transported to the microbiology laboratory as soon as possible (with a maximum delay of 1 hour).

Swabs were plated onto following media:

1. enriched medium – blood agar ,
2. selective medium – mac conkey's agar ,
3. selective medium – Sabaraud's dextrose agar.

The plates were incubated at 37^0 C overnight for bacterial growth. Sabaraud's dextrose agar was incubated at room temperature and observed for fungal growth for up to 10 days. Identification of various bacterial and fungal isolates was carried out as per standard procedures.[7] Fig 1 shows the scheme used for identification of bacterial isolates. The important pathogens were studied further for their antimicrobial susceptibility testpatterns (AST patterns) by the method of Kirby Bauer disc diffusion. The antibiotics studied were Amoxycillin (AN), Augmentin (AU), Cefotaxime (CX), Ceftriaxone (CA), Cefuroxime (CO),Ciprofloxacin (CP),Clindamycin (CY), Erythromycin (ER), Gentamicin (G), Lincomycin (L), Ofloxacin (OF), Tobramycin (TO), Amikacin (AM), Cefoperazone (CF), Lomefloxacin (LO), Kanamycin (NT), Pefloxacin (PF). In addition, oxacillin discs were used to look for methicillin resistance among the S.aureus isolates.

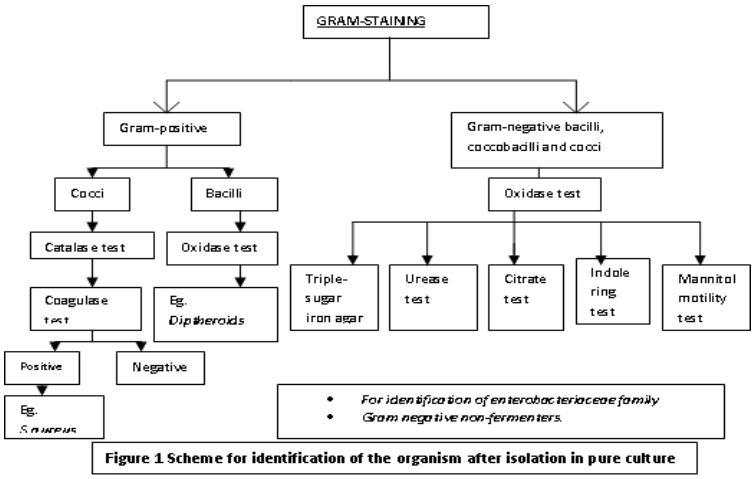

Figure 1 Scheme for identification of the organism after isolation in pure culture

OBSERVATION AND RESULTS

Out of the 120 mobile phones of health care personnel screened, 99 (82.5%) mobile phones showed bacterial or/and fungal contamination. Isolation of micro-organisms was maximum in the case of laboratory technicians (90%), followed by ward-boys (86.66%) and nurses (80%), while it was the least among doctors (73.33%). (Table 1)

Table 1: Various categories of health care personnel and the number of mobile phones yielding microbes.

Health care personn	Number of mobile phones contaminat with microbes
DOCTORS	22/30 (73.33%)
TECHNICIANS	27/30 (90%)
NURSES	24/30 (80%)
WARD-BOYS	26/30 (86.66%)
TOTAL	99/120 (82.5%)

Table 2: Shows number of contaminants harbored on mobile phones

	DOCTOF (n=30)		TECHNICIAI (n=30)		WARD-BC (n=30)		NURSES (n=30)	
Only 1 bacteri	1	43.3	1(	53.33	1	53.3	18	60
More than 1 bacteria	5	16.6	6	20%	4	13.3	5	16.6
Only fungi	2	6.6(	0	0%	1	3.3:	0	0%
Bacteria and fur	2	6.6(	5	16.66	5	16.6	3	10

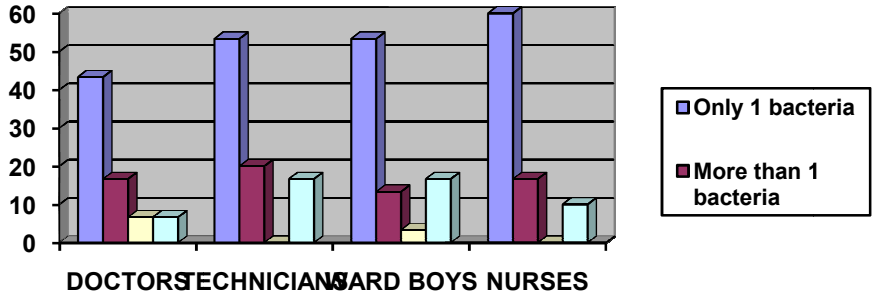

Figure 1: Graph showing contaminants harboring on mobile phones

Bacteria were isolated to a much greater extent (97/120) i.e. 80.8% of the mobile phones as compared to fungi (16/120) 13.3%. In total 99/120 (82.5%) mobile phones demonstrated evidence of bacterial contamination and 85/120 (70.8%) mobiles sampled grew bacteria that are established nosocomial pathogens like Staphylococcus aureus, Enterococci, Pseudomonas, Citrobacter, Escherichia coli Acinetobacter and Enterobacter.

Table 3. Number and type of bacterial agent isolated in mobile hones of the study.

	DOCTOR (n=30)		TECHNICIAI (n=30)		WARD-BOY (n=30)		NURSES (n=30)		TOTAL (n=120)	
S.aureus	12	40%	17	56.66%	18	60%	18	60%	65	54.16%
Micrococci	6	2%	9	3%	4	13.33%	6	2%	25	20.83%
Diptheroids	0	0%	3	1%	3	1%	3	1%	9	7.55
Enterococci	3	1%	0	0%	2	0.6%	0	0%	5	4.1%
Pseudomonas	2	0.6%	1	0.3%	1	0.3%	0	0%	4	3.33%
Citrobacter	1	0.3%	3	1%	0	0%	0	0%	4	3.33%
Bacillus species	0	0%	0	0%	3	1%	1	0.3%	4	3.33%
E.coli	0	0%	0	0%	3	1%	0	0%	3	2.5%
Acinetobacter	1	0.3%	0	0%	0	0%	1	0.3%	2	1.6%
Enterobacter	0	0%	0	0%	0	0%	2	0.6%	2	1.6%
Streptococci	0	0%	0	0%	0	0%	2	0.6%	2	1.6%

The isolation of Staphylococcus aureus was maximum in all the categories of health care workers (54.16%), followed by Micrococci(20.83%), Diptheroids (7.5%), Enterococci (4.1%), Pseudomonas, Citrobacter, Bacillus (3.3%each), Acinetobacter, Enterobacter and Streptococcus viridans (1.6%each)

Table 4. Shows antibiotic resistance patterns of Staphylococcus aureus from different sources.

	AN	AU	CX	CA	CO	CP	CY	ER	G	L	OF	TO	sensitive	resistant
doctors	4	3	0	0	0	0	1	1	1	2	1	1	7	5 (41.6%)
technicians	2	1	1	1	0	0	0	1	0	4	0	0	9	8 (47%)
ward boys	1	3	0	0	0	0	2	3	0	1	1	0	5	13 (72%)
nurses	1	3	0	0	0	0	0	1	0	0	0	0	12	6 (50%)

Table 5: Shows % isolation of MRSA from mobile phones of different health care personne

	methicillin resistant	methicillin sensitive	% MRSA
Doctors	2	3	2/12(16.66%)
Technicians	3	2	3/17(17.64%)
Ward boys	4	-	4/18(22.22%)
Nurses	2	4	2/18(11.11%)
Total	11	9	11/65(16.92%)

Antibiotic sensitivity test was done for various pathogenic bacteria like Staphylococcus aureus, Escherichia coli, Pseudomonas. AST pattern of S.aureus isolate shows maximum resistance to Methicillin, Amoxicillin, Augmentin, Erythromycin and Lincomycin. Gram negative micro-organisms were mostly sensitive to most of the antibiotics except E.coli which was resistant to Augmentin, Ciprofloxacin, Ceftazidime and Lomefloxacin. Pseudomonas was also sensitive to all antibiotics.The fungi isolated from the mobile phones mainly comprised of Candida species and Aspergillus species only from 1 mobile each and Trichophyton were isolated.

Table 8: Number and type of fungal agents isolated in the stud

	doctors	(n=30) technicians	(n=30) ward-boys	(n=30) nurses	(n=30) total
Candida species	2	3	3	0	8 (6.66%)
Aspergillus	1	1	2	2	6 (5%)
Mucor	0	1	0	0	1 (0.8%)
Trichophyton	0	0	0	1	1 (0.8%)

DISCUSSION

Since 1980's , infectious disease specialists have recognized that intensive care unit patients acquire nosocomial infections at a much higher rate than patients elsewhere in the hospital.[9] Strict attention is paid to changing clothes, removing jewellery, covering hair and undertaking hand hygiene measures to reduce the transfer of potentially harmful bacteria.[5] However, local policy places no restriction on the use of mobile phones in clinically sensitive areas.[10] Mobile phones have become indispensable accessories of professional and social life. Hence the use often occurs in the hospital setting as well. Very few studies have been carried out to understand the role played by mobile phones in spreading bacteria especially nosocomial pathogens. No studies have described the carriage of fungi. Thus, our study tries to define the role played by mobile phones of health care personnel in the carriage of bacteria and fungi. The isolation of bacteria in this study was less (82.5%) compared to that of Brady et al (95.7%), Usha et al (91.6%) and Kara bay et al (90.98%).[2,3,6] However isolation of nosocomial pathogens was found to a greater extent (70.8%) as compared to the findings of Brady et al (11.5%), and Kara bay et al (9%). In the present study, Staphylococcus aureus was the main organism isolated (54.16%) while Pseudomonas and other Gram negative bacteria like Escherichia coli, Acinetobacter and Enterobacter were isolated in very few cases. 16.9% isolates of Staphylococcus aureus were resistant to methicillin (MRSA).In contrast to this, studies of Brady et al and Kara bay et al showed higher isolation of coagulase negative staphylococci and no isolation of Staphylococcus aureus. This is a significant observation and could reflect the differences in carrier states of health care personnel for Staphylococcus aureus in different countries. The isolation of yeasts and Aspergillus, though to a lesser extent, nevertheless reiterate that they too can be transmitted via mobile phones. The fact that several isolates are potential pathogens and demonstrated resistance to several antibiotics highlights the need for even more stringent measures to be followed in the hospitals to prevent the spread of such bacterial strains.

CONCLUSION

The isolation of bacterial flora was seen to a greater extent among the laboratory technicians and the ward boys as compared to the nurses and the doctors. This brings forth the importance of educating these health care personnel

regarding the spread of harmful pathogens via mobile phones. As mobile phones have become indispensable devices today, restrictions on their use is not a practical solution. Increasing the levels of awareness among the health care personnel would lead to better adherence to hand washing as well as regular decontamination of the mobile phones.

SUMMARY

Mobile phones are increasingly being used by health care workers in day today life.They come in contact with various surfaces while carrying out health care activities and are thus likely to get contaminated by variety of organisms. This study was carried out to know the microbiologicalflora on mobile phones of health care personnel and also to know the antibiotic resistance patterns of pathogenic bacteria. Mobile phones of health care personnel were swabbed and inoculated on enriched and selective media, incubated for 24 hours and a variety of biochemical tests were carried out to know the bacterial or fungal species. Antibiotic sensitivity tests were done for pathogenic bacteria using Kirby Bauer disc-diffusion method. It was found that out of 120 mobile phones of health care personnel, 99(82.5%) were contaminated, while 85(70.8%) harbored pathogenic bacteria.Out of 120 mobile phones; 65 (54.16%) harbored S. aureus, 25 (20.83%) Micrococci, 9(7.5%) Diptheroids, 5(4.1%)Enterococci, 4 (3.3%)each Pseudomonas, Citrobacter and Bacillus, 2(1.6%)each Acinetobacter, Enterobacter and Streptococcus viridans. S. aureus was resistant to methicillin, amoxycillin, augmentin, erythromycin and lincomycin.11/65 (16.9%) Methicillin Resistant Staphylococcus aureus were isolated from health care providers. Fungi isolated were Candida 8 (6.66%), Aspergillus 6 (5%), Mucor 1(0.8%) and Trichophyton 1(0.8%) . We conclude that mobile phones can act asimportant fomites for transmission of nosocomial infections as severe as MRSA.Transmission of such infections via mobile phones can be curbed to a great extent bylimiting their use in the ICU's and other critical care areas as well as washing hands thoroughly before examining patients. We also opine that mobile phonesshould be regularly decontaminated by health care personnel

REFERENCES

1. Fiona McRae. 'Wash your hands caller, your mobile is dirtier than you think',
2. Science Reporter, DAILY MAIL. 2006, 2nd August.
3. Brady RR, Wasson A, Sterling I , McAllister C, Damani NN , :Is your phone bugged? The incidence of bacteria known to cause nosocomial infection on health care workers' mobile phones J Hosp Infect 62:123-125.2006
4. Usha S, Jayalakshmi J, Appalaraju B. 'Cell phones as reservoir of nosocomial pathogens'. Abstract no: OA -10, IX – National Conference of Hospital Society of India, Chandigarh, India.2007, 16th February.
5. Ulger F, Esen S, Dilek A, Leblebicioglu H et al. 'are your mobile phones clean?' European congress of Clinical microbiology and Infectious Diseases, Munich, Germany. Abstract no: 1733_269. 2007, 31stMarch.
6. Brady RR, Fraser SF, Dunlop MG, Gibb AP, 'Bacterial contamination of mobile communication devices in the operative environment' J Hosp Infect 66: 397-398.2007, August.
7. Karabay O, Kocoglu E, Tahtaci M, 'The role of mobile phones in the spread of bacteria associated with nosocomial infections' J Infect Developing Countries 1:72-73.2007,14th June.
8. Collee JG, Marmion BP, Fraser AG, Simmons Anthony. Mackie and McCartney practical Medical Microbiology, 14thed. ChurchillLivingstone: UK; 1996.
9. Mulligan ME, Standiford HC, Kauffman CA, 'Methicillin resistant Staphylococcus aureus: a consensus review of the microbiology, pathogenesis, and epidemiology with implications for prevention and management' Am J Med 94:313-328.1992,8th September.
10. Donowitz IG, Wenzel RP, Hoyt JW, 'High risk of hospital –acquired infection in the ICU patient Crit Care Med 10:355-357.1982
11. Medical devices Committee: Mobile telephone policy. NHS Lothian University Hospitals Divisions LOH.CTOP.29:1, 2004, May.