Original Article

Microbial Profile of Mobile Phones of Health Care Workers in A Tertiary Care Hospital

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ABSTRACT

Objective: Mobile phones are increasingly recognized as potential vectors for hospital-acquired infections (HAIs) due to their frequent use and close contact with hands, faces, and various surfaces. Hence the present study is to evaluate the role of mobile phones in relation to transmission of bacteria from mobile phone to health care workers and their pathogenicity.

Materials and Methods: This is a cross-sectional prospective study, done on 100 healthcare workers mobile phones for a period of one year. The study was conducted in the Department of Microbiology, Dr. Patnam Mahender Reddy Institute of Medical Sciences, Chevella, Telangana. After swabbing, they were placed in the BHI broth. Then they were taken to the microbiology laboratory immediately and incubated at 37°C for 24-48 hrs. Positive samples will be further subcultured on different growth media and standard biochemical tests were used for the confirmation of bacterial pathogens. Disc diffusion method was used to determine the antibiotic susceptibility pattern of pathogens. Ampc and ESBL producers were identified by phenotypic methods.

Results: The study found the bacterial contamination level 38%. The most common microorganism isolated was *Staphylococcus aureus* 13 (34.2%), followed by Coagulase Negative Staphylococcus (CoNS) 11 (28.9%), *Pseudomonas aeruginosa* 7(18.4%), *Escherichia coli* 4(10.5%), *Klebsiella pneumoniae* 2(5.26%) and *Acinetobacter baumanii* 1(2.6%). Most of the organisms were resistant to penicillin, amoxycillin-clavulanate, ceftazidime. Among the 13 strains of GNB isolated, 5 strains were Ampc producers (2 *E.coli*, 2 *Pseudomonas aeruginosa* and 1 *Klebsiella pneumoniae*), 2 were ESBL producers (*E.coli*) and one strain of *Klebsiella pneumoniae* was both Ampc and ESBL producer.

Conclusion: The study recommended that there should be some rules and regulations strictly followed in restricting the usage of mobile phones atleast in the critical care and hand hygiene should be strictly followed by the all HCWs which may reduce the frequency the HAIs.

Keywords: HAI, Mobile phones, Bacteria, Antibiotics, AmpC, ESBL.

INTRODUCTION

Now-a-days smart phones are one of the most important gadgets that every human being will carry and can be seen everywhere in the Clinical and Non clinical settings. They have been implicated as a source of bacterial contamination. Mobile phones are increasingly recognized as potential vectors for hospital-acquired infections (HAIs) due to their frequent use and close contact with hands, faces, and various surfaces[1]. Mobile phones are handled frequently by healthcare workers, patients, and visitors, often without proper hand hygiene.

Phones are exposed to various hospital environments, including patient rooms, operating theaters, and common areas, which can harbor pathogens. Unlike medical equipment, mobile phones are rarely cleaned or disinfected regularly. There are no restrictions on the usage of mobile phones by the health-care workers and no guidelines are formulated till yet[2]. Contaminated phones can contribute to the spread of HAIs, including infections that are difficult to treat due to antibiotic resistance. Phones can facilitate the transfer of pathogens between different areas of the hospital, increasing the risk of cross-contamination.

Drug resistant pathogens such as *Methicillin resistant Staphylococcus aureus* (MRSA), Gram negative bacteria like *E.coli*, *Pseudomonas aeruginosa*, *Clostridium difficile*, and Vancomycin resistant Enterococci, Streptococcus species etc. are raising important safety corners over the use of such devices in clinical areas[3]. A number of studies have consistently reported that 5-21% of persons who are working in hospitals, their mobile phones acts as the reservoir for bacteria that cause nosocomial infections. *Acinetobacter baumannii* a commonly acquired nosocomial pathogen because of its tendency to survive in hospital environment and highly contaminate fomites[4-5].

The preventive measures include regular and thorough hand washing or use of alcohol-based hand sanitizers before and after handling mobile phones, routine cleaning and disinfection of mobile phones using appropriate disinfectant wipes, implementation of hospital policies that address the use and cleaning of mobile phones, including guidelines for healthcare workers and educating healthcare workers, patients, and visitors about the risks associated with mobile phone contamination and the importance of hygiene practices. The aim of the present study is to evaluate the role of mobile phones in relation to transmission of bacteria from mobile phone to health care workers and their pathogenicity.

MATERIALS AND METHODS

Study design: This is a cross-sectional prospective study, done on 100 healthcare workers mobile phones.

Study place: The study was conducted in the Department of Microbiology, Dr. Patnam Mahender Reddy Institute of Medical Sciences, Chevella, Telangana.

Study period: The samples were collected during the period of March 2023 to March 2024.

Sample size: The study sample size was 100 mobile phones swabs.

Informed consent: The study was conducted after taking the informed consent from all the participants

Ethics clearance: The study was conducted after obtaining the Ethics clearance from the Institute.

Inclusion Criteria: Health Care Workers present on the days of data collection.

Exclusion Criteria: Nil

METHODS

In total, 100 mobile phones were sampled. The sides of the mobile, screen and back of mobile phone were swabbed using a sterile cotton swab. The swabs were collected from the healthcare workers mobile phones working in Casualty, OTs, EMD, Central lab, wards etc. After swabbing, they were placed in the BHI broth. Then they were taken to the microbiology laboratory immediately and incubated at 37° C for 24-48 hrs. Positive samples will be further sub cultured on different growth media like Blood agar and MacConkey agar. The microorganisms were identified based on Gram's staining and Biochemical tests like Catalase, Coagulase, Bile esculin hydrolysis test for Gram-positive organisms and Indole, Citrate utilization, urease test, Triple sugar iron agar test for Gram-negative organisms.

Antimicrobial susceptibility test:

The antimicrobial susceptibility of isolated microorganisms was performed by using Kirby- Bauer disc diffusion method according to CLSI guidelines 2023 in a Mueller-Hinton agar plates. The antibiotic susceptibility pattern was examined by using commercially available antibiotic discs. The interpretation usually categorizes each result as susceptible (S), Intermediate sensitive (I) and Resistant (R). Based on the sensitivity pattern, the AMR i.e. MDR towards the antibiotics will be identified.

Detection of Ampc producers:

The Ampc production was detected by measuring the zone of inhibition surrounding cefoxitin (cx) disc. If the inhibition zone was greater than 18mm it is considered as Ampc producer.

Detection of ESBL producers:

The ESBL production was tested with the CLSI confirmatory test using Ceftazidime (CAZ) (30 µg) disc and with CAZ- Clavulanic acid (CA) (10 µg) combination. After incubating the plate, the production of ESBL was confirmed by increase in the growth-inhibitory zone around the CAZ disc with CA was 5 mm or greater of the diameter around the disk containing CAZ alone.

RESULTS

Out of 100 samples collected from HCWs mobile phones, 54 were females and 46 were males. The mean age group of the study was 38±4.9. The participants included 20 Surgeons, 7 Anaesthesiologists, 19 technicians, 10 OT nurses, 5 operating room assistants, 6 microbiologists, 5 pathologists, 10 dentists and 18 ward nurses. The general reason for using the mobiles during the work period was answering calls and to gather the information related to their profession, research articles, case reports and their outcome, any surgical interventions and skills by 75% of the HCWs browsing the net for professional information. Nearly 10% of the staff using their mobile phones for taking the images during any procedures and the rest of the 15% HCWs use for their personal purpose. Out of the 100 health care workers, 17% were disinfecting their mobile phones with alcohol based disinfectant once in a day. 24% were disinfecting their mobile phones once in a week and only 7% HCWs disinfecting their mobile phones once in a month and the rest of the 52% were not at all disinfecting their phones. Out of 100 samples tested, 38% samples tested positive for microbial growth and 62% were sterile. The most common microorganism isolated was *Staphylococcus aureus* 13 (34.2%), followed by Coagulase Negative Staphylococcus (CoNS) 11 (28.9%), *Pseudomonas aeruginosa* 7(18.4%), *Escherichia coli* 4(10.5%), *Klebsiella pneumoniae* 2(5.26%) and *Acinetobacter baumanii* 1(2.6%). Most of the strains of *S.aureus* were resistant to penicillin 92.3% followed by Amoxyclav 77%. Most of the CONS were resistant to penicillin 81.8%. Most of the *P.aeruginosa* strains were resistant to ceftazidime 71.4% followed by cefotaxime and Amoxyclav 42.8%. Most of the E.coli strains were resistant to ceftazidime 75%. *A.baumanii* strains were resistant mostly to Co-trimoxozole, AMC and CAZ 100%. 100% resistance to AMC was showed by 2 strains of *K.pneumoniae* (Table 1). Out of 13 strains of *Staphylococcus aureus*, we isolated 2 strains of MRSA. Among the 13 strains of GNB, 5 strains were Ampc producers (2 *E.coli*, 2 *Pseudomonas aeruginosa* and 1 *Klebsiella pneumoniae*), 2 were ESBL producers (*E.coli*) and one strain of *Klebsiella pneumoniae* was both Ampc and ESBL producer.

DISCUSSION

Mobile phones have been used indiscriminately in any health care sector which act as one of the reservoir source for some part of the hospital acquired infections. After swabbing the mobile phones from the HCWs in our hospital, we found the bacterial contamination level 38%. This prevalence rate is somewhat lesser when compared to the studies done by the previous researchers Jayalaxmi et al.[6] showed the bacterial mobile phone contamination level of 91.6% whereas Rawia Ibrahim et al. [7] also reported

the highest prevalence 93.7% and Ulger et al. showed 94.5%[8]. Usha et al. in 2009 showed the prevalence of 40% similar to the findings of the present study[9]. The most common microorganism isolated was *Staphylococcus aureus* 13 (34.2%), followed by Coagulase Negative Staphylococcus (CoNS) 11 (28.9%), *Pseudomonas aeruginosa* 7(18.4%), *Escherichia coli* 4(10.5%), *Klebsiella pneumoniae* 2(5.26%) and *Acinetobacter baumanii* 1(2.6%). Similar findings were reported by Ulger et al.[8] and Datta et al. [10] who reported the major isolate of mobile phone contamination was S.aureus followed by CONS and

P.aeruginosa and they concluded that the contamination of mobile phones being was due to keeping the phones in the pockets (warmth) and heat created by vibrations of mobiles which favors the growth of these pathogens. Additionally, these are sturdy organisms able to survive desiccation. Sufia in 2018[11] in their study found that *Staphylococcus aureus*, 44 (37.6%) was the most common isolate followed by Coagulase Negative Staphylococcus, *Pseudomonas aeruginosa*, 14 each (12%) and Acinetobacter species 6(5.1%) and these findings coincide to the results of the present study.

Table 1: Antibiotic resistance pattern of isolated microorganisms

Antibiotics	*Staphylococcu saureus* (13)	CONS(11)	*Pseudomonas aeruginosa (7)*	E.coli (4)	*Acinetobacter spp (01)*	*Klebsiella spp(02)*
Penicillin	12(92.3%)	9(81.8%)	-	-	-	-
Tetracycline	1(7.7%)	2(18.18%)	-	-	-	-
Clindamycin	4(30.76%)	0(0%)	-	-	-	-
Cefoxitin	0(0%)	0 (0%)	2(28.57%)	2 (50%)	0 (0%)	1 (50%)
Linezolide	0 (0%)	0 (0%)	-	-	-	-
Vancomycin	0(0%)	0 (0%)	-	-	-	-
Ciprofloxacin	2(15.3%)	1 (9.1%)	-	-	-	-
Gentamicin	0 (0%)	0 (0%)	-	-	-	-
Co-trimoxozole	4(30.6%)	1 (9.1%)	1(14.28%)	1	1(100%)	1(50%)
Piperacillin+TazoBactum	-	-	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Meropenem	-	-	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Amoxyclav	10(77%)	2 (18.2%)	3(42.8%)	2(50%)	1(100%)	2 (100%)
Amikacin	-	-	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Cefotaxime	-	-	3(42.8%)	2 (50%)	0 (0%)	2(100%
CZA+CA	-	-	0 (0%)	0 (0%)	0 (0%)	1(50%)
Cefepime	-	-	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Ceftazidime	-	-	5(71.4%)	3 (75%)	1 (100%)	2(50%)

Most of the strains of S.aureus were resistant to penicillin 92.3% followed by Amoxyclav 77%. Most of the CONS were resistant to penicillin 81.8%. Most of the *P.aeruginosa* strains were resistant to ceftazidime 71.4% followed by cefotaxime and Amoxyclav 42.8%. Most of *the E.coli* strains were resistant to ceftazidime 75%. A.baumanii strains were resistant mostly to Co-trimoxozole, AMC and CAZ 100%. 100% resistance to AMC was showed by 2 strains *of K.pneumoniae*. Sufia et al. (2011) reported most of the isolated strains of S.aureus, CONS, *P.aeruginosa, Acineobacter spp*. and *K. pneumoniae* showed resistant to commonly available antibiotics like Co-Trimoxazole, Ampicillin, and Amoxyclav which coincides to the findings of the present study. However, in the present study most of the Gram-positive organisms were resistant to penicillin. Rajput et al. (2021) in their research isolated Staphylococcus aureus (MRSA) 62 (50%) was the most predominant isolates followed by *Staphylococcus aureus* 33(26.61%), *Pseudomonas spps* 11(8.87%), *Klebsiella pneumonia* 9(7.25%), E.Coli 6(4.83%), *Acinetobacter calcoaceticus* baumani complex 2(1.61%), *Klebsiella peumoniae* (ESBL) 1 (0.80%). However, in our study the

prevalence of MRSA is quite lesser compared to Rajput et al. study we isolated 2 strains of MRSA. The predominance of the other organisms was quite similar to the present study. Among the 13 strains of GNB, 5 strains were Ampc producers (2 *E.coli*, 2 *Pseudomonas aeruginosa* and 1 *Klebsiella pneumoniae*), 2 were ESBL producers (*E.coli*) and one strain of *Klebsiella pneumoniae* was both Ampc and ESBL producer whereas Sufia et al.[11] reported MRSA 16% MRSA, and ESBL and MBL were not noted.

CONCLUSION

From the present study it was concluded that, mobile phones of HCWs were contaminated with potential bacterial pathogens which may contribute to HAI rate in the hospital. Staphylococcus aureus and CONS were the major isolates of the present study though the overall contamination level is somewhat less in your institute 38%, but the study recommended that there should be some rules and regulations strictly followed in restricting the usage of mobile phones atleast in the critical care and hand hygiene should be strictly followed by the all HCWs which may reduce the frequency the HAIs.

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