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Original Research Article

Study of microbial contamination of mobile phones of healthcare workers (HCWs)

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ABSTRACT

Introduction : In order to provide an enhanced communication network, the worldwide infrastructure for mobile phones and telecommunication was developed in 1982 in Europe. In the modern-day scenario, Asia has the fastest growing number of mobile phone subscribers in the world. Around 75% of the world's adults have the access to mobile phones. Mobile phones may act as fomites and may facilitate the transmission of microorganisms from one patient to another in the hospital during their treatments. These mobile phones are now described as technical Petri dishes where they could play a role in health-related infections as they spread through the hands of healthcare staff.

Aim : To determine the microbial contamination from mobile phones of healthcare workers (HCWs).

Objectives : To study the microbial contamination of mobile phones used by healthcare workers, Identify the isolated organism.

Materials and Methods: All specimens were processed for gram staining, Culture was done for those samples which were showing gram positive or gram-negative organisms on gram stain on different culture plates (Nutrient agar, Blood agar, MacConkey agar). Plates were incubated for 24 hours at 37⁰ C, after 24 hours of incubation the culture plates were examined for growth.

Result : We had swabbed the 134 mobile phones of health care workers, working in critical areas out of 134 mobile phones, 132 showed the growth of the bacterial pathogen in a significant amount and 2 were negative, so the overall contamination of the mobile phones was found to be 98.50% and no growth was found to be 1.49%.

Conclusion : The most predominant bacteria were *Staphylococcus aureus* MRSA in our study. It may be due to MRSA residue in the nose, when it comes to our hand then individuals get exposed to cross infection. The dominance of clinical phones that could be contaminated by different microorganisms inside the ICUs and OTs has become unacceptable. there are no rules and regulation for staff to carry their phone in sterile area like OTs, ICUs. Study showed there is no cleaning guidelines for the mobile of health care workers.

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1. Introduction

In order to provide an enhanced communication network, the worldwide infrastructure for mobile phones and telecommunication was developed in 1982 in Europe. In the modern-day scenario, Asia has the fastest growing number of mobile phone subscribers in the world. Around 75% of the world's adults have the access to mobile phones.¹

Mobile phones may act as fomites and may facilitate the transmission of microorganisms from one patient to another in the hospital during their treatments.

These mobile phones are now described as technical Petri dishes where they could play a role in health-related infections as they spread through the hands of healthcare staff.²

The human skin most frequently remains in the contact with the microorganisms and thus quickly infected by certain microbes. The human skin wrapped about 2m with

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the supporting surface area approximate 10^{12} bacterial count per person through a single mobile phone call, the mobile phone comes in direct interaction with certain areas of Infected human body, such parts are ear, hand, mouth, and nose which may result in settlement by possible pathogens which are present on human skin and mobile phones.³

Mobile phone contamination can occur through several sources such as handbags, pockets, food, human skin, bags, and other environmental practices. As the previous literature suggests that mobile phones were found to keep a large number of microorganisms because some bacteria grow at elevated temperatures and phones are breeding place for these microorganisms as they are kept safe and secure in our handbags and pockets.¹

The infected hands of healthcare workers (HCWs) play a crucial role in the spread of the disease in the health care premises (HCPs).

The continuous use of mobile phones by health care workers makes it an available place for microorganism's transmission activity as well as for hospital acquired infections.

2. Ethics approval

Ethics approval was obtained from TMMC Moradabad institutional Ethics Committee (TMMC-IEC) Ref. No. TMMC & RC /IEC/18-19/082r.

3. Material and Method

3.1. Sample collection

The samples were taken by swab stick from the mobile phones of health care workers working in critical areas-ICUs, Emergency & casualty and OTs.

The sample were then inoculate on nutrient agar, blood agar, macConkey agar plates. Plates were incubated for 24 hours at 37° c, after 24 hours of incubation the culture plates were examined for growth, gram staining, colony characteristics & biochemicals.

3.2. Conventional tests for identification of bacteria

Organisms grown were identified by their –

A- Culture media

1- Nutrient agar.

2- Blood agar

3- MacConkey agar

B-Culture characteristics

C- Gram's staining of the isolated colonies.

D- Identification by enzymatic or rapid test & biochemical test.

4. Results

A total number of 134 samples was included, in this study mobile phones of healthcare workers from the various area's

ICUs, OTs & Emergency & Casualty were collected and examined.

Table 1: Shows total no of positive and no of negative sample (N=134)

Total sample	No. of positive sample	No. of negative sample
134	132	02

This table reveals that out of 134 mobile phones, 132 showed the growth of the bacterial pathogen in a significant amount and 2 were negative, so the overall contamination of the mobile phones was found to be 98.50% and no growth was found to be 1.49%.

Table 2: Shows types of colonies grown on the mobile phone of health care workers (N=134)

Total no of sample	No growth	Single/pure growth	Mixed type of growth
134	02	124	08

Table 3: Shows Different organism isolated from different Health care workers working in critical areas of hospital (N=124)

Bacteria isolated from health care workers	No of bacteria isolated
<i>Staphylococcus aureus</i> (MRSA)	62
<i>Staphylococcus aureus</i>	33
<i>Pseudomonas spp</i>	11
<i>Klebsiella pneumoniae</i>	9
<i>E.Coli</i>	6
<i>Acinetobacter calcoaceticus baumani complex</i>	2
<i>Klebsiella pneumoniae</i> (ESBL)	1

5. Discussion

Medical infection outbreak is a major emerging concern in many hospitals and health centres. Medical environment plays a critical role in the propagation of the hospital acquired infection related organisms. The microorganisms can be transmitted from one individual to another and mobile phones are the most extensively used devices and serve as a common mechanism for transporting microorganisms from mobile phones to hands.⁴ Health care workers (HCWs) mobile phones can serve as a source for the transmission of nosocomial infections from one patient to another in a health care facility.⁵ Mobile phones now are appropriate devices for health care staff to carry over illness from patient to patient.⁶

The aim of our research was to examine the contamination of mobile phones that are carried by health care workers serving in sensitive areas. Mobile phones are used without any restriction in the hospital which makes them a potential reservoir of bacterial pathogens. In our

Table 4: Shows distribution of organism isolated from different areas of hospital.(N=126)

Area of hospital	Total no of samples	Samples having growth	Samples having no growth	Percentage %
MICU	5	5	0	3.96%
ICCU	18	16	02	14.28%
SICU	13	13	0	10.31%
Emergency & casualty	48	48	0	38.09%
Neuro ICU	9	9	0	7.14%
Major OT	19	19	0	15.32%
Gynae OT	14	14	0	11.29%

study, the microbial contamination of phones used by health care workers in critical areas of the hospital was collected. We had swabbed the phones of 134 health workers in our hospital and 98.50 % of the bacterial infection was observed. Gashaw et al⁷ had described the bacterial contamination of mobile phones of healthcare workers as 98.3% which corresponded to our study. Similarly, studies conducted by Bhat ss et al,⁸ Rao SJP et al⁹ and Shakthivel GPC et al¹⁰ reports the nosocomial infections as 99 %, 92 % and 90 %. Which shows the slight difference between them and our study.

The study conducted by Arora U et al¹¹ and Elmanama A et al¹² had reported microbial contamination with different bacteria as 91.60% and 90.9%. which is less than our study (98.50%) thus the studies are concluded unsimilar to our study. Thus, these result implies that the microbial contamination of cell phones will serve as a pathogen source that can be rapidly spread through mobile phones to the hands of the health care worker and passed to the patient's body during the assessment of the patients. Whenever a phone call has been made the phone comes in close contact with the human hand. Later these bacteria can be spread to susceptible parts of the human body, such as the nose, throat, ear and eyes.¹³ Mobile phones in various ICUs, OTs, or hospitals can quickly transfer bacterial isolates.¹³

In our study *Staphylococcus aureus* (MRSA) 62 (50%) was the most predominant isolates followed by *Staphylococcus aureus* 33(26.61%), *Pseudomonas spp*s 11(8.87%), *Klebsiella pneumonia* 9(7.25%), *E.Coli* 6(4.83%), *Acinetobacter calcoaceticus baumani complex* 2(1.61%), *Klebsiella pneumoniae* (ESBL)1(0.80%).

A identical study was done out by Shahlol AMA et al¹⁴ 14 they found the most predominant bacterial isolates were Methicillin resistant *Staphylococcus aureus* 35 %, *Bacillus spp.* 33.5 %, *Staphylococcus. Albus* 22.85%, *Escherichia. Coli* 8.57 %.

Similarly, Subhedar V et al¹⁵ reported that 75(69.44%) were *Staphylococcus aureus* (MRSA 35.18%, MSSA 34.26%), 14.81 were *Staphylococcus epidemidis*, 28.70% *Moraxella sp*, 29.63% *Aerobic bacilli*, 1.85% *Micrococcus Sp*, *Acinetobacter sp* and *Pseudomonas ssp* and 9.92% *Klebsiella sp*. 43 of 108(39.8%).

6. Conclusion

The most predominant bacteria were *Staphylococcus aureus* MRSA in our study. It may be due to MRSA residue in the nose, when it comes to our hand then individuals get exposed to cross infection.

1. The dominance of clinical phones that could be contaminated by different microorganisms inside the ICUs and OTs has become unacceptable.
2. There is no rules and regulation for staff to carry their phone in sterile area like OTs, ICUs. Study showed there is no cleaning guidelines for the mobile of health care workers.
3. Active preventive measures and strategy should be followed
4. Measures to control the hospital acquired infection are -

6.1. Standard precautions

1. Hand hygiene practice
2. Personalprotective equipment's (PPE like gloves, mask, gown, face shields)
3. Injection safety
4. Environmental cleaning
5. Spillage cleaning
6. Medical equipment's-glucose meter and other care devices, endoscope and surgical instruments should be clean before and after use to patients.
7. Respiratory hygiene
8. Sharp handling- all sharps including needle should be handled with extreme care
9. Biomedical waste management
10. Isolation-
 - A. All patients having contagious diseases must be isolated.
 - B. Patients with multidrug resistance organisms and MRSA should be isolated and treated.
 - i. Strategy to prevent hospital acquired infection are Hand hygiene, environmental cleaning, screening and cohorting patient, antibiotic stewardship, surveillance, following guidelines, safely isolation.
 - ii. Regular training to the healthcare workers may reduce the risk of health care associated infection.

iii. Unnecessary use of mobile phones by the health care workers in working hours should be restricted.

iv. The infectious diseases executive committee within each medical facility might take action to set out strict guidelines for the use of mobile phones in healthcare services.

7. Conflicts of Interest

All contributing authors declare no conflicts of interest.

8. Source of Funding

None.

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