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MOBILE PHONES: A CONTEMPORARY ECOSYSTEM FOR BACTERIAL GROWTH- OUR EXPERIENCE FROM RURAL MAHARASHTRA

Medical Science

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ABSTRACT

Today, mobile phones have become an indispensable part of our life. They are usually stored in bags or our pockets and are handled frequently and held close to the face. Mobile phones can spread infectious diseases by its frequent contact with hands. Hands of health care workers have been known to be a potential source of infection. The combination of constant handling and the heat generated by them creates a prime breeding ground for all sorts of microorganisms which can be multi drug resistant and simple procedures of disinfection of mobile phones can prove to be very effective against its elimination. The aim of this study was to compare the carrying rate and growth of bacteria on mobile phones of health care workers from the clinical and non-clinical departments and test the effectiveness of disinfection by 70% isopropyl alcohol.

KEYWORDS

Mobile Phones, Microorganism, Health Care Workers, Nosocomial Infections

INTRODUCTION

Mobile phones are the most widely used gadgets today and have been integrated into our daily lives. Today, India has about 1.16 billion mobile phone users. (1) With advancement in technology, mobile phones have become a part and parcel of our daily life for the people of all disciplines including medicine. Phones are used to dispense laboratory and imaging results, patient data, photographic images, which are being used by physicians during bedside rounds, in order to engage clinicians, residents, and students. HCWs access pharmaceutical knowledge and literature by mobile phones, which facilitates learning and clinical performance. (2) Mobile phones can be highly loaded with tens of thousands of microbes living on each square inch area and represent an often-overlooked reservoir for several enteric diseases (3) Mobiles can be brought in ICU's, post-operative wards and operation theatres etc. by enabling vibratory mode. (4) However, they are rarely cleaned and are often touched during or after examination of patients and handling of specimens without proper hand washing. (5) Thus, unhygienic ways of handling mobile phones make them a leading reservoir of an array of pathogenic microorganisms which can prove fatal to the patients.(6) It can also be a potential hazard to the patient's family or to the doctor's family or to the doctor themselves.(7) They are also widely used in contaminated areas such as toilets, hospitals and kitchens, which are loaded with microorganisms and can transfer on the cell phone (8) and it becomes an exogenous source of nosocomial infection among hospitalized patients.

Also, scientists at the University of Arizona in the United States of America have found out that cell phones carry 10 times more bacteria than most toilet seats (9) and can be even dirtier than the bottom of your shoe!(10) This study was undertaken to analyse the carrying rate of bacteria on mobile phones of health care workers in clinical and nonclinical departments and effectiveness of disinfection by 70% Isopropyl alcohol.

MATERIALAND METHODS:

Study Design: Cross-Sectional Observational study

Sampling Method: Stratified Random Sampling Method

Inclusion Criteria: Study subject having touch screen mobile and willing to participate in the study after written informed consent.

Exclusion Criteria: Study subjects who do not have touch screen mobile phones and those who are not willing to participate.

METHODOLOGY

A total of 140 cell phones belonging to health care workers from both clinical and non-clinical departments of MIMSR medical college and hospital, Maharashtra were screened for bacterial isolates after written consent was taken from them. Sterile swabs soaked in sterile saline water were used for swabbing the mobile phones. This was followed by disinfection of cell phones with 70% isopropyl alcohol. After allowing it to dry for 10 minutes, repeat swabs were taken from the cell phones. These swabs were brought to the department of Microbiology immediately, where they were subjected to culture on blood agar and MacConkey agar. After incubation for about 24 hours at 37 degree Celsius, the growth obtained was identified on the basis of colony characters and morphology by gram staining and various biochemical tests following standard procedures(11).

OBSERVATIONS

A total of 140 mobile phones were swabbed and cultured.Out of total 140 mobile phones, growth was obtained from 88 (62.86%) mobile phones. *(Table 1)*

Table 1. Total Mobile phones Showing Positive & Negative Growth

Total Samples	Positive Growth	Negative Growth
140	88 (62.86%)	52 (37.14%)

Out of 70 mobile phones swabbed from each department (clinical and non-clinical) growth was obtained from 57 (81.42%) mobiles of clinical departments and 31(44.28%) mobiles from non-clinical departments. *(Table 2)*

Table 2: Mobile phones Showing Positive & Negative Growth in Clinical and Non-Clinical Departments

Department	Total Samples	Positive Growth	Negative Growth
Clinical	70	57 (81.42%)	13 (18.58%)
Non-Clinical	70	31 (44.28%)	39 (55.72%)

Overall isolation rate was more from clinical departments, i.e., 57 (64.78%) than non-clinical departments, i.e., 31(35.22%).

Coagulase Negative Staphylococcus (CoNS) was foundon 37 (42.05%) mobiles. It was most commonly found followed by ***Staphylococcus aureus***on34 (38.63%) mobiles and ***Pseudomonas aeruginosa***on 11 (12.50%) from both clinical and non-clinical departments.

Ecoli was found on 3 (3.40%) mobile phones of the doctors and residents of the Clinical Department. They regularly perform clinical work in the wards and Intensive Care Unit (ICU) of the hospital.

Micrococci were found on 3 (3.40%) mobile phones.

Table 3. Microorganisms Isolated from Mobile Phones

Isolates	Clinical	Non-Clinical	Total
Coagulase Negative Staphylococci (CoNS)	24(27.28%)	13 (14.77%)	37 (42.05%)
Staphylococcus aureus	20 (22.72%)	14 (15.91%)	34(38.63%)
Pseudomonas aeruginosa	8 (9.10%)	3(3.41%)	11(12.50%)
E. coli	3(3.41%)	-	3 (3.41%)

Micrococcus	2 (2.27%)	1 (1.13%)	3 (3.41%)
Total	57 (64.78%)	31(35.22%)	88 (100%)

All the above isolates obtained were more in percentage from the clinical departments, than the non-clinical departments.

The organisms that were isolated are tabulated in Table 3 and Fig 1.

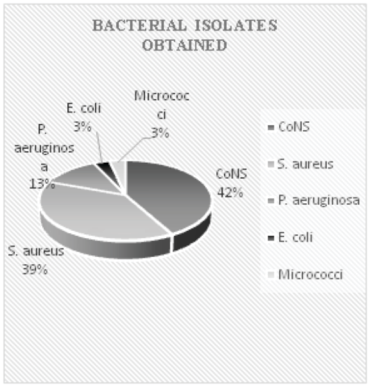


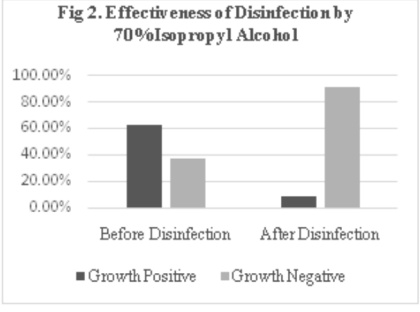
Fig 1: Total percentage of bacterial isolates obtained

After disinfection with 70% isopropyl alcohol only 12 (8.58%) mobile phones showed positive growth. There was a decrease in the bacterial carriage rate from62.86% to 8.58%.Thus, proving that the efficacy of disinfection is 91.42%. *(Table 4 and Fig 2)*

Table 4. Results after Disinfection of Mobile Phones

Mobile Phones	Growth Positive	Growth Negative	Total(n)
Before Disinfection	88 (62.86 %)	52 (37.14 %)	140
After Disinfection	12 (8.58 %)	128 (91.42%)	140

with 70 % Isopropyl Alcohol



DISCUSSION

Due to increase of mobile phones at affordable prices, they have become universally accepted accessories. The heat generated by them contributes to the bacteria harboring on them to multiply at alarming levels. Thus, to live a healthy life, a standard of living must be maintained in terms of hygiene.

In this study, out of total 140 mobiles that were swabbed, growth was obtained in 88(62.857%) mobile phones *(Table 1)*.

Similar observations were made by Chinchal Panchal *et al* [12], which showed positive growth in 65(65%) mobile phones.This study is in contrast with the findings of another study by Usha Arora *et al* [5]which showed positive growth in 65(40.62%) mobile phones.This might be because of more frequent usage of mobile phones by health care workers in our institution.

Out of 70 mobile phones swabbed from each clinical and nonclinical department, growth was obtained in 57 (81.42%) of clinical departments and 31(44.28%) of non-clinical departments*(Table 2)*. Similar observations were made by Chinchal Panchal *et al*[12], which showed positive growth in 46(92%) mobiles of the clinical departments and positive growth in 14(56%) mobiles of the non-clinical departments.It was observed that mobile phones from the health care workers working in clinical departments showed a higher bacterial carriage rate as compared to the health care workers of the non-clinical side as they are regularly involved in clinical work of the hospital like being in contact with patients who may harbor a variety of diseases, organisms. They also visit the Intensive Care Unit (ICU) and Operation Theater often. These bacteria can be readily transferred to the critically ill patients who already have a low immunity.

Out of the total organisms isolated, CoNS was present on 37(42.05%) mobiles. It was the most common organism isolated followed by *Staphylococcus aureus* which was present on 34(38.63%) mobiles*(Table 3 and Fig 1)*. This finding correlates with the results of the study by Usha Arora *et al*[5] who also found CoNS as the commonest isolate showing an isolation rate of 27(41.53%) followed by *Staphylococcus aureus* on 22 (33.8%) mobiles. Similar observations have also been obtained by Surender Kaur *et al*[13] in which CoNS was present on 30 (42.8%) mobiles and *Staphylococcus aureus* was on 17 (24.28%) mobiles.It is known that organisms like *Staphylococcus aureus* and *Coagulase Negative Staphylococcus* resist drying and thus, can survive and multiply rapidly in the warm environments of mobile phones.

Pseudomonas aeruginosa was isolated from 11(12.50%) mobile phones in our hospital. Higher isolation rate, from 21(18%) mobiles was noted by S. E. Amala*et al*[14]. *Pseudomonas aeruginosa* defiles the activities of many antiseptic and germicides used in disinfection and is therefore, is an important agent of hospital acquired infections. Itis metabolically versatile, ubiquitous in both terrestrial and aquatic environs [15]. Presence of this organism on mobile phones of medical workers calls for serious public health attention

E. coli was found on 3(3.40%) clinician's mobile phones. Higher isolation rate of 51(22.90%) was noted by KetakiGhatole*et al*[16]. They were mainly isolated from mobile phones of health care workers performing surgeries or handling acutely ill patients and therefore they could transfer this to the patients.

Low carriage rate of the above two bacteria, i.e., *Pseudomonas* and *E. coli*, in our hospital may be due to good sterilization and disinfection measures being followed.

In this study, *Micrococcus sp*. was found on 3(3.40%) mobiles. Similar study by Usha Arora *et al*[5] shows isolation in 7(4.37%) mobiles.These bacteria are located in various places such as water, soil and are part of normal skin microbial flora, frequently found on devices which are not adequately cleaned or disinfected [17]. Generally, *Micrococcus sp*. is considered on-haring bacteria and have not been reported as a nosocomial infection agent[18].

The efficacy of disinfection is 91.42% in our study*(Table 4 and Fig 2)*. Similar findings were noted by Usha Arora *et al*[5], showing efficacy of disinfection of 96.87%. Another study by KetakiGhatole*et al*[16] showed efficacy of disinfection as 96% suggesting that alcohol-based solutions like 70% Isopropyl alcohol are effective in disinfection of mobile phones and can reduce carriage rate of bacteria and transmission of infections across patients and health care workers.

CONCLUSION

From this study, it can be concluded that Clinical health care workers have a higher bacterial carriage rate of 57(81.42%) on their mobile phones as compared to the Non-Clinical side 31(44.28%).

It was observed that simple procedures like disinfection with 70% Isopropyl alcohol decreased the bacterial carriage rate to 8.58% from 62.86% before disinfection.Thus, the efficacy of disinfection is 91.42%.

Thus, mobiles that are carried around by health care professionals in the hospital may serve as mechanical vectors for the transmission of bacteria to the patients and even to their family members. Restriction or prohibition of such devices is impractical. Therefore, tactics to prevent nosocomial transmission is a must.

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