



RESEARCH ARTICLE

CARRIAGE OF BIOFILM PRODUCING BACTERIA ON MOBILE PHONES OF HEALTH CARE WORKERS IN A TERTIARY CARE HOSPITAL

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ABSTRACT

Background: Hospital acquired infections (HAI) are a major concern for health care systems around the world. Mobile phones can be a source of infection as they are used not only in Out-patient departments and wards but are also carried to critical areas like intensive care units. A prospective cross-sectional study of isolates from mobile phones of Health care workers (HCW) working in a tertiary care maternity hospital was undertaken to study the microbiological profile and biofilm formation and to formulate mobile phone disinfection protocol. **Materials and methods:** Two samples were taken from each mobile phone. One prior to disinfection and one post disinfection with 70% isopropyl alcohol. Sample swabs were processed by inoculation onto chocolate and MacConkey media. The positive cultures were subjected to standard microbiological procedures for identification and antibiotic sensitivity testing. Biofilm formation was detected using Congo Red Agar (CRA) method. **Results:** Among 100 health care workers (HCW) who were studied, 93% yielded positive cultures. The most common organism isolated was Coagulase-negative staphylococci (CoNS) 44% followed by Leuconostoc mesenteroides (24%). 44% of these isolates formed biofilms. None of the post disinfection swabs yielded growth. **Conclusion:** The two most common organisms isolated from the mobile phones of HCWs were Coagulase-negative staphylococci (CoNS) and Leuconostoc mesenteroides and these organisms had biofilm forming potential. This study also highlights the importance of disinfection of mobile phones.

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INTRODUCTION

Hospital-acquired infections (HAI), a major concern for healthcare systems around the world, are significantly associated with morbidity and mortality and contribute to increased hospitalization costs. Nosocomial infection has been recognized for over a century as both a critical problem affecting the quality of health care and a leading cause of morbidity, mortality and increased health care cost. (1) Health care workers have become so dependent on devices. Mobile phones have become an important and essential accessory of our life in today's world. Apart from the numerous advantages these devices offer, they have their negative outcomes too. Mobile phones are taken with health care workers wherever they go. They are used not only in the wards but are also carried to high-risk areas like intensive care units and operation theatres. They might be a source of microorganisms that can be a cause of HAI. With continuous advancement in mobile phones, they are now used for a variety of purposes.

Their use by doctors in clinical settings and hospitals has increased significantly over the past decade as mobile health applications proliferated and more doctors started using their devices at work. They are used for making calls, connected to CCTVs, connected to PAC system, reading medical literature sending and receiving text messages & emails, surfing the Internet, taking pictures and videos, communicating on social platforms. Many of the organisms isolated from hospital devices and instruments like implants are capable of forming biofilms. (2) Biofilms represent a significant threat for public health, being responsible for persistent infections with relevant economic and health impacts. In fact, biofilms account for 65% of microbial diseases and about 80% of chronic infections, associated to both medical devices and biotic surfaces. (3) Thus in this study, we have studied the microbiota of mobile phones used by HCWs and also looked for biofilm formation by the same. We have highlighted that disinfecting mobile phones and limited use of mobile phones in health care settings can bring a significant decrease in the incidence of HAI.

MATERIALS AND METHODS

The study was conducted in the Department of Microbiology of a tertiary care maternity hospital. This was a cross-sectional study in which convenient random sampling was done from 100 HCWs. HCWs include consultants, post graduates, interns, nursing staff, technicians. Informed consent was taken from the participants. The phones of health care workers were sampled. Two samples were collected from each participant, one of which was collected prior to disinfection and the other one 5 minutes post disinfection. 70% isopropyl alcohol was used for disinfection. Samples were collected using sterile swabs from the frequently touched surfaces. A total of 200 swabs were collected and immediately transferred to the Microbiology laboratory. The specimens were processed immediately first by inoculating onto culture media and then direct smear examination by Gram Stain to avoid contamination. The samples were processed by inoculating onto the following media: Chocolate agar and MacConkey agar, incubated at 37°C aerobically for 48 hours and if there was no growth, the media was incubated for 8 more days to allow the growth of slow growing or fastidious organisms.

All the cultures were subjected to Gram stain and later isolates were identified using standard microbiological procedures and tested for antimicrobial susceptibility by means of agar disc diffusion method of Kirby Bauer according to the guidelines of Clinical and Laboratory Standards Institute (2023). VITEK 2 was also used for the identification and antibiotic sensitivity of the cultures. Detection of biofilm formation was done by Congo Red Agar (CRA) method.

This is a qualitative method for biofilm detection as described by Freeman et al., (4). Congo Red Agar is composed of Brain heart infusion broth (37 gms/L), sucrose (50 gms/L), agar no.1 (10 gms) and congo red stain (0.8 gms/L, HiMedia). Biofilm producers form black colonies with a dry crystalline consistency and non-biofilm producers form pink coloured colonies. (Fig 1)

RESULTS

Out of the 100 mobile phones included in the study, 93% of the pre disinfection swabs showed positive cultures. Both monomicrobial (79%) and polymicrobial (21%) growth was present. 90% of the organisms were gram positive and 10% were gram negative. Most of the gram-positive organisms were Coagulase-negative staphylococci (CoNS) 44% and *Leuconostoc* species 24%. Out of these gram positive organisms 44% formed biofilms. (Fig 2) 25% of the biofilm producing organisms were Methicillin resistant staphylococcus aureus (MRSA). Gram negative organisms did not produce biofilms. All the swabs taken post disinfection with 70% isopropyl alcohol yielded no growth.

DISCUSSION

Our study aimed to investigate the microbial contamination of mobile phones used by health care workers. Hands, instruments, mobile phones or other inanimate hospital objects used by HCWs may serve as vectors for the nosocomial transmission of microorganisms. In the present study, 93% of the samples yielded positive cultures. Out of these, 90% were gram positive and 10% were gram negative organism.



Fig 1. Screening for biofilm formation using Congo Red Agar Method

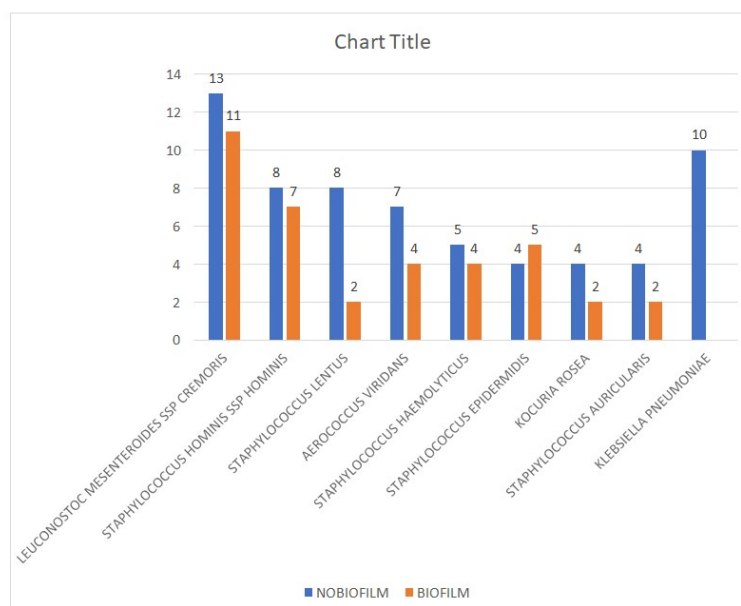


Fig 2. Bar diagram showing various organisms isolated and their biofilm production

The most predominant organisms were found to be Coagulase-Negative Staphylococci (CoNS). This finding is in concordance with studies conducted by Tusabe *et al*(5), Sonia Shivani *et al*(6) and Bhumbra *et al*(7). The second most predominant organism found in our study was *Leuconostoc mesenteroides*. To the best of our knowledge this is the first time that this organism has been isolated from mobile phones of HCW in maternity hospital and should be considered as a potential pathogen because of its biofilm forming capacity and is alarming, They belong to the family Lactobacillaceae. They are gram positive cocci forming pairs and chains. They are catalase negative, facultative anaerobic bacteria. It is a lactic acid bacterium (LAB) that is used in industrial dairy fermentation.

It is used in the production of cottage and cream cheese and cultured milks. These organisms can be dismissed as contaminants during routine cultures and hence should be added to list of pathogens/as they are currently considered potentially pathogenic as seen in a study conducted by Bou *et al* (8) in which they are responsible for nosocomial infections. Meneguetti *et al*(9) describes bacteraemia caused by *Leuconostoc mesenteroides* in an immunocompetent patient. *Leuconostoc mesenteroides* is also responsible for bacteremia in pre term infants as described by Janow *et al*(10) and Yossuck *et al*(11).

44% of the organisms found on the mobile phones had biofilm forming capacity.(Fig 4) This is also seen in the study conducted by Sonia Shivani *et al* (6) in which the organisms found on the mobile phones had biofilm producing potential. Biofilms are microbial communities encased within polysaccharide rich extracellular matrix on surfaces of wounds. They are associated with drastically enhanced resistance against most antimicrobial agents leading to treatment failures. Therefore, chronic infections caused by biofilms are often difficult to treat effectively due to recalcitrance of biofilms to antimicrobial therapy.(12)

According to the CDC's Guidelines for Disinfection and Sterilization in Healthcare Facilities(13), mobile devices are considered noncritical items that come in contact with intact skin but not mucous membrane and recommends using 70% alcohol to disinfect phones.(14) We have used 70% isopropyl alcohol which is shown to effectively disinfect the mobile phones. This is in concordance with a study conducted by Sriram *et al*(15).

CONCLUSION

In our study, we found that 93% of the phones were contaminated. Organism like *Leuconostoc mesenteroides* on mobile phones and forming biofilms is a revelation and we do not have any literature regarding this to the best of our knowledge. This study showed that disinfection with 70% isopropyl alcohol eliminated the bacteria as well as the biofilms and should be incorporated in Hospital infection prevention protocols. Complete restriction of the use of mobile phones in critical areas, regular disinfection of the mobile phones has to be followed. Adding touching mobile phones to the five moments of hand hygiene is a simple infection control strategy worth considering in hospital and community settings.

CONFLICT OF INTEREST: Authors have no conflict of interest to declare

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KEY POINTS

- Mobile phones are a source of Hospital acquired infections.
- Biofilm forming *Leuconostoc mesenteroides* found on mobile phones is a cause for concern.
- Disinfection of mobile phones is of utmost importance.
- Touching mobile phones should be included in the five moments of hand hygiene.

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