ORIGINAL ARTICLE

Isolation and Identification of Microbes from Mobile Phones in Orthopedic Operation Theatre

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ABSTRACT

Background: Post-operative infection in orthopedic surgery is an emerging problem for the orthopedic surgeons and patients. Mobile phones are the most common object brought in theatre by the health professionals and are contaminated by different strains of bacteria which may be the cause of surgical site infection.

Objective: To isolate and identify the microbes on the surface of the mobile phones of the hospital staff in orthopedic operation theatre.

Methods: Samples were taken from the mobile phones of the health care professionals (Surgeons, assistants, Anesthetists, Staff nurses and paramedical staff) entering the operation theatre of the LIHAS (Lahore Institute of Hand and Arm Surgery). All the samples were taken using the culture swab sticks on both sides of the mobile phones of the health care staff of operation theatre on the same day.

Results: The total numbers of mobile phone sampled were 45. 97.3% of the cell phones were contaminated with one or more bacteria and the most common bacteria isolated was Staphylococcus Epidermidis (62.22%) followed by Staphylococcus Aureus (42.2%), Micrococcus (37.77%), Bacillus (33.33%), E.Coli (31.11%), Pseudomonas Aerugonosa (22.22%) and others including Proteus Mirabilis, Enterobacter and Acinetobacter Baumannii (8.88%).

Conclusion: It is concluded that the mobile phone can be the major source of contamination in operation theatre, so the use of mobile phone in the theatre should be minimized and should encourage to clean the phone regularly.

Key words: Orthopedic operation theatre, contamination, Mobile phones.

INTRODUCTION

Mobile phone nowadays is the most common necessities of the human being used for communication[1,2]. Being cost effective and necessity it is used by almost every one. The mobile phones are user friendly, easy to access and easy to carry anywhere so it outnumbered the old traditional landline telephones in many countries [3]. Mobile phones are also commonly used by the patients and the healthcare workers i.e. 98% of the healthcare workers owe the mobile phone and almost 84.5% bring them to their workplace regularly[4,5]. Besides all these benefits the use of mobile phone may have health hazards to the mobile users[5].

Researcher contribute that the mobile phones are the ideal thing that serve as reservoir for the microorganisms to grows because of the continuous handling of the device, the rough surface of the phone and the heat generated by the device[6,7,8]. It is also said that these bacteria can live on the surface of mobile phones for several weeks[9]. The hand plays a drastic role in transmission of the bacteria on the mobile phone [10]. Therefore the use of mobile phones in the operation theatre can lead to post-operative infection and cross contamination between healthcare workers and patients[11,12,13].

Tagoe D.N et. al in 2011 reported isolation of Coagulase negative Staphylococci, (a common bacteria isolated from human skin) from the surface of the mobiles phone which was also confirmed by various other authors [7,14,15].

Qureshi NQ et.al. in 2020 published a study of 100 mobile phones in which they isolated Coagulase negative Staphylococci in 62%, Micorococcus in 41% and Bacillus in 26% mobile surfaces. They also concluded that risk of contamination was decreased by cleaning the mobile phones with alcohol swabs and increased with phone covers and broken or cracked screen[16].

So the aim of our study was to identify and isolation of microbes from the mobile phones used in the orthopedic operation theatres by the hospital staff and also to advise the suggestion in order to minimize the contamination by using the mobile phones.

MATERIAL AND METHODS

It was a cross sectional-study conducted at orthopedic operation theatre of the LIHAS (Lahore Institute of Hand and Arm Surgery) on a single random day using "**Random Calendar date Generator"**[17] on 22nd March 2021. After permission from Ethical Committee, it was picked randomly out of 82 possible dates between 25th January 2021 and 30th April 2021. The samples were collected from 45 mobile phones of the operation theatre staffs including anesthetist, surgeons, staff nurses and operation theatre attendants after getting informed consent and a self-made questionnaire (regarding age, sex, and profession, use of mobile at work and frequency of mobile phone cleaning by alcohol swab). The only exclusion criteria were the patients and visiting persons like medical students.

The samples were taken after getting wash up and dressing with surgical scrub with cap and mask, wearing sterile gloves in order to avoid cross contamination and using sterile culture swab stick soaked with normal saline. The samples were taken from both sides of the mobile phone, cracks on the screen and from back covers. Sample was saved and labeled and gloves were discarded.

The samples were taken to the microbiology lab and were streaked on Nutrient agar, Blood agar, MacConkey agar, Sabouraud Dextrose agar and Glucose yeast agar. The plates were incubated at 34-37°C for 48 hours and later were observed for growth of the microbes and colony morphology.

Gram Staining was done in order to differentiate the isolated colonies of bacteria into Gram Positive and Gram Negative bacteria. Catalase test was done on Gram Positive cocci to differentiate between Staphylococcus and Streptococci. Staphylococci bacterial isolates were further distinguished into coagulase negative and coagulase positive bacteria by using coagulase test. Staphylococcus Epidermis was differentiated from Staphylococcus Aureus by coagulase test. Gram negative bacterial isolates were distinguished using Simmons' citrate test, Indole test, triple sugar iron agar and Oxidase test. Oxidase test was used to differentiate between Pseudomonas Aerugonosa, Vibrio to Enterobacterales. The fungal was inoculated on Sabouraud Dextrose agar and was identified on the appearance and based on

colour, spores and mycelia. Data was analyzed using SPSS version 22, and all variables were assessed, chi-square test was done to see the relationship between demographic variables like age sex, gender, cracked screen etc. and mobile phones contamination.

RESULTS

A total numbers of mobile phone sampled were 45. The total participants were 40. Out of which 27(67.5%) were males and 13(32.5%) were females (p-value = 1.000). The age ranged between 25-55 years with a mean age of 34 years (p-value = 1.000). Out of 40 participants 17 (42.5%) were orthopedic surgeons team, 06(15%) were of anesthesia team, 09 (22.5%) were nursing staff whereas 08 (20%) were other staff like operation theatre assistant and sweeper (p-value = 1.000). Only 04 out of 40 participants were using the basic phone, whereas rest were having smart phones (p-value = 1.000). 31 mobile phones were having mobile cover on it. 13 had one or more crack on the screen (p-value = 0.0326). None of the participant reported to clean the mobile with alcohol swab.

Culture and sensitivity: 97.3% of the cell phones were contaminated with one or more bacteria and the most common bacteria isolated was Staphylococcus Epidermidis (62.22%) followed by Staphylococcus Aureus (42.2%), Micrococcus (37.77%), Bacillus (33.33%), E.Coli (31.11%), Pseudomonas Aerugonosa (22.22%) and others including Proteus Mirabilis, Enterobacter and Acinetobacter Baumannii (8.88%). (Table I). 07 mobile phones culture yields 08 organisms while 38 mobile phones harbored more than one organism. The presence of the gram-negative rod, Enterobacter aerogenes, a member of the coliforms, indicates the possibility of the presence of faecal contamination on the mobile phone.

The fungus isolated from the culture and identified on the basis of color, mycelia, appearance and spores yields Aspergillus Niger (40%), Alternaria alternata (33.33%), Penicillium spp. (28.88%), Cladosporium sp (13.33%), Aspergillus flavus (8.88%), and Aspergillus fumigates (4.44%) (Table II).

The cracks on the screen of smart phone significantly increase the bacterial contamination (p-value = 0.0326), whereas gender, age, mobile phone type and participant job had no significant role in increasing the contamination. (p-value = 1.000).

Table I: Results of bacterial culture

Organism Isolated	Mobile Phone
Staphylococcus Epidermidis	28
Staphylococcus Aureus	19
Micrococcus	17
Bacillus	15
E.Coli	14
Pseudomonas Aerugonosa	10
Proteus Mirabilis	04
Enterobacter	04
Acinetobacter Baumannii	04

Table II: Fungus isolated from the culture

Fungus Isolated	Number of mobile phone
Aspergillus Niger	18
Alternaria alternate	15
Penicillium spp.	13
Cladosporium sp	06
Aspergillus flavus	04
Aspergillus fumigates	02

DISCUSSION

The incidence of surgical site infection in orthopedic surgery despite all efforts to minimize still persists [18]. Along with improving the operation theatre sterile condition, using new and different regimens of antibiotic prophylaxis, multiple attempts were made in order to identify the possible source of surgical site infection in operation theatre [19]. Mobile phones also fall among one of the suspects in spreading surgical site infection, beside considered as a useful, academic and communicative tool for the surgeons and other healthcare workers[20,21,22]. Owing the contamination of mobile phones with resistant bacteria may lead to restriction of its use inside the operation theatre.

Our results showed that 45out of 45 mobile phones of the health care workers in orthopedic theatre were contaminated with pathogenic organism, also according to different studies the most common bacteria causing post-operative surgical site infection is coagulase negative staphylococcus [23, 24, 25, 26, 27]. Our study also yields most common bacteria as staphylococcus epidermis.

Similar studies published in the world showed isolation of different bacteria from the surface of mobile phones including staphylococcus Epidermis, Staphylococcus aureus, Acinetobacter species [28, 29, 30, 31, 32] which also somehow favours our study. The variation in the isolation may be because of difference in demographic and geographic status between countries. In 2017 a meta-analysis was published which states that the contamination of mobile phones in developing countries was significantly high complaining with developed countries [33].

Currently in our study we only isolated the organism found on the surface of the mobile phones of the persons in orthopedic operation theatre. We did not investigated the extent of the microbial colonization. In 2020, Qureshi NQ et.al. published a study in which they investigated the extent of the microbial colonization [16] which was not performed in our study.

Chang et. al. in 2017 published a study in which they used the genotype to assess the transmission of pathogenic organism between nostrils, hand and mobile phone. However they did not perform the type of strain responsible for surgical site sepsis.[34] Another study by Borer A. et. al. compared the strains found on mobile phone and skin of health care worker and starins isolated from surgical site abscess and found a match with the skin of patient but not with in the blood isolates.[35] We in our study did not compare between the strains of isolated from the patient's skin or wound.

Qureshi NQ et. al. in their study performed the antibiotic sensitivity with the isolated bacteria and found significant resistance with meropenem and among the Enterobacter and Pseudomonas species and also 54% of the coagulase negative staphylococcus were resistance to Oxacillin/Methicillin.[16] We did not performed the sensitivity of the bacteria isolated in our study. Previous study showed that cracked screen and use of mobile cover significantly increase the risk of contamination, [16] which was also seen in our study. Similarly there is no significant difference between use of basic phone and smart phone which was also seen in Qureshi et. al. study[16].

In our study we did not investigate the extent of colonization and antibiotic resistance against the isolated organism and also we did not compared the strains with the strains of the patients wound and skin, so further research is being suggested in order to investigate the contribution between isolated bacteria and surgical site infection. Furthermore antibiotic resistance should be assessed in order to minimize the cause of the infection.

CONCLUSION

It is concluded that the mobile phone can be a major source of contamination in orthopedic operation theatre resulting in surgical site infection. Furthermore cleaning of the mobile phones of health care workers with alcohol swab should be encouraged and the cracked screen and mobile covers should be replaced very often.
Further research should be encouraged to rule out association between mobile phone contamination and surgical site infection in the theatre.

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Conflict of interest: Nil

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