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Research Article

**INCIDENCE OF NOSOCOMIAL PATHOGENS ON THE MOBILE
PHONES**

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Abstract:

Mobile phones present a potential threat in transferring the infectious agents among the patients in a hospital. But it remains unnoticed due to lack of enough awareness about the use of mobile phones. Since there were no adequate data about the risk of mobile contamination among the lab technicians working in clinical laboratories, the present study was designed to examine the role of lab technician in transferring pathogenic organisms. In addition, the present study was performed to create awareness about the health risk caused by mobile phones as a fomite and to insist the cleanliness of mobile phones after every use.

Keywords: *Lab technicians, Mobile phones, Staphylococcus aureus*

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1. INTRODUCTION

A mobile or cellular telephone is a long-range, portable electronic device for personal telecommunication. A side the standard voice function of a mobile phone, a mobile phone can support many additional services such as Short Message Service (SMS) for text messaging, email, pocket switching for access to the internet, and Multi Message Service (MMS) for sending and receiving photos and videos [1]. India has the fastest growth rate of mobile phone subscribers from different part of the world.

It is known fact that the electromagnetic radiation emitted by the mobile phones cause serious threat to living beings. Recent studies indicated that the radiation is not only the problem, but the mobile phone itself can be a reservoir for many microorganisms. The use of mobile phones by individuals may serve as a potential vehicle for the spread of pathogenic microorganisms [2]. The mobile phones are good carriers for microorganisms thousands of microbes living on each square inch of the phone. Microbiologists state that constant handling and the heat generated by the phones creates a prime breeding ground for different kinds of microorganisms that are normally present on the skin[1].The mobile phones might act as a fomites as they are the third hand of their owner and carried to all places including toilets, hospitals, kitchens *etc.*[3].

Worldwide usage of headset, and bluetooth rapidly increased due to mobile phones, portable music and mp3 players. It is known that sharing of mobile accessories could have been possible predisposing factor for the transmission of ear infection causing pathogens from user to user [4].

In hospitals, laboratories or while in intensive care units, mobile phone use often occurs. Although, patients do not have direct contact with these phones, colonized bacteria on the devices may be transmitted to them by healthcare staff. This may cause nosocomial infections if the patient's immune system is weak Brady *et al* [2];Karabay *et al.*,[5].

The laboratory technicians may often touch the mobile phones before and after sample collection without proper hand washing. Generally, the microbiologist working in the laboratories tends to handle dreadful pathogens are at high risk, where the mobile phones are the potential vehicle in transmitting contagious diseases between the communities. Thus,the mobile phones can act as fomites in transferring the pathogens. The mobile phones of non microbiologist (biochemist) may also

get contaminated due to sharing of mobile and its accessories among the microbiologist.

Based on the serious issues discussed above, the present study was designed to isolate bacterial and fungal pathogens from the mobile phones and its accessories of the laboratory technicians working in clinical laboratories.

MATERIALS AND METHODS:

Collection of Samples

The present study was conducted between December 2016 to March 2017 at Department of Microbiology, Annamalai University, Tamil Nadu. The study population includes two groups of lab technician's (microbiologists and non-microbiologist) working in the different clinical laboratories around Chidambaram. About 50 samples were collected from 50 mobiles (includes touch screen and button), and 10 samples were collected from the headset, and 5 samples from bluetooth devices.

The samples were collected using sterile cotton swab immersed in sterile 0.85% normal saline solution. The swabs were rubbed over the surface of mobile phone, headsets and bluetooth devices. After collection, the swabs were kept in peptone broth and transferred to the laboratory for further processing.

Processing of Samples

The sampled cotton swabs were inoculated on to the surface of Nutrient agar, Blood agar and Mac-Conkey Agar (for isolation of bacteria), Potato Dextrose Agar (for isolation of fungi). The inoculated plates were incubated at 37°C for 24 hours (for bacteria) and PDA plates were incubated at room temperature for 4 to 5 days (for fungi).

Identification of Bacterial Isolates

The colonies appeared on the Nutrient agar/Blood agar and Mac-Conkey Agar was selected and subjected to identification by following standard microbiological methods. The various tests employed in the present study were Gram's staining, motility, and biochemical tests such as IMVIC test, Oxidase, Catalase and Coagulase test.

A tube coagulase test was carried out to identify *Staphylococcus aureus* , further Methicillin Resistance of *Staphylococcus aureus* was also determined by using oxacillin 1 µg/ disc as per Clinical and Laboratory Standards Institute (CLSI) guidelines.

Identification of Fungal Isolates

The fungal colonies appeared on the PDA plates were subjected to identification by Lactophenol Cotton

Blue (LPCB) staining method [6].

RESULT:

A total of 50 samples collected from mobile phones (includes 12 samples from button type mobiles and 38 samples from touch screen type mobiles) in the present study.

Out of the 50 samples, about 48 (96%) samples showed contamination. The button type mobiles showed 100% contamination, where as the contamination of touch mobile phones was 95%. Only 2 mobile samples showed no growth and they were

considered as sterile. All the samples collected from microbiology lab technicians showed 100% (N=31) contamination. But the samples obtained from non – microbiologist (Biochemist) showed 89.4% (N=19) contamination (Table-1 and 2).

About 10 samples were collected from headset of lab technicians, all 10 samples showed contamination (100%). Five samples (3 from microbiologist and 2 from non microbiologist technicians) collected from bluetooth devices, the percentage of contamination was 100% in the case of microbiologist and no contamination was observed in the samples collected from non microbiologist.

Table 1: Percentage of Contaminated Mobile Phones and Accessories

Mobile types	No. of mobile phones contaminated with microbes				Percentage of contamination	
	Microbiology Lab Technicians	Lab	Non Microbiology Lab Technicians	Total		Sterile
Button type (N=12)	8		4	12	-	100%
Touch Phone (N=38)	23		13	36	2	95%
Headset (N=10)	5		5	10	-	100%
Bluetooth (N=5)	3		-	3	2	60%

Table 2: Percentage of contaminated mobile phones sourcewise

Study population	No. of mobile samples Examined (N=50)	No. of contaminated samples	Percentage of contamination
Microbiology Lab Technician	31	31	100%
Non-Microbiology Lab Technician	19	17	89.4%
Total	50	48	96%

Totally 62 isolates were obtained from mobile phones and its accessories. Based on morphological, cultural and biochemical characteristics the isolates were identified.

The bacterial flora isolated in the present study includes *Bacillus sp* (43.5%), *Staphylococcus aureus* (32.2%), *Pseudomonas sp* (11.2%), *E.coli* (4.8%), and *Streptococci sp* (8%). Two species of fungi such as *Aspergillus niger* (12%), and *Candida sp* (6.4%). were encountered in this study (Table-3) (Fig-1,2).

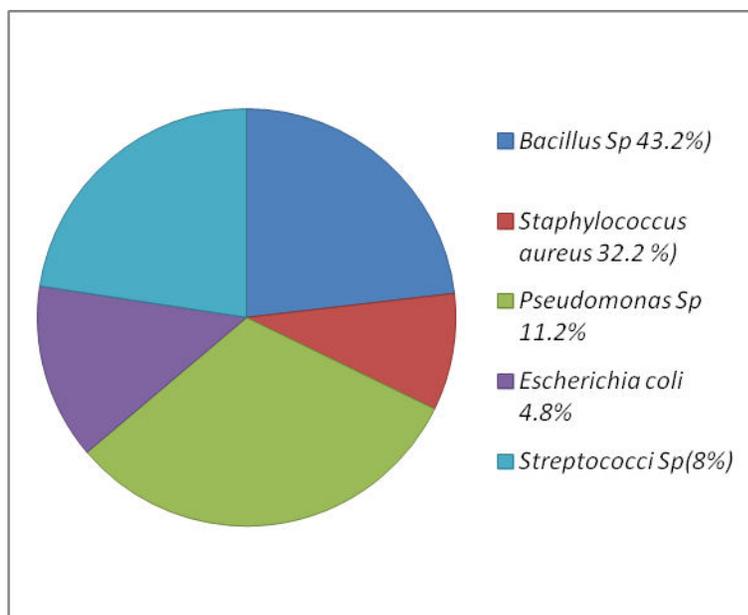


Fig.1 Percentage of bacterial isolates obtained from mobile phones of lab technicians.

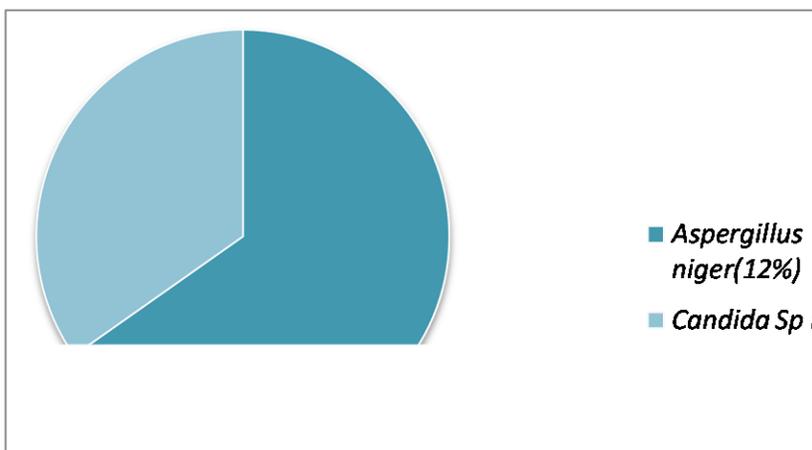


Fig.2: Occurrence of fungal pathogens on the mobile phones of lab technicians.

Table 4: Incidence of MRSA isolates obtained from mobile phones of lab technicians

S.No	Source	No of MRSA isolates	%MRSA
1.	Microbiology Lab Technicians	2	2/20 (10%)
2.	Non Microbiology Lab Technicians	1	1/20 (5%)
3.	Total	3	3/20 = (15%)

DISCUSSION:

About 50 samples, (31 samples from mobile phones of microbiology lab technicians and 19 samples from non-microbiology lab technicians) were collected from mobile phones working in different clinical laboratories around Chidambaram. Out of 50 samples, 48 (96%) samples were found to be contaminated. Mobile phones of microbiology lab technicians were hundred percent contaminated, but non-microbiologist mobile phones were 89.4% contaminated. Our results are in agreement with the reports of Kuhu pal *et al.*, [7]. Results of their study showed that 100% of cell phones belonging to lab technicians were contaminated. The higher contamination rate might be due to improper hand washing practices before and after collecting samples from the patients, lack of mobile cleanliness, lack of restriction to use mobile phones in working areas of the laboratory.

Earlier reports about the study strongly confirmed that the mobile phones could act as a fomite for transferring different microbes. The predominate isolates were *Staphylococcus aureus*, *E.coli*, *Acinetobacter*, *Pseudomonas aeruginosa* etc. In addition to this multi drug resistant strains were also isolated from mobile phones including MRSA, ESBL producing organisms Kuhu pal *et al.*, [7]; Ulgar *et al.*, [8]; Tekerego *et al.*, [9]. On comparison, button type mobiles showed 100% contamination than touch screen phones. This might be due to the fact that the microbes may get anchored well on the cracks and crevices present in the keypad [6]. But the touch screen mobiles will not support the firm attachment of microbes when compared with button type mobiles.

Microbiological examination of mobile accessories (Headset and Bluetooth) of lab technicians also analyzed in the present study. The usage of headsets has been increased worldwide due to hands free operation. High rate of sharing of headsets and bluetooth could have been possible predisposing factor for transmission of ear infection causing pathogens USA Today, 2008 [3]. About 10 samples were obtained from headsets of lab technicians (5 from microbiology lab technician and 5 from non microbiology lab technician). All the 10 samples showed contamination (100%). Five samples (3 from microbiologist and 2 from non-microbiologist) obtained from bluetooth devices, 3 samples from microbiologist showed contamination (100%) and no contamination was seen from the bluetooth samples collected from non microbiology technicians. The sterility of bluetooth samples is due to rare usage of the device. The constant handling of headsets by

different users make it breeding ground for microbes especially those associated with skin of different users, from the mobiles of the uses [10].

A total of 62 isolates were obtained from 65 swab samples collected from mobile phones, headsets and bluetooth devices belonged to lab technicians working in clinical laboratories. Among the isolates *Bacillus sp* was the predominant isolate (43.5%) on the mobile phones. The ubiquitous nature of *Bacillus sp* spores and vegetative cells might be reason for their higher occurrence. A similar results were reported by Anibujivan *et al.*, [11]; Deshmukh *et al.*, [12]; Kuhupal *et al.*, [7].

The second most encountered pathogen was *Staphylococcus aureus*, which accounted for 32% out of all isolates. *Staphylococcus aureus* is the normal flora of the skin glands, nose, nasopharyngeal, gastrointestinal track that can cause various infection in humans. These organisms may gain entry to their phones through the skin and hand [11]. Moreover, *Staphylococcus aureus* is considered as a notorious nosomial pathogen. Similar results were reported by many researchers kuhupal *et al.*, [7]; Elamanama *et al.*, [13]; aneja [6]; Misgana *et al.*, [14]; Sepehr *et al.*, [15]; Ulgar *et al.*, [8].

An attempt was made to find out MRSA among the *Staphylococcus aureus* isolates, results revealed that 15%, isolates showed resistance to methicillin. All the MRSA isolates were isolated from the mobile phone of microbiologist.

The occurrence of MRSA on mobile phones may have been transmitted from patients to lab technicians while collecting sample. Elmanama [13] observed a relatively high resistance rate against some commonly used antibiotics for *Staphylococcus aureus*. They have reported 28.3% MRSA isolates from mobile phones of health care workers. The higher incidences of MRSA (37.7%) were reported by Ulgar *et al.*, [8], Misgana *et al.*, [14] recorded 39% of MRSA isolates from mobile phones of healthcare worker. Our results are comparable with the results of Tambe and Chitrapai [16]. About 16.9% isolates of *Staphylococcus aureus* obtained from health care personal were resistant to methicillin.

The occurrence of fungi on the mobile phones were less when compared with bacteria. Two fungal species viz., *Aspergillus niger* and *Candida sp.* were isolated. In the present study Tambe and Chitrapai, [16] isolated four fungal species viz., *Candida sp.*, *Aspergillus sp.*, *Mucor sp.*, and *Trichophyton sp.* Al-Abdalall [1] demonstrated the incidence of various fungi on the mobile phones in

the city of Dammam, Saudi Arabia. *Alternaria alternata* (29.07%), *Aspergillus niger* (26.74%), *Cladosporium* (20.93%), *Penicillium* sp (10.47%), *Aspergillus flavus* (6-98%), *Rhizopus stolonifer* and *Aspergillus fumigatus* (2.33%) were isolated and identified based on mycelia, colour and spores.

According to WHO, electromagnetic radiation emitted by phones causes threat to lives by damaging DNA producing sperm cells illusamy *et al.*, [17]. Recent studies have shown that the mobile phones could act as reservoir for variety of microorganisms. Mobile phones get contaminated via different sources include human skin, hand, bag, phone, pouch, pockets environment and food particles. The microorganisms get colonized on the phone, thus acting as fomites in transmitting the disease. The combination of handling and the heat generated by phones create a prime breeding ground for all microorganisms [18].

CONCLUSION:

Although several studies have been published on the microbiological contamination of mobile phones few studies are there in mobile phones used by lab technicians. The present study was performed to make public awareness about the hidden hazardous groups of microorganism on their mobile phones; hence most of the people are unaware of it. The alarming results of the present study indicated that the lab technicians are at high risk, since their mobile phones acting as reservoir for the different nosocomial pathogens. Comprehensive knowledge on the importance of cleaning of mobile phones at least once in a day is essential to reduce the risk of mobile contamination with pathogens. The study states the importance of hand wash before and after processing the samples, cleaning of mobile phones with disinfectants, avoiding the use of mobile phones during working hours can reduce microbial contamination of mobile phones.

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