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Mobile phones: Potential Threat in Infection Control

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Abstract:
Introduction: Today cell phones are indispensable accessories both professionally and socially. But they also play the role as perfect substrate for microorganisms and may serve as vehicles in transmitting nosocomial infections. Present study aimed to address this issue by screening for bacterial pathogens on mobile phones of doctors employed in a teaching hospital in Medak.

Methodology: 74 cell phones of doctors in various clinical and non-clinical departments were screened for bacterial isolates with sterile cotton swabs and subjected to culture using BHI Broth and identified by conventional methods.

Results: revealed high percentage (91.8) of bacterial contamination. 51.3% of mobile phones showed polymicrobial growth. Isolates included pathogens like Staphylococcus aureus, Enterococci, Escherichia coli, Klebsiella, and Pseudomonas. These results showed that doctors’ mobile phones are contaminated and their use can pose a potential threat in dissemination of infectious pathogens.

Conclusion: Development of effective preventive strategies such as regular decontamination of mobile phones with disinfectant and hand hygiene can help reduce the burden of contamination.

Keywords: Cell phones, bacterial isolate

Introduction
Nosocomial infection is an important problem in all modern hospitals. As early as 1861 Semmelweiss demonstrated that bacteria were transmitted to patients by contaminated hands of health care workers (HCW). Hospitals, labs, and Intensive Care Units (ICU) are the work places that need highest hygiene standards. Personnel working there and the equipment used by them should also meet the same requirements (1).

Today mobile phones are increasingly being used for communication by HCW in every location including ICU and OTs. They come in contact with various surfaces while carrying out health care activities like examining the patients, providing nursing care, processing samples etc and are likely to get contaminated by variety of organisms some of which could be pathogenic (2). Although patients do not have direct contact with these cell phones, colonized bacteria on the devices may be transmitted to them by health care staff. This may cause nosocomial infections if patients’ immune system is weak (3). Screening of mobile phones have been carried out in several studies (4,7,9,10,11,14,15) all of them reporting high rate of contamination. Paucity of such studies in our area made us carry out the study. It aimed at screening for microbial flora of mobile phones of doctors employed in MNR Medical College and Teaching Hospital located in Medak.

Materials and methods
After Institutional Ethical Committee approval this cross sectional study was carried out with written informed consent from 74 doctors in MNR Medical College. The sample size was determined with help
of experts. Surface samples are collected aseptically using damp cotton swabs on the keys of mobile phones and inoculated into Brain Heart Infusion broth as a transport medium and incubated at 37°C for 24 hrs aerobically. Further subcultures were made on 5% sheep blood agar, and Mac Conkeys' agar and incubated at 37°C for 24 - 48hrs aerobically. Plates were observed for growth and colony morphology and further identified by conventional methods. The data were tabulated and analyzed.

<table>
<thead>
<tr>
<th>Total num of cell phones</th>
<th>74</th>
<th>100%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cell phones with growth</td>
<td>68</td>
<td>91.8%</td>
</tr>
<tr>
<td>no bacterial growth</td>
<td>06</td>
<td>8.1%</td>
</tr>
</tbody>
</table>

[Table 1 - Growth pattern]

<table>
<thead>
<tr>
<th>Bacterial growth</th>
<th>No. of cellphones</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single colony</td>
<td>26</td>
</tr>
<tr>
<td>Two colonies</td>
<td>32</td>
</tr>
<tr>
<td>Three/ more colonies</td>
<td>06</td>
</tr>
<tr>
<td>Total bacterial isolates</td>
<td>108</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Bacterial isolates</th>
<th>Number</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Micrococi</td>
<td>13</td>
<td>12%</td>
</tr>
<tr>
<td>CONS</td>
<td>18</td>
<td>16.6%</td>
</tr>
<tr>
<td>Staphylococcus aureus</td>
<td>08</td>
<td>7.4%</td>
</tr>
<tr>
<td>Enterococci</td>
<td>05</td>
<td>4.6%</td>
</tr>
<tr>
<td>Klebsiella sps</td>
<td>12</td>
<td>11%</td>
</tr>
<tr>
<td>Pseudomonas</td>
<td>06</td>
<td>5.5%</td>
</tr>
<tr>
<td>Bacillus sps</td>
<td>26</td>
<td>24%</td>
</tr>
<tr>
<td>Diphtheroids</td>
<td>20</td>
<td>18.5%</td>
</tr>
<tr>
<td>Candida sps</td>
<td>01</td>
<td>0.9%</td>
</tr>
</tbody>
</table>

[Table 2& 3]

**Results**

Except for 6 cellphones of the total 74 doctor’s mobilephones all were contaminated (91.8%) table 1. Single bacterial type was recovered from 26, two or more than two bacterial types were isolated from 32 and 6 cellphones respectively.(table 2). Contaminating pathogens were coagulase positive Staphylococci, Enterococci, Escherichia coli, Pseudomonas, Klebsiella sps, and others amounting to 108 isolates(table 3). 71.3% of contaminated mobile phones grew normal skin and oral flora.

**Discussion**

These results show that Staphylococcus aureus, Enterococci, Escherichia coli, Klebsiella, and Pseudomonas are the main pathogenic bacteria isolated from doctors’ mobile phones. These organisms may perhaps found their way through the skin and hands because mobile phones are seldom cleaned and often touched during or after examination of patients and handling of specimens, without proper hand wash.(10) 71.3 % of isolated bacteria are a subset of normal microbiota of skin. Constant handling with heat generated by the phones, warmth of the body, hand bags, snug pouches, further potentiates the growth, colonization, and proliferation of virulent pathogens as well. Food particles from unclean hands provide good nutrient media for their growth. Sweat from hands and other body parts in a tropical country like ours is another
excellent medium for transportation and growth of bacteria. Another astonishing fact is that there is a close relationship between the emission of electromagnetic radiation and the microbial load on the mobile phones. Bacteria absorbing electromagnetic energy from cellphones also emit these electromagnetic radiations which again form a conducive medium for their growth. Hence cell phones are rightly called as “technological petridishes” for thousands of worms.

Contamination rate of 91.8% correlates with Jayalakshmi et al (11.), as compared with other studies. (table 4). Recovery rate of Coagulase Negative Staphylococci (16.6%) and Staphylococcus aureus (7.4 %) was very less in our study as compared to Jaya lakshmi - 40% (6), Usha 46%(10), Padma srikanth- 48% (7), Kabir O – 42% (9). This is a significant observation and could reflect differences in carrier states of health care personnel in different parts of the country. Isolation of E.coli, Klebsiella and Enterococci indicate fecal contamination of cellphones. Poor hand washing after fecal discharge and wound scratch leads to incorporation of these bacteria onto hands and nails and subsequent spread via mobile phones. E.coli, Klebsiella and Pseudomonas are implicated in gram negative sepsis. Bacillus sps (24%) is the main isolate in our study, known to be an important organism in food spoilage and contaminant of food if food is prepared or eaten with infected hands. Diphtheroids amounting to 18.5% of isolates, though considered as normal skin flora can at times cause opportunistic infections in susceptible individuals. One candida sps is recovered from cellphone of a pharmacologist working with rabbits. Yeast isolation, though to lesser extent, nevertheless reiterate that they too can be transmitted via mobile phones.

Similar to the study of Yazhini Jagadeesam (12) broad spectra of bacteria isolated in the present study is indicative of potential nature of mobile phones to act as fomites and addresses the need for stringent measures to be followed in hospitals to prevent spread of such bacterial strains.

Present study did not check the efficiency of various chemical disinfectants for cleaning of mobile phones which needs to be done in future. The overall implication of this result is that the cell phones which are meant to make communication easy are gradually assuming the status of pathogenic agent of disease transmission.

Conclusion and Recommendations

This study highlights mobile phones as a potential threat in infection control practices and could exaggerate rate of health care associated infections. Today cellphones became indispensable accessories both professionally and socially but their role in being a perfect substrate for microorganisms is greatly overlooked and underemphasized.

As there are no guidelines for care, cleaning and restriction of mobile phones in health care settings, their use can play important role in transmission of infections to patients and probably could also be a vehicle for transmission of biological weapons.

Educational campaigns to enlighten health care personnel and also general public on microbial colonization should be undertaken. Such programmes should also address the role of mobile phones acting as fomites for infection transmission and also emphasize the need for routine cleaning with alcohol disinfectant wipes. Control measures can include engineering modifications such as use of hands free mobiles, surfaces that are easy to clean and disinfect like cellphene lamination of mobile phones which
reduces the crevices where bacteria can harbor (6). Stress on the use of antimicrobial additive materials for mobile phones is another way to reduce bacterial infection. Recently ultra sonic cleaning by an ultrasonic cleaner can clean the cellphones thoroughly and safely. HYGreen is another system to monitor HCW’s hand hygiene by detecting sanitizer or soap fumes given off from their hands(5). Sterilizing cellphone chargers are now being marketed which can charge and sterilize at the same time (11). But these are all expensive and not readily available. Instead strict adherence to simple precautions like hand hygiene and regular cleaning of mobile phones with 70% isopropyl alcohol can be practiced.

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**References**


