Mobile (Cellular) Phones Contamination with Nosocomial Pathogens in Intensive Care Units

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Abstract

Mobile phones are widely used as portable electronic devices for communication and it is in close contact with the body of health care workers (HCW). Mobile phones may serve as vectors for the nosocomial transmission of microorganisms.

Aim of this Work: To evaluate the role of mobile phones in relation to the transmission of bacteria from the mobile phones to the health care workers (HCW) hands in intensive care units. This study was conducted in forty beds intensive care unit (ICU); A total of 136 staff-20 senoir, 8 intensivests, 30 ward physicians (assistant doctors), 48 nurses and nurse aids and 30 persons supportive services and housekeepers-represented the materials for this study.

Samples Collection and Cultures: Obtained from the dominant hand of the participants and their mobile phones at the same time. Isolated microorganisms were identified and allocated to appropriate genera.

Results: Revealed contamination of mobile phones by bacteria and other microorganisms representing rate of 96.5%. Microorganisms from mobile phones and hands were similar and same of them are known causes of nosocomial infections. Staphylococcus aureus (SA) strains isolated from mobile phones 48.0% and 31% of these isolated from the hands were methicillin resistant (MRSA +ve). The gram negative strains isolated from 30.0% of the mobile phones and 32.0% from the hands were ceftazidimeresistant strains. The nosocomial isolates at ICU were: 33% staphylococci, 20% non-fermentative gram negatives, 24% coliforms, 11% enterococci and 12.0% yeasts. The mean colony count was higher in ring using staff’s phones (p>0.05). The rate of routine cleaning of HCW’s mobile phones was 8.0% and 92% of the participants never cleaned their mobile phones. Although the assistant doctor’s phones have higher colony count; There was no significant difference in the rates of specific types of bacterial growth and colony counts isolated on all different group’s mobile phones.

Conclusion: This study confirmed that mobile phones were contaminated with nosocomial pathogens. The use of mobile phones in ICU may have serious hygienic consequenc- es. It is needed to work at various levels to minimize the risk of mobile phones as vectors for pathogen transmission. Multidisciplinary hospital infection control teams should develop active preventive polices and strategies to reduce cross-infection caused by mobile phones in intensive care units.

Key Words: Mobile phones – Nosocomial pathogens – Intensive care units.

Introduction

MOBILE phones are widely used as portable electronic devices and it is in close contact with the body. Mobile communications and wireless data transmission are playing an increasing role in health care. The initial hospitals responses to ban cellular devices in intensive care units (ICU) to avoid electromagnetic interference; These restrictions are relaxing as the knowledge base in this area expands. Medical device malfunction is extremely rare if the distance from the transmitting device is greater than 1m [1].

Hands and instruments used by health care works (HCW) may serve as vectors for the nosocomial transmission of microorganisms. The use of cellular telephones by medical personnel and the associated nosocomial transmission of pathogens have not thoroughly examined [2].

Nosocomial infection is an important problem in all modern hospitals. Semmelweis demonstrated that bacteria were transmitted to the patients by the contaminated hands of healthcare workers as early as 1861 [3].

The risk of infection involved in using mobile phones in the ICU has not yet been determined as no cleaning guidelines available that meet hospital infection control standards. However, the mobile phones are used all day long but not cleaned properly [4].
The aim of this study was to evaluate the role of mobile phones in relation to the transmission of bacteria from the mobile phones to the health care workers hands.

**Material and Methods**

This study was conducted in 40 beds intensive care unit in Mouwasat Hospital in Dammam, eastern province, Saudia Arabia. These 40 beds included 10 beds coronary care unit (CCU), 14 beds Medical intensive care unit (MICU), 6 beds surgical intensive care unit (SICU) and 10 beds in the intermediate care-step down-unit. A total of 136 staff-20 senior, 8 intensivists 30 ward physicians (assistant doctors), 48 nurses and nurse aids, and 30 persons supportive services and housekeepers were candidates for samples collection. All participants agreed and informed consent was obtained. Cultures were obtained from the dominant hand of participants and their mobile phones at the same time. Profession, gender, ring use, dominant hands of HCW, routine cleaning (and the method of the cleaning) of the mobile phones were recorded.

A sterile swab moistened with sterile saline was rotated over the surface of both sides of mobile phones. Another swab was rubbed over the entire ventral surface of the dominant hand (including the thumb and the fingers) of HCW. These samples were immediately streaked into plates that consist of blood agar supplemented with 5% defibrinated sheep blood and eosin methylene blue agar. Plates were incubated aerobically at 37 °C for 48 hours.

Isolated microorganisms were identified using gram stain, colony counts, morphology, catalase and oxidase reaction. All isolates were allocated to the appropriate genera.

VITEK 2 (bioMerieux, France) System was used to identify gram negative bacteria. A slide coagulase test differentiated staphylococcal isolates into staphylococcus aureus and Coagulase-negative staphylococci (CONS). Oxacillin sensitivity of the staphylococci and ceftazidime sensitivity of the gram negative isolates were investigated by disk diffusion method according to clinical laboratory standards (CLSI) criteria [8].

**Data analysis:**

Categorical variables were assessed by chi-square analysis. None-categorical findings were assessed by the student t-test or Man-Whitney U test. p-values <0.05 were considered significant. SPSS for Windows 13.0 software (SPSS Inc., Chicago, USA) was used for these analyses.

**Results**

Contamination of mobile phones by bacteria and other microorganisms represented rate of 96.5%. The isolated microorganisms from the mobile phones and hands were similar (Table 1). Some of them are known causes of nosocomial infection. It was found that 42.0% of phones grew one bacterial species, 29.0% two different species and 25.5% three or more different species. No bacterial growth were identified in 3.5% of phones.

<table>
<thead>
<tr>
<th>Bacteria</th>
<th>Mobile phones (n=136)</th>
<th>Hands of HCWs (n=136)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gram +ve:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Staphylococcus aureus</td>
<td>40</td>
<td>43</td>
</tr>
<tr>
<td>Streptococcus spp</td>
<td>9</td>
<td>16</td>
</tr>
<tr>
<td>Coagulase-negative staphylococcus (CONS)</td>
<td>108</td>
<td>123</td>
</tr>
<tr>
<td>Enterococcus spp</td>
<td>8</td>
<td>6</td>
</tr>
<tr>
<td><strong>Gram –ve:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-fermentative gram negatives</td>
<td>13</td>
<td>17</td>
</tr>
<tr>
<td>Coliforms</td>
<td>9</td>
<td>16</td>
</tr>
<tr>
<td><strong>Others:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yeasts</td>
<td>9</td>
<td>6</td>
</tr>
<tr>
<td>Moulds</td>
<td>13</td>
<td>13</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>209</td>
<td>241</td>
</tr>
</tbody>
</table>

More than one type of microorganism growth (bacteria or others) were isolated in some mobile phones. CONS = Coagulase negative staphylococci.
Staphylococcus aureus (SA) strains isolated from mobile phones 48.0% and those isolated from the hands of 31.0% were methicillin resistant (MRSA +ve). The gram negative strains isolated from mobile phones were 30.0% and the ceftazidime resistant strains from the hands were 32.0%.

**Nosocomial isolates at ICU:**

33% staphylococci, 20.0% non-fermentative gram negatives, 24% coliforms, 11% enterococci and 12.0% yeasts. Among 136 HCWs involved in this study; about 57 were ring users (one or more rings) representing 42%. The mean colony count was higher in ring using staff’s phones \((p>0.05)\). The rate of routine cleaning of HCW’S mobile phones was 8.0% which means 92.0% of the participants never cleaned their mobile phones.

Although the assistant doctors phones have higher colony count; There was no significant difference in the rates of specific types of bacterial growth and colony counts isolated on all different groups of mobile phones (Table 2).

### Table (2): HCWs hand contamination rate according to profession and colony count (with or without ring).

<table>
<thead>
<tr>
<th>Profession</th>
<th>Number N (Mean ± SD)</th>
<th>Mobile phones of ring users (Mean ± SD)</th>
<th>Mobile phones of non-ring users (Mean ± SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nurses &amp; Nurse aids</td>
<td>48 (9±21)</td>
<td>38</td>
<td>10</td>
</tr>
<tr>
<td>Supportive &amp; housekeepers</td>
<td>30 (8±26.3)</td>
<td>20</td>
<td>18</td>
</tr>
<tr>
<td>Ward physicians (assistant doctors)</td>
<td>30 (7±15.6)</td>
<td>13</td>
<td>17</td>
</tr>
<tr>
<td>Senior physicians</td>
<td>20 (5±11.3)</td>
<td>13</td>
<td>7</td>
</tr>
<tr>
<td>Intensivests</td>
<td>8 (3±6.7)</td>
<td>3</td>
<td>5</td>
</tr>
</tbody>
</table>

Health care personnel (physiotherapist, clerikal supportive service and housekeepers).

**Discussion**

In this study, the use of mobile phones by HCWs working in ICUs not only demonstrated a high contamination rate with bacteria but also more importantly contamination with nosocomial pathogens.

The transmission of nosocomial pathogens by electronic devices such as personal digital assistants, handheld computers were previously reported and some of them were epidemiologically important drug-resistant pathogens [6,7].

Butz et al. [8] stated that immobile phones might carry pathogens as well; Stationary phones in a day care facility were contaminated with rotavirus. Singh et al. [9] reported that 47% of immobile phones were contaminated with pathogenic microbes. Neely et al. [10] also identified nosocomial A. Baumannii infection on keyboards as a reservoir in burn and ICUs.

These results suggested that contaminated objects could serve as reservoirs of bacteria and other microorganisms where could be easily transmitted from the mobile phones to the HCWs’ hand. During every phone call the mobile phones come into close contact with strongly contaminated human body areas with hands to hands and hands to other areas like mouth, nose and ears. It is obvious that mobile phones are much more problematic when compared to immobile devices. Mobile phones may facilitate transmission of bacterial isolates from patient to another patient in different wards or hospitals.

The results of this study confirmed what was reported by Borer et al. [11] and Brady et al. [12]. The results showed that mobile phones were contaminated with nosocomial pathogens. Our results demonstrated cross transmission of bacteria between HCWs’ dominant hands and 40% of mobile phones. These mobile phones carried ceftazidime resistant Gram negative isolates and S. aureus isolated were resistant to methicillin. It is important to mention the limited scale of our study and no molecular tests were conducted for determining clonal relation.

Our study demonstrated that the isolated microorganisms from hands and phones were similar. It was evident that it is not applicable to estimate the level of bacterial contamination with one sampling technique. Borer et al. [11] observed that there were contaminations of hands and mobile phones only in 10% of their staff who were sampled once as he was studying acinetobacter transmission. In the current study, contamination rate of mobile
phones was 96.5% for one sampling. Since no warning has been given for cleaning mobile phones to meet hospital standards, the same rates and composition of contamination of mobile phones could be risky when carried outside the hospital environment.

Jeske [13] reported that the use of mobile phones may have more serious hygienic consequences, because unlike fixed mobile phones are often used in the OR (operation room) close to the patient. He recommended considering the benefit of using mobile phones in the OR should be weighed against the risk for unperceived contamination.

Goldblatt [14] concluded that hands and instruments used by healthcare workers may serve as vectors for the nosocomial transmission of microorganisms. Findings in his study show that cellular telephones are commonly used by hospital personnel, even during patient contact. One-fifth of the cellular telephones were found to harbor pathogenic microorganisms.

Fukada [15] reported that anesthetists should perform hand hygiene before and after anesthesia and remove gloves often each procedure and before using equipments like computers.

Ramesh [16] concluded that mobile phones were used widely by staff and were considered by most participants as a more efficient means of communications. However, microbial contaminations a risk associated with the infrequent cleaning of phones. Hospital should devlope polices to address the hygiene of mobile phones.

Fagernes and Lingaas [17] reported that wearing finger rings increases the carriage rate of nonfermentative gram negative bacteria and enterobacteriaceae on the hands of healthcare workers. However, no statistically significant differences in the incidence of transmission of nonfermentative gram negative bacteria or Enterobacteriaceae were detected between the healthcare workers who wore rings and those who did not. These observation agree with our results but bigger number on large scale in separate study is recommended to determine the significant of wearing finger rings and noscomial microbial transmission.

According to these results, it is needed to work at various levels to minimize the risk of mobile phones as vectors for pathogen transmission. The training of healthcare workers about strict infection control procedure, hand hygiene, environmental disinfection are standards to control pathogen transmission.

Otherwise, the potential benefit of using mobile phones by the personnel for private communication or emergency situations in ICU or OR would change into this means of communication detrimental to hospital hygiene. Therefore, near the hand hygiene, cleaning of these devices should be kept in mind. Prevention of contamination risk of nosocomial pathogens and infections standards out as problem that must be weighed in mind.

Developing active preventive polices and strategies like routine decontamination of mobile phones with suitable alcohol containing disinfectant materials or other similar chemicals might reduce cross-infection. Another way of reducing bacterial contamination on mobile phones might be the use of antimicrobial additive materials. In the future mobile phones could be produced by using protective material against the bacterial and other microbial contamination.

References


