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Mobile Phones of Health Care Workers: Potential Vector for Hospital Acquired Infections

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A B S T R A C T

The objective of this study was to evaluate the microbial contamination of mobile phones used by health care workers (doctors and staff nurse) in intensive care units and surgical post-operative wards of a tertiary care hospital. Samples were taken from the surface of the mobile phones of HCWs using sterile swabs, processed and identified as per standard protocol. The oxacillin disc diffusion test and double-disc synergy test were used to identify methicillin-resistant Staphylococcus aureus (MRSA) and expanded-spectrum beta-lactamase (ESBL)-producing Gram-negative bacilli, respectively. Overall, 123 mobile phones were screened. The rate of bacterial contamination in this study was 85.4%.HenceHCWs' mobile phones could be potential vectors for transferring nosocomial pathogens between HCWs, patients, and the community. The study also aimed to describe mobile phones disinfection practices as well as factors associated with mobile phone contamination.

Introduction

Hospital acquired infections (HAIs) are a major challenge to the healthcare system and are associated with significant morbidity and mortality. It is estimated that of every 100 hospitalized patients at any given time, 7 in developed and 10 in developing countries will acquire at least one HAI [1]. HAIs are becoming increasingly common due to the expansion of the population at risk, which results from aging population, increase of chemotherapeutic options for cancer treatment, increase in the number of patients with transplants, in addition to complex and invasive surgical and medical care procedures [2]. Patients in intensive care units and surgical post-operative wards are particularly susceptible to HAIs because of their poor health status, stress and the use of invasive equipment like catheters and cannulae.

Contaminated hands of healthcare providers play a major role in spread infections in healthcare settings. Hand hygiene is one of the most important preventive interventions against the spread of infections in healthcare settings [3]. Objects with frequent hand contact can serve as reservoirs, examples being medical equipment like stethoscopes and other accessories such as mobile phones, pen, ornaments etc [4, 5]. Mobile phones have become an indispensable accessory and are being used extensively in hospital settings. The regular use of the mobile phone by HCWs exposes it to an array of bacteria and makes it a good carrier for microbes, especially those associated with the skin, resulting in the spread of different microorganism from the user [4]. Hand

washing may not usually be performed often enough and many people may use a personal mobile phone in the course of their work throughout the day, the potential role of mobile phones as a source of microbial transmission is considerable [6].

Studies that investigated the contamination of clinicians' mobile phones in developed countries, like USA and UK, reported an overall mobile phone contamination (pathogenic and non-pathogenic organisms) ranging from 75 % to 96 % [4, 7–9]. The most common isolated organisms were coagulase-negative staphylococci (CoNS) and *Micrococcus*; while between 9 % and 25 % of mobile phones were contaminated by other pathogenic bacteria known to cause HAIs, including methicillin-sensitive and methicillin-resistant *Staphylococcus aureus* (MSSA & MRSA), *Acinetobacter* species, and *Pseudomonas* species [4, 7–9]. In addition, studies in healthcare settings in developing countries (Nigeria, Turkey) demonstrated that 42 % to 97 % of clinicians' mobile phones were contaminated. CoNS were the most common isolated organisms; while other microorganisms, such as *Escherichia coli*, *Acinetobacter* species, *Pseudomonas* species, and MRSA, were isolated from 8 % to 31 % of the clinicians' mobile phones [7, 10–14].

This study was aimed to investigate the prevalence of contamination of mobile phones of HCWs, and to describe the microbiological profile of contaminated mobile phones.

Materials and Methods

This is a cross-sectional study conducted in all intensive care units (ICUs) and post-operative surgical wards in a tertiary care hospital. Clinicians and staff nurses in ICUs and surgical post-operative wards were aimed. The only exclusion criterion was the lack of mobile phone ownership, which was found to be zero. The screen, sides, and back of mobile phones were swabbed using a sterile swab. The collected samples were given unique identification numbers and labeled. The samples were transported to the microbiology laboratory for culture within 30minutes of sampling. Swabs were cultured on nutrient, MacConkey and blood agar plates, which were incubated at 37 °C for 48 hours. Plates which showed no growth were reported as negative, while those showing any growth were reported as positive. Positive growths were subsequently identified using routine microbiological methods. Gram staining technique, carbohydrate fermentation tests in triple sugar iron agar and biochemical tests such as catalase and coagulase were used for gram-positive cocci, while oxidase, urease, citrate utilization, nitrate reduction, indole and others were used for identification of gram-negative bacilli.

The antibiotic sensitivity pattern was determined by the disc diffusion method [15]. A suspension of each bacterium was prepared in peptone water to give a concentration equivalent to McFarland 0.5 and 1.0 standards for gram-negative bacilli and gram-positive cocci, respectively.

This was inoculated on the surface of plain Mueller–Hinton agar by spreading with a swab to give a semi-confluent growth. Antibiotic discs were placed on it and incubated at 37 °C overnight. The antibiotics tested are as follows: ceftazidime (CAZ) 30 µg, ofloxacin (OFL) 5 µg, ampicillin (AMP) 10 µg, gentamicin 10 µg, amoxicillin/clavulanate (AMC) 30 µg, cotrimoxazole (COT) 30 µg, erythromycin (E) 10 µg, ceftriaxone (CRO) 30 µg, and ciprofloxacin (CPL) 5 µg. Sensitivity to vancomycin was also tested for *Staphylococcus aureus*. The oxacillin disc diffusion test and double-disc synergy test were used to identify methicillin-resistant *Staphylococcus aureus* (MRSA) and

expanded-spectrum beta-lactamase (ESBL)-producing Gram-negative bacilli, respectively.

Results and Discussion

The rate of bacterial contamination of HCW mobile phones in this study was 85.4%. A total of 123 HCW mobile phones were screened for possibility of microbial contamination. Of which 88 (71.5%) samples were from surgical post-operative wards and 35 (28.5%) from intensive care units HCWs. From the 123 samples collected 105 (85.4%) were culture-positive, 77 (73.3%) from post-surgical wards and 28 (26.7%) from intensive care units.

This study was aimed to investigate the microbiological contamination of mobile phones of HCWs in ICUs and post-operative wards in a tertiary care hospital in South India. Approximately, 85.4 % of HCWs mobile phones were found to be contaminated. This is higher than that reported from Saudi Arabia, where 43.6 % of clinicians' mobile phones were contaminated [16]; and in other parts of India, where 42 % of clinicians' mobile phones in different wards were contaminated [12]. On the other hand, the prevalence of contamination of clinicians' mobile phones in our setting was lower than that reported from other studies in Turkey, where 94.5 % of clinicians' mobile phones in operating rooms and ICUs were contaminated [10], and 97.8 % of clinicians' mobile phones in all departments were contaminated [11]. Higher estimates of the contamination of clinicians' mobile phones have also been reported from UK (96.2 % of mobile phones of all physicians) [9], Austria (95 % of mobile phones of anesthetists) [18], Saudi Arabia (96.5 % of mobile phones of clinicians in ICU) [17] and Nigeria (94.6 % of mobile phones of health care workers in a hospital) [14].

Distribution of positive samples in the respective wards

	Surgical post-operative wards	Intensive care units	Total
Sample collected	88	35	123
Culture positive	77	28	105
Culture negative	11	7	18

The organisms isolated were CoNS, Micrococci, Diphtheroids, *Pseudomonas*, Escherichiae coli including 7 (6.7%) MRSA and 9 (8.6%) ESBL strains

	Surgical post-operative wards	Intensive care units	**Total**
CoNS	19	8	**27**
Micrococci	8	3	**11**
Diphtheroids	7	2	**9**
Pseudomonas spp	4	2	**6**
S aureus (MSSA)	14	3	**17**
S aureus(MRSA)	5	2	**7**
Klebsiellaspp	4	1	**5**
ESBL	1	0	**1**
Escherichiae coli	10	4	**14**
ESBL	5	3	**8**
Total	**77**	**28**	**105**

The contamination of HCWs mobile phones by various microorganism in the ICUs and surgical post-operative wards was found to be high. Although most microorganisms can be considered non-pathogenic in normal circumstances, they are potentially harmful in ICU and post-operative settings, where patients are extremely vulnerable to infections. Some mobile phones even harbored extremely harmful bacteria, such as MRSA or Gram-negative organisms.

Our findings highlight the need for a more comprehensive approach to reduce nosocomial infections, which in addition to promoting hand hygiene also focuses on cleanliness of mobile phones and other objects that clinicians may carry. The present study pointed out that none of the clinicians had ever disinfected their mobile phones, apart from routine wiping of mobile screen which is not an optimal practice.

Recent innovations in mobile communication which have been found to be useful in healthcare facilities have led to better patient control of diseases. Hence our study highlights the need to increase the awareness about mobile phone disinfection among clinicians, given that banning mobile phones in hospital settings is practically impossible.

However, since it possesses the hazard of being a potential vector of nosocomial pathogens, a well-coordinated cleaning guideline incorporated in a strict and effective infection control policy may reduce the risk of its usage. One study reported the use of 70% isopropyl alcohol as an effective disinfectant [19] or antimicrobial additive materials which may be effective in reducing the risk of cross contamination [20]. Another study reported that the restricted use of mobile phones during working hours along with proper hand hygiene practices enabled mobile phones to remain free of contamination [21].

In conclusion, since contamination of the mobile phones of HCWs has been associated with nosocomial pathogens, concerted and deliberate efforts should be made to avoid the risk of transmission to patients. It is recommended that regular training programs be organized by the appropriate authorities for different cadres of HCWs to emphasize the need for the implementation of infection control policies. This should include strict hand washing after every contact with a patient, regular surface disinfection of fomites, including cell phones, pens, stethoscopes, etc., by simple methods already suggested by other researchers above. This will increase awareness and reduce the risk of infection by nosocomial pathogens that could have tragic consequences for immune compromised patients.

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