International Journal of Microbiology Research
ISSN: 0975-5276 & E-ISSN: 0975-9174, Volume 8, Issue 1, 2016, pp.-717-719.
Available online at http://www.bioinfopublication.org/jouarchive.php?opt=&jouid=BPJ0000234

BACTERIAL CONTAMINATION OF HEALTHCARE WORKERS ACCESSORIES: A POTENTIAL RISK TO PEDIATRIC INTENSIVE CARE UNIT AND NURSERY PATIENTS

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Received: December 07, 2015; Revised: December 16, 2015; Accepted: December 29, 2015

Abstract- Aim: Infections associated with health care are a significant matter of concern due to significantly high morbidity, mortality & cost particularly in ICU setting. Health care workers play an important role in the transmission of hospital acquired infections as they interact and provide essential services to the patients. In the present study, a prospective observational study was undertaken with an aim to review the micro flora associated with the accessories such as stethoscopes, pens, mobile phones and rings of doctors and nursing staff working in paediatric intensive care unit and nursery. **Methodology:** Standard microbiological procedures were followed for isolation, culture and antimicrobial assay's. **Results:** 56% of mobile phones, 52% of the stethoscopes, 40% of finger rings, and 28% of the pens used by healthcare workers showed growth of various microorganisms. Predominant pathogens isolated were coagulase negative *Staphylococcus* spp. (70.46%), *Staphylococcus aureus* (13.69%) and *Acinetobacter* spp. (11.64%). Methicillin resistant *Staphylococcus aureus* was also observed (30%). **Conclusion:** The results emphasize for improvement in the compliance to hand hygiene and disinfection practices along with accessories in order to reduce the rate of cross infection between patients and health care workers.

Keywords- Health care associated infection, Accessories, Health care workers, ICU.

Citation: Jagdish Lavanya, et al., (2016) Bacterial Contamination of Healthcare Workers Accessories: A Potential Risk to Pediatric Intensive Care Unit and Nursery Patients. International Journal of Microbiology Research, ISSN: 0975-5276 & E-ISSN: 0975-9174, Volume 8, Issue 1, pp.-717-719.

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Introduction

Health care associated infections (HCAI) are associated with significant morbidity, mortality & health care costs, globally [1]. In hospital settings, paediatric Intensive Care Unit (ICU) and nurseries are the most critical areas, which require high a standard of hygiene. However, accessories such as stethoscopes, mobile phones, finger rings and pens of health care professionals are seldom disinfected, and hence serve as a potential source of infection [2]. These accessories are often used in close contact with the patient body and are merely covered under any cleaning guidelines so as to meet the available hospital hygiene standards and risks involved in using them. Moreover, the risk associated with the use of such article (probably contaminated), is yet to be determined [3]. It has been well documented that the rate of antimicrobial resistance is much higher in bacterial isolates of ICUs as compared to isolates from hospital wards and outpatient department (OPDs). In this situation, the accessories used by the staff may get contaminated with multi-drug resistant organisms and can transfer it to other places [4-5]. The contamination of mobile phones of health care workers with pathogenic bacteria, have been demonstrated [6-7]. In a similar study, it has been shown that accessories of health care workers used to get contaminated with pathogenic bacteria during their use in hospital [8]. Happening so, the degree of contamination, extent of microbial survival and antimicrobial resistance status might become crucial for seriously ill patients admitted in isolated wards such as ICUs [9-11]. Therefore, the present study was undertaken to understand the dynamics of bacterial contamination of health care workers accessories attending paediatric intensive care unit and nursery of a tertiary care hospital in India. The findings of study will help in understanding the patient care situations with higher levels of contamination so as to improve hygiene and disinfection practices.

Materials and Methods

Sample collection: Institutional ethics committee approved the present study design. Written and informed consent was obtained from the study participants (Doctors: 50; Nurses: 50). A total of 325 samples were collected. Sample included, mobile phones (n=100), stethoscopes (n=100), pens (n=100) and finger rings (n=25) from the doctors and nurses working in paediatric ICU and the nursery of the hospital. Each sample was collected by swabbing the surface of the accessories with a sterile cotton swab moistened with sterile normal saline.

Bacteriological examination: Swab samples were immediately inoculated on Blood agar and MacConkey agar plates and plates were incubated overnight at 37°C. Plates were examined for bacterial growth after 24 hrs. The microorganisms were identified using standard biochemical identification procedures [12].

Antibiotic susceptibility: Antibiotic susceptibility testing of isolated microorganisms was done by routinely used antibiotic susceptibility method i.e. Kirby disc diffusion method. Briefly, the Mueller Hinton agar plate was divided in two parts. On one part standard strain was plated while on the other half, test strain was plated. Antimicrobial discs of different antibiotics were placed on both sides. Methicillin resistance in Staphylococcus aureus was detected by using Mueller Hinton agar with 30-µg cefoxitin and 1 µg oxacillin disk using CLSI guidelines [13].

Results

Out of 325 samples collected, a total of 146 (44.92%) showed bacterial growth on culture. Among articles samples, 56% of mobile phones, 52% of stethoscopes, 40% of finger rings and 28% of the pens, harboured various pathogens [Table-1]. The spectrum of microorganisms includes coagulase negative *Staphylococcus*, *Staphylococcus aureus*, *Acinetobacter*, *Escherichia coli*, *Klebsiella* spp. etc.

Table-1 *Bacterial isolates recovered from various accessories used by Health care workers while attending paediatric ICUs and nurseries.*

Samples (n=325)	Mobile phones (n=100)	Stethoscopes (n=100)	Pens (n=100)	Finger rings (n=25)
CoNS (103)	40(71.4%)	40 (76.9%)	20(71.4%)	3 (30%)
S. aureus (20)	6 (10.7%)	6 (11.5%)	6 (21.4%)	2 (20%)
Acinetobacter spp. (17)	6 (10.7%)	4 (7.6%)	2 (7.1%)	5 (50%)
E. coli (4)	4 (7.1%)	0	0	0
Klebsiella (2)	0	2 (3.8%)	0	0
Total (146)	56 (56%)	52 (52%)	28 (28%)	10(40%)

Further, out of 146 samples, *Staphylococcus aureus* (20) was the most common pathogen isolated followed by Coagulase negative *Streptococci* (CoNS) (103). On antibiotic susceptibility testing, 6 (stethoscope-2, mobile phones-2, pens-1, finger rings-1) methicillin resistant *S. aureus* (MRSA) were also observed [Table-2]. Amongst Gram-negative bacteria, *Acinetobacter* spp. (17) was the predominant isolate followed by *E. coli* (4) and *Klebsiella* spp. (2) [Table-1-2]. *Klebsiella* spp. was isolated only from stethoscopes. 33.3% of *Acinetobacter* spp. isolates were resistant to commonly used antibiotics such as ciprofloxacin, gentamycin, erythromycin, ceftazidime, imipenem and amikacin.

Table-2 *Antibiotic resistance pattern as determined by disc diffusion method for different bacterial isolates recovered from accessories of health care workers*

Antibiotics	CoNS (N-103)	*S. aureus* (N-20)	*Acinetobacter* (N-17)	*E. coli* (N-4)	*Klebsiella* (N-2)
P	44 (42.7%)	6 (30%)	-	-	-
OX	44 (42.7%)	6 (30%)	-	-	-
G	44 (42.7%)	6 (30%)	7 (41.17%)	1 (25%)	1 (50%)
CF	44 (42.7%)	6 (30%)	7 (41.17%)	1 (25%)	1 (50%)
LE	5 (4.85%)	3 (15%)	3 (17.64%)	-	1 (50%)
E	44 (42.7%)	6 (30%)	7 (41.17%)	1 (25%)	1 (50%)
CO	44 (42.7%)	6 (30%)	6 (35.29%)	1 (25%)	1 (50%)
CD	44 (42.7%)	6 (30%)	-	-	-
T	14(13.59%)	4 (20%)	-	-	-
CA	-	-	7 (41.17%)	1 (25%)	1 (50%)
PIT	-	-	5 (29.41%)	1 (25%)	0%
I	-	-	6 (35.29%)	1 (25%)	0%
MRP	-	-	5 (29.41%)	0%	0%
TIG	-	-	0%	0%	0%
TE	0%	0%	-	-	-
CL	-	-	0%	0%	0%
LZ	0%	0%	-	-	-
NT	-	-	2 (11.76%)	0%	0%
AK	-	-	8 (47%)	1 (25%)	1 (50%)

(P-Penicillin, OX- Oxacillin, G-Gentamicin, CF- Ciprofloxacin, LE- Levofloxacin, E-Erythromicin, CO-Cotrimoxazole, CD- Clindamycin, T- Tetracyclin, CA-Ceftazidime, PIT-Piperacilline-Tazobactam, I-Imepenem, MRP- Meropenem, TIG-Tigecycline, CL- Colistin, LZ-Linezolid, NT- Netilmicin, AK- Amikacin)

Discussion

Health care associated infections (HCAIs) result in significant morbidity, mortality & cost particularly in the ICU setting. Out of various microorganisms responsible for these infections, methicillin resistant *Staphylococcus aureus* (MRSA), multi-drug resistant *Pseudomonas*, and vancomycin resistant *Enterococci* are a major cause of concern [14]. The accessories of health care workers (HCWs) can harbour various potential pathogens and hence become an exogenous source of HCAIs particularly amongst ICU patients. They become a potential health hazard for service provider too [15]. In the present study, an attempt was made to evaluate the contamination profile of various accessories (mobile phones, stethoscopes, finger rings and pens) used by HCWs and, further to observe their antibiogram. The results showed that 44.92% of various accessories were contaminated with various Gram positive and Gram-negative bacteria. Amongst accessories, the mobile phones were the most contaminated followed by stethoscopes. This finding is in agreement with previous studies [2,15-19]. However, the spectrum of micro flora observed was different. In the present study, *Staphylococcus* spp. was the most common microorganism isolate from mobile phones, stethoscopes and pens whereas *Acinetobacter* was the predominant microorganism isolate from finger rings. This could be because of their survival nature i.e. *Staphylococcus* spp. survives better on dry surfaces, whereas *Acinetobacter* on wet environment [20]. Moreover, as human skin generally contains *Staphylococcus* as normal flora, this may be the most probable reason of observation of a high number of *Staphylococcus* in this study. Electronic devices such as mobile phones have been shown to be possible modes of transmission of nosocomial pathogens since microorganisms of medical importance has been isolated from these devices, previously [16]. In a similar study, approximately 40% of mobile phones of health care workers were found to be culture positive [17]. In a study conducted in New York and Israel by Ulger *et al.,* it was demonstrated that 94.5% of health care workers and their devices were contaminated [21]. The result of the present study corroborates with previous findings. It indicates that such close contact contaminated objects could serve as reservoirs for bacterial pathogens, and hence can transmit pathogens easily from the mobile phones to the hands, and then finally to body parts resulting in infections. In line with that, the isolation of MRSA and multidrug resistant *Acinetobacter* reported in the present study, is a significant finding as these organisms are found to be responsible for the outbreaks in many hospital settings [22] and suggesting that serious hand hygiene practices need to be followed in hospitals, especially in ICUs and nurseries since HCAI rate in adult and paediatric ICUs are approximately three times higher than elsewhere in hospitals [23]. Contaminated accessories spread more harmful infections in children than in adults. Especially, immature often-abraded skin with a variety of skin wounds of premature and very low birth weight infants, due to intravenous access or recent surgeries pose great risk of such infection transmission. In the present study, mobile phones, stethoscopes and pens used by doctors showed greater levels of contamination than those used by nurses. On the other hand, all the samples taken from finger rings were of nurses. Moreover, most of the participants were ignorant about the threat of contamination of these accessories with potential pathogens.

In our institution, on analysing data retrospectively, it was observed that *Acinetobacter* species and *S. aureus* were the most common bacterial pathogens isolated from surgical site infections and ventilator associated pneumonia in the PICU and nursery during last one year. CoNS and *S. aureus* were the major pathogens isolated from blood stream infections during the same period. This highlights the importance of pathogenic potential of the accessories of HCWs. Although HCWs were aware about the pathogenic potential of accessories, but due to high patient load, it becomes practically impossible to disinfect accessories on a regular basis during patient care in a day. Moreover, in many institutions, strict guidelines have not been followed to restrict medical staff from carrying accessories into the sterile environment of the OT, ICU or other critical areas. Further, cleaning guidelines for the accessories of HCWs is also required.

Conclusion: The baseline data presented in this study and other similar studies indicate the need and importance of such guidelines. Moreover, these data can be helpful in the formulation of strict infection control practices for adherence to proper hand hygiene and disinfection practices for accessories, especially in critical areas to reduce HCAIs. It emphasizes that only hand washing is not sufficient and disinfection of accessories also needs to be practiced. Otherwise, cross transmission of pathogens from accessories to clean hands to patients or vice versa, will continue. Further training and education programme for HCWs to manage their accessories with good hygiene practices may also need to be implemented.

Conflict of interest: There is no conflict to declare.

Funding: None to declare

Acknowledgement
We are indebted to the participants who permitted us in using their accessories for our study and also department staff for the laboratory workup.

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