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Research Article

STUDY OF ANTIBIOTIC RESISTANCE OF BACTERIAL ISOLATES FROM HANDS OF HEALTH PERSONNEL & FINGERPRINT BIOMETRIC DEVICES IN A TERTIARY CARE CENTRE LUCKNOW, INDIA

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ABSTRACT

All the hospital surfaces or articles are likely to carry pathogens and so the healthcare personnel must follow the hand hygiene practices in the hospital, to prevent the transmission of infections. Further, the fingerprint biometric attendance devices get infected, after being touched by the infected hands of healthcare personnel. This study was undertaken to assess the antibiotic resistance pattern of pathogenic bacteria isolated from hands of healthcare personnel as well as from fingerprint recognising surface of biometric devices (FRBD).31 (56.3%) hand-swabs and 15 (27.3%) swabs from biometric devices showed growth of the pathogenic bacteria. *Escherichia coli* was the most common isolate from hand swabs and out of which,5 were resistant to all routine antibiotics whereas *Klebsiella* spp.5 (33.3%) was found to be the most common isolates from the biometric devices, out of which 2 were resistant to all routinely used antibiotics. All the gram positive bacteria from both sources were Methicillin resistant. Out of all 33 gram negative bacteria,3 isolates were ESBL producers and 10 were Carbapenemase producers. It is important to reduce transmission of these multidrug resistant organisms which can be achieved by following hand hygiene protocol strictly and use of non-touch type of biometric device should be encouraged.

INTRODUCTION

All the Hospital surfaces and articles should be considered potentially infective and capable of transmitting infections. In order to prevent the transmission of infections, the healthcare personnel should follow simple hand hygiene guidelines, after touching any hospital article or surfaces and before touching any patient or patient's articles. Many healthcare workers fail to follow such guidelines and their hands are prone to carry pathogenic microorganisms.[1] Further, in many institutions, attendance of employees is recorded at the beginning as well as at the end of the working hours, by fingerprint scanning biometric devices. Even also, many critical healthcare personnel have to confirm their presence in-between their duty hours. When health workers mark their attendance, there is a physical contact between the finger and finger recognising surface of biometric devices. While so many personnel marking their attendance one after the other; there is very less time interval left to potentially disinfect such devices. Thus, there is a potential risk of transmission of infection through these devices.

The present study was taken to assess the prevalence of pathogenic bacteria on the hands of health personnel and the finger touching surface of biometric devices; causing hospital acquired infection and to also evaluate their antibiotic resistance pattern.

AIM & OBJECTIVE

To study the antibiotic resistance pattern of bacterial isolates from hands of health personnel and fingerprint biometric devices, in a Tertiary care hospital, Lucknow.

MATERIALS & METHODS

The study was done in a tertiary care hospital, Era's Lucknow Medical College and Hospital, Lucknow, Uttar Pradesh, in May 2018. Randomly selected 55 health personnel working in hospital and all the 55 biometric attendance devices in hospital building were included in this study.

Sterile cotton swabs moistened with sterile normal saline, were used to take samples from both the hands of health personnel. These swabs were placed in test tubes containing peptone water

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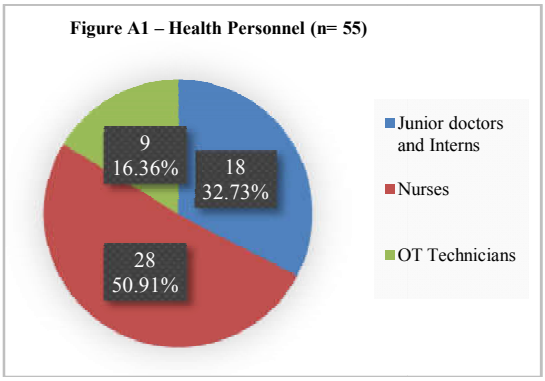
and were transported to the microbiology laboratory within one hour. After 2-4 hrs of incubation at 37^{O}C in peptone water, the sample were inoculated on Blood agar and MacConkey agar culture media. The plates were further incubated at 37^{O}C overnight.

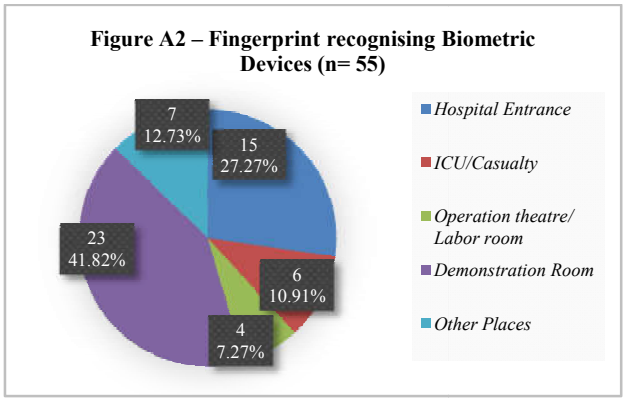
If any visible growth was found on the culture plate, then the bacterial isolates were further identified using Gram's staining, colony characteristics, and biochemical tests. All the bacterial isolates were further subjected to antibiotic susceptibility testing by standard Kirby-Bauer disc diffusion method as per CLSI-2018 guidelines. The antibiotic resistant Gram-positive strains were also screened for Methicillin resistance and resistant Gram-negative stains were screened for the presence of 'Extended spectrum Beta lactamases (ESBL)' and 'Carbapenemases (like Metallo-betalactamses, MBL; Klebsiella pneumoniae carbapenemases, KPC)' as per CLSI-2018. The same process was followed for testing the isolates from fingerprint recognising surface of the biometric attendance devices.

OBSERVATIONS & RESULTS

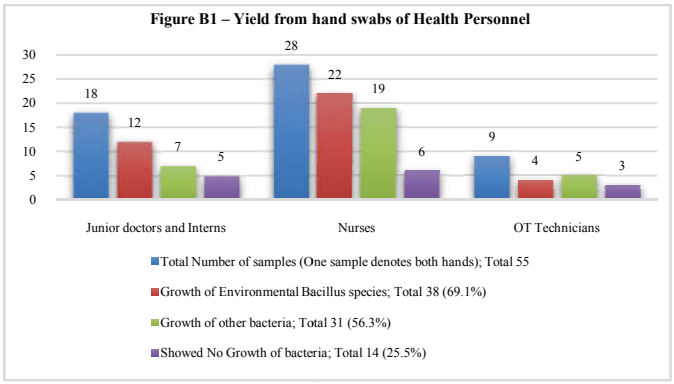
Among the health personnel, the swabs were collected from junior doctors/interns, nurses and OT technicians (Distribution shown in Figure A1).

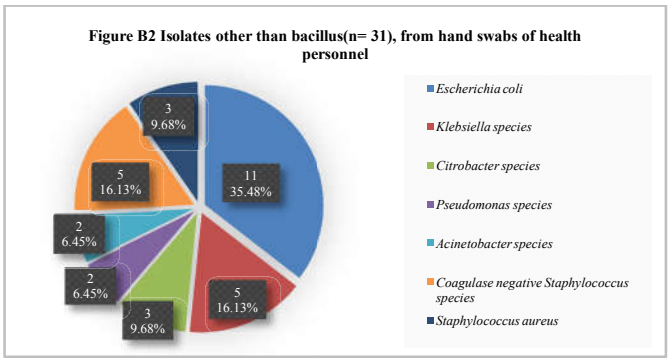


The swabs were also collected from the Fingerprint recognising Biometric Devices (FRBD) located at hospital entrances, ICU/Casualty, Operation theatre/Labor Room, Demonstration room and various other places (Distribution shown in Figure A 2).

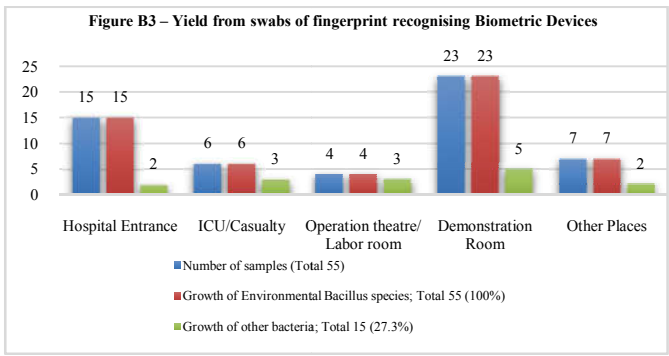


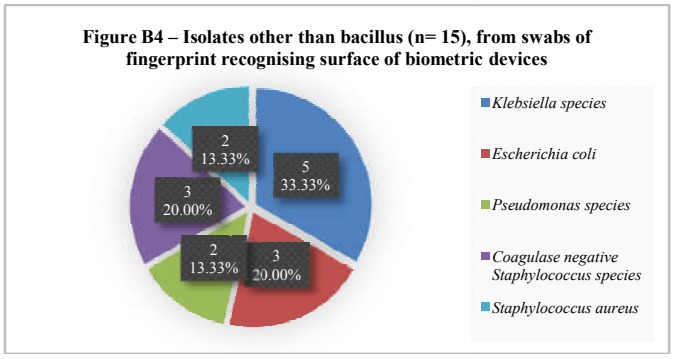
Out of all 55 swabs from health personnel, 14 (25.5%) showed no growth of bacteria, 38 (69.1%) samples showed growth of Environmental *Bacillus* species and 31 (56.3%) showed Growth of 'Other bacteria' which were characterised as follows - 11 (35.4%) *Escherichia coli* (most isolates), 5 (16.1%) *Klebsiella* species, 5 (16.1%) Coagulase negative *Staphylococcus* species, 3 (9.67%) *Staphylococcus aureus*, 3 (9.67%) *Citrobacter* species, 2 (6.45%) *Pseudomonas* species and 2 (6.45%) *Acinetobacter* species (Figure B1 & B2).





Out of all 55 swabs from Fingerprint recognising surfaces of biometric devices (FRBD), all samples showed the growth of Environmental *Bacillus* species but 15 (27.3%) samples showed growth of 'Other' bacteria along with *Bacillus*. (Figure B3) which were further identified as *Klebsiella* species 5(33.3%), 3(20.0%) were *Escherichia coli*, 2(13.3%) were *Pseudomonas* species, 2(13.3%) were *Staphylococcus aureus* and 3(20.0%) were Coagulase negative *Staphylococcus* species (Figure B4).





Antibiotic resistance pattern of isolates from hand swabs of healthcare personnel and fingerprint recognising surface of biometric devices is shown Table 1.

resistant *Staphylococcus aureus* (MRSA). Among the 10 Gram negative bacteria; 1 isolate (1 *Klebsiella*) was ESBL positive, 4 (2 *Klebsiella*, 1 *E. coli* and 1 *Pseudomonas*) were *Klebsiella pneumonia Carbapenemase* positive and 2 (1 *Klebsiella* spp. and 1 *E. coli*) were Metallo-betalactamses positive.

DISCUSSION

Among Health personnel, pathogenic bacteria were isolated mostly from the hand swabs of Nurses and OT technicians. Of all hospital places where biometric devices are installed, the common sites of isolation of pathogenic bacteria were near Operation Theatre/Labor room followed by ICU/Casualty.

Bacterial isolates from hand swabs included *E. coli* (11), *Klebsiella* spp. (5), *Citrobacter* spp. (3), *Pseudomonas* spp. (2),

Table 1 Distribution table of Antibiotic resistant isolates

	Isolates from hand swabs of health personnel							Isolates form fingerprint biometric devices				
	Gram Positive		*Gram Negative*					*Gram Positive*		*Gram Negative*		
Antibiotics	***CoNS (n=5)***	***Staphylococcus aureus (n=3)***	***Escherichia coli (n=11)***	***Klebsiella spp. (n=5)***	***Citrobacter spp. (n=3)***	***Pseudomonas spp. (n=2)***	***Acinetobacter spp. (n=2)***	***CoNS (n=3)***	***Staphylococcus aureus (n=2)***	***Escherichia coli (n=3)***	***Klebsiella spp. (n=5)***	***Pseudomonas spp. (n=2)***
LZ-Linezolid	0	0	-	-	-	-	-	0	0	-	-	-
CD-Clindamycin	0	1	-	-	-	-	-	0	1	-	-	-
CX-Cefoxitin	5	3	-	-	-	-	-	3	2	-	-	-
VA-Vancomycin	0	0	-	-	-	-	-	0	0	-	-	-
TEI-Teicoplanin	1	1	-	-	-	-	-	0	1	-	-	-
DO-Doxycycline	1	0	10	4	2	-	1	1	0	3	5	-
CIP-Ciprofloxacin	3	3	9	4	2	2	2	2	2	3	5	2
LE-Levofloxacin	3	3	9	4	2	2	2	2	2	3	5	2
AMC-Amoxyclav	4	3	11	4	3	-	1	3	2	3	5	-
GEN-Gentamycin	0	1	9	3	2	2	1	0	1	3	4	2
AK-Amikacin	0	1	6	3	2	1	-	0	1	2	4	1
NET-Netilmycin	-	-	7	2	2	1	1	-	-	2	3	1
TOB-Tobramycin	-	-	7	2	2	2	1	-	-	2	3	2
PIT - Piperacillin Tazobactum	-	-	7	2	2	1	-	-	-	2	2	1
CFS - Cefoperazone Sublactum	-	-	7	4	2	1	-	-	-	2	5	1
CPM-Cefepime	-	-	10	4	2	-	-	-	-	3	5	-
CTR-Ceftriaxone	-	-	10	4	2	-	-	-	-	3	5	-
CZA-Ceftazidime	-	-	-	-	-	1	-	-	-	2	3	1
IMP-Imipenem	-	-	6	3	1	1	0	-	-	2	2	2
MRP-Meropenem	-	-	6	2	1	1	0	-	-	2	2	2
DORI-Doripenem	-	-	5	2	1	1	-	-	-	0	0	2
TGC-Tegecycline	-	-	0	0	0	-	-	-	-	0	0	-
CL-Colistin	-	-	0	0	0	0	-	-	-	3	5	0

For antibiotic resistance pattern of isolates from hand swabs of health personnel, it was also noticed that among the 8 Gram positive bacteria; all the 5 (100%) Coagulase negative *Staphylococcus* were Methicillin resistant CoNS (MR-CoNS) and all the 3 (100%) *Staphylococcus aureus* were Methicillin resistant *Staphylococcus aureus* (MRSA). Among the 23 Gram negative bacteria; 2 isolates (1 *Klebsiella* & 1 *Acinetobacter*) were ESBL positive, 6 (26.08%) (1 *Klebsiella*, 4 *E. coli* and 1 *Pseudomonas* spp.) isolates were Klebsiella pneumoniae Carbapenemase positive and 3 isolates (21.7%) (1 *Klebsiella* spp., 2 *Pseudomonas* spp.) were Metallo-betalactamses positive.

In comparison to this, the antibiotic resistance pattern of isolates from fingerprint biometric devices, also showed that among the 5 Gram positive bacteria; all the 3 Coagulase negative *Staphylococcus* were Methicillin resistant CoNS (MR-CoNS) and both the *Staphylococcus aureus* were Methicillin

Acinetobacter spp. (2), CoNS (5) and *S. aureus* (3). But bacterial isolates from biometric devices only included *E. coli* (3), *Klebsiella* spp. (5), *Pseudomonas* spp. (2), CoNS (3) and *S.aureus*(2); not *Citrobacter* spp. nor *Acinetobacter* spp.

Escherichia coli were the most common isolates from hand swabs of health personnel whereas *Klebsiella* species were most common bacteria isolated from the fingerprint recognising surface of biometric devices.

Many of such organisms have property to form biofilms that stick onto the surfaces of various objects. But otherwise also, they are able to survive on an inanimate surface for long durations, depending on the humidity, temperature and presence of organic matter (pus, faeces etc.)[2].

In Present study, even though lesser bacteria were isolated from 55 biometric devices as compared to hands of 55 health personnel; antibiotic resistance pattern showed that bacteria isolated from biometric devices were more resistant than those isolated from the hands of health personnel. Most of the *Klebsiella* isolates and *Escherichia coli* from the biometric devices were resistant to commonly used antibiotics but most of such species isolated from hand swabs were still sensitive to these antibiotics. All the Gram positive bacteria isolated from hands & devices were Methicillin resistant. 60% (6/10) Gram negative bacterial isolates from devices were Carbapenemase producers whereas only 39.13% (9/23) Gram negative bacteria from hands swabs were Carbapenemase producers. Only 1 isolate from fingerprint recognising surfaces was ESBL producers whereas 2 isolates from hand-swab were ESBL producers.

Previously in the past, numerous studies have been conducted to demonstrate the risk of transmission of pathogens from the surfaces of such inanimate objects in hospital setting. In the last decade, Bures *et al*.[3] tested computer keyboards from I.C.U and study stated that MRSA was the most common isolate, followed by *Enterococcus sp., Enterobacter sp.* Similarly, in 2010, Chigozie J. *et al*.[4] isolated *S. aureus* (53%), *P. aeruginosa* (19%), *E. faecalis* (14%) and *E. coli* (13%) from the stethoscopes. In 2016, Nirupa *et al*. [1] isolated organisms from biometric devices. 49% were CoNS, 43.5% were other gram-positive bacilli and 7.5% were gram negative bacilli like *Acinetobacter* spp., *Enterobacter* spp., and *Aeromonas*. In 2013, Nirupa S. *et al*.[5] stated that Coagulase negative *Staphylococcus* was the most common (65%) bacteria isolated form the mobile phone of healthcare workers followed by *Escherichia coli, Pseudomonas sp., Acinetobacter sp*., etc. In year 2017, Dayavanti *et al*.[6] published the results of a study on the nurses' hand hygiene in our institute. The organisms isolated were *Escherichia coli* (48.8%), *Klebsiella* sp. (20.8%), Pseudomonas sp. (8.3%), S. aureus (16.6%) and CoNS (8.3%). In a study on hand swabs of health care workers, by Maheshwari *et al.*[7], from a total of 140 swabs the microorganisms isolated were 13 (18.6%) *S. aureus* and 44 (63%) C*oagulase negative Staphylococcus.* Out of 13 *S. aureus,* 6 (46.2%) isolates were Methicillin Resistant S. aureus (MRSA). Among Gram negative bacteria (GNB) isolates 15 (68.2%) were ESBL positive. Among these ESBL producers, 9 were *Klebsiella spp.*, 5 *Escherichia coli* and one *Proteus spp.*

The hands of healthcare workers are likely to carry more potential pathogens. Without proper hand hygiene practices and factors like high pressure physical contact of unprotected naked fingers with the surface of biometric devices, short turnover duration between consecutive fingerprint scans; it is difficult to keep such devices as 'infection free'.[8]

It is difficult, but it is essential to reduce the risk of transmission of infections. Instead of fingerprint type of biometric systems, the hospital setting should install the devices with face recognition feature or iris scan or voice scan. A commitment in following hand hygiene practices with proper hand wash with soap and water or alcohol based hand rub[8]; can significantly reduce the transmission of hospital acquired infections.[9,10]

CONCLUSION

Even though less number of bacteria were isolated from biometric devices as compared to hands of health personnel, antibiotic resistance pattern showed that bacteria isolated from biometric devices were more resistant than those isolated from the hands of health personnel. To prevent transmission of such multi-drug resistant bacteria, it is required that health personnel must follow hand hygiene guidelines and these fingerprint biometric devices must be replaced by non-touch or non-contact type (facial recognition or iris scan) of biometric devices.

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