

**Study of Microorganisms Isolated From Palm and Articles Used By Health Care Workers**<sup>1</sup>Mr. Bingu Shiv Kiran Reddy, Intern, Jawaharlal Nehru Medical College, Wasrdha (MS), Pin-442107<sup>2</sup>Dr. Silpi Basak, Professor, Jawaharlal Nehru Medical College, Wasrdha (MS), Pin-442107**Corresponding Author:** Dr. Silpi Basak, Professor, Jawaharlal Nehru Medical College, Wasrdha (MS), Pin-442107**Type of Publication:** Original Research Paper**Conflicts of Interest:** Nil**Abstract**

Hospital acquired infection or nosocomial infection is a major problem worldwide. Health care workers (HCWs) are potential source of Health Care Associated Infections (HAI) with many of the pathogens transmitted by contaminated hands and articles used by HCWs. Objective: Hence, the present study was undertaken to detect the microorganisms isolated from palm and articles used by Health Care Workers (HCWs) in a tertiary care hospital. MATERIAL & METHODS: The present cross-sectional study included 80 Health Care Workers (HCWs) and 20 Controls. Swabs were collected from Palm of dominant hand before & after Hand Hygiene and articles used by them. Swabs were cultured and growth was identified by conventional methods. Antibiotic susceptibility profile was studied. Results: 24 bacterial strains were isolated from palm of controls before Hand Hygiene, whereas 144 microorganisms were isolated from palm of Health Care Workers before Hand Hygiene. 9 MRSA and 37.6% ESBL producing strains were isolated from HCWs. CONCLUSION: Strict implementation of Infection Control Practices should be done to prevent Health Care Associated infection (HAI).

Word count: 169

**Keywords:** Health Care Associated infections, Hand Hygiene, Health Care Workers.**Introduction**

Health Care Associated Infection or nosocomial infection is a major problem worldwide. Presently, the term Health care associated infection (HAI) is preferably used instead of nosocomial infection. Hospital environment and Health care workers (HCWs) can transmit many pathogenic microorganisms in the Health Care Set up.

In last century, mankind has experienced tremendous advancement in Medical field both in diagnostic and therapeutic approach to diseases. But with all these advancements HAIs are on the rise in recent years. The major impacts of HAI are increased morbidity and mortality, prolonged hospital stay and increased cost of health care [1]. According to WHO report, 2002 more than 1.4 million people suffer from HAI [2]. Actually, HAI vary from 5-25% in developed countries, whereas data from developing countries is not available as it is not reported properly [3]. In 2007, Klevens et al. had reported that HAIs killed 99000 patients in American hospital [4] and 37000 death in Europe [5]. The mortality rate ranges from 12-80% in ICUs of developed countries [6]. Childs D reported that HAIs kill more patients every year than do AIDs, breast cancer and automobile accidents together worldwide [7]

Hospital environment and Health care workers (HCWs) are potential source of HAI with many of the pathogens transmitted by contaminated hands and articles used by HCWs.

HCWs carry Methicillin Resistant *Staphylococcus aureus* (MRSA), Multidrug resistant Gram negative bacteria, Vancomycin resistant *Enterococci* on hands and dress. Hand hygiene is the most important and simplest practice to reduce the transmission of HAI. In 2009, WHO theme was 'Save Lives: Clean Your Hands' [8]. This simple practice of Hand Hygiene before and after touching each patient are omitted from day to day practice.

Hence, the present study was undertaken to detect the microorganisms isolated from palm before and after Hand Hygiene and articles used by Health Care Workers (HCWs) in a tertiary care hospital.

#### Material and Methods

The present study was conducted in the Department of Microbiology, and was approved by Institutional Ethical Committee. It was a short term cross sectional experimental study

80 Health Care Workers of our hospital including Final MBBS students attending clinical posting were included in the study. 20 Controls were taken and out of which 10 were 1<sup>st</sup> MBBS students and 10 were official staffs of Administrative section of Medical College, who do not have contact with hospital patients and do not have history of hospitalization in last one month.

From 80 Health Care Workers (HCWs) and 20 Controls, swabs were collected from Palm of dominant hand before & after Hand Hygiene, Apron pocket, Mobile, Pen, Stethoscope etc. Swab from diaphragm of stethoscope were collected from 26 resident doctors and 13 Final MBBS students only. From 20 controls instead of Stethoscope, swabs were collected from Keyboard of computer or Laptop and instead of Apron pocket, from 10

official staffs swabs were collected from working table top. For Hand Hygiene the alcohol based hand sanitizer used in the hospital was used. The swabs were inoculated into 2 ml of Brain Heart Infusion (BHI) broth immediately after collection and was transported to Microbiology laboratory where it was incubated at 37<sup>0</sup> C for 4 hours. Then from inoculated BHI broth, culture was done on Blood agar, MacConkey's agar and Sabouraud's Dextrose agar with chloramphenicol. The plates were incubated at 37<sup>0</sup> C overnight. Next day, the growth was observed and identified by conventional methods [9].

Antibiotic susceptibility test for the isolates was done by Kirby-Bauer disc diffusion method [10] according to Clinical and Laboratory Standard Institute (CLSI) Guidelines, 2016 [11]. In case of *Staphylococcus aureus* detection of MRSA was done by Cefoxitin (30 µg) disc method [11]. Cefoxitin is a surrogate marker of *mecA* gene mediated Methicillin resistance. In case of *Enterococcus sp.* High Level Aminoglycoside Resistance was detected by putting High Level Gentamicin and Streptomycin discs [11]. For Gram negative bacterial isolates, Extended Spectrum β-lactamase (ESBL) production was detected by combine disc method [11]. All the culture media and antibiotic discs were procured from Hi Media Pvt. Ltd, India.

#### Observation & Results

A total number of 100 individuals were included in the study. 80 were Health care workers and 20 were controls. From 80 Health Care Workers (HCWs) and 20 Controls, swabs were collected from Palm of dominant hand before (1) & after (2) Hand Hygiene, Apron pocket (3), Mobile (4), Pen (5), Stethoscope (6) etc. From 20 controls instead of Stethoscope, swabs were collected from Keyboard of computer or Laptop (6) and instead of Apron pocket, from 10 official staffs swabs were collected from working table top (3).

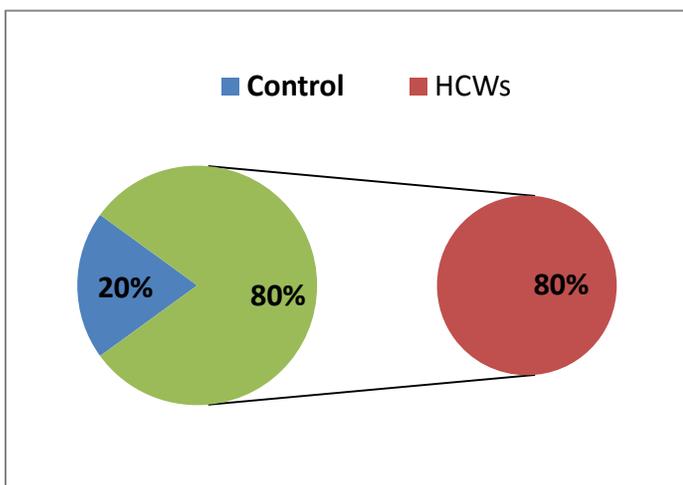


Figure 1: HCWs and Controls studied (n=100)

Figure 1 shows number of HCWs and controls studied. Out of 20 controls 10 were 1<sup>st</sup> MBBS students and 10 were Office staffs of Administrative section. who do not have contact with hospital patients and do not have history of hospitalization in last one month.

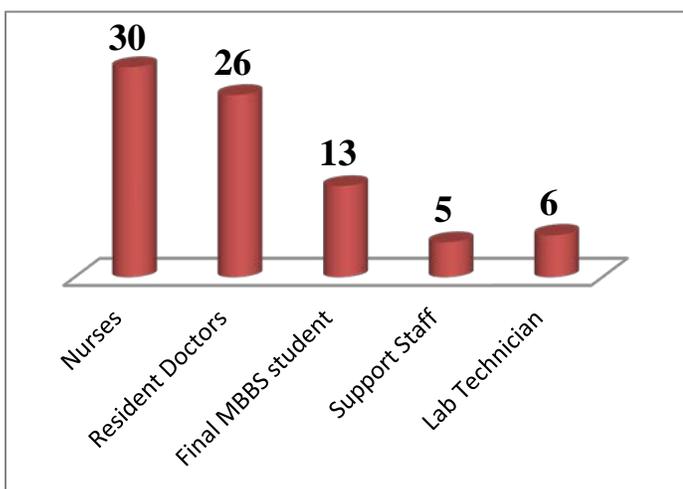


Figure 2 : HCWs including Final MBBS students studied. (n=80)

Figure 2 shows 80 Health care workers included in the study. Out of which 30 (37.5%) were Nurses, 26 (32.5%) were Resident Doctors, 13 (16.3%) were Final MBBS students, 5 (6.3%) were Support staffs and 6 (7.5%) were Laboratory Technicians.

Table 1: Isolation of different microorganisms from controls.(n=20)

Organisms	1	2	3	4	5	6
Palm Before hand hygiene						
Palm after hand hygiene						
Apron pocket /Table top						
Mobile						
Pen						
Key Board						
<i>Bacillus sp.</i>	8	-	9	5	3	5
Micrococci	1	2	5	6	4	6
CONS*	3	-	2	5	3	2
<i>Neisseria sp.</i>	4	1	2	4	2	3
<i>Klebsiella pneumoniae</i>	3	-	3	1	-	2
<i>Pseudomonas aeruginosa</i>	2	-	1	2	1	1
<i>Enterococcus faecalis</i>	1	-	-	1	-	-

CONS\* : Coagulase negative staphylococci

Table 1 shows isolation of different microorganisms from 20 controls. After hand hygiene the number of organisms became less. Even those who did not follow the steps properly, the non-pathogenic organisms like Micrococci, and *Neisseria sp* were grown. Amongst pathogenic organisms, *Klebsiella pneumoniae*, *Pseudomonas aeruginosa* and *Enterococcus faecalis* were grown from palm before hand washing and articles used by controls. 24 bacterial strains were isolated from mobile phones of controls. 19 bacterial strains were isolated from Keyboard of computer from controls, from 8 samples no organism was grown and mixed growth was observed from 4 samples. No Methicillin Resistant Coagulase negative Staphylococcus (MRCONS) and *Staphylococcus aureus* was isolated from controls. All CONS and *Enterococcus faecalis* isolated from controls were sensitive to Vancomycin and Linezolid. Out of 15 CONS 6 (40%) were Resistant to Penicillin.

Table 2: Isolation of different microorganisms from HCWs. (n=80)

Organisms	1 Palm Before hand hygiene	2 Palm After hand hygiene	3 Apron pocket	4 Mobile	5 Pen	6 Stethoscope*
<i>Bacillus sp.</i>	37	2	25	12	19	21
Micrococci	19	2	16	27	22	16
CONS*	9	1	10	7	5	8
<i>Staphylococcus aureus</i>	15	-	6	11	8	5
<i>Klebsiella pneumoniae</i>	17	-	7	9	12	7
<i>Pseudomonas aeruginosa</i>	7	-	4	8	5	5
<i>Enterococcus faecalis</i>	9	-	5	4	7	8
<i>Acinetobacter baumannii complex</i>	6	-	4	9	4	5
<i>E.coli</i>	6	-	2	3	3	2
<i>Neisseria sp.</i>	8	1	9	13	14	11
<i>Candida sp.</i>	11	-	4	6	7	6

Stethoscope\*: Swabs from diaphragm of stethoscope from 26 Resident doctors and 13 Final MBBS students were taken.

Table 2 shows isolation of different microorganisms from 80 HCWs. The number of bacterial strains isolated from HCWs' palm before hand hygiene were 144. Out of which 33 HCWs had single type of organisms, 30 HCWs had 2 Types of organisms and 17 HCWs had 3 types of organisms. Out of these 144 organisms, 89 (61.8%) were Gram positive organisms, 44(30.6%) were Gram negative organisms and 11 (7.6%) were *Candida species*.

Among the pathogenic Gram positive cocci a total number of 45 *Staphylococcus aureus*, 40 CONS and 33 *Enterococcus faecalis* were isolated from swabs collected from HCWs. Out of which 9 (20%) were Methicillin resistant *Staphylococcus aureus* (MRSA), 5 (12.5%) MRCONS. Amongst *Enterococcus faecalis*, 12 (36.4%) were High Level Aminoglycoside Resistant (HLAR). All the pathogenic Gram positive cocci were resistant to Penicillin and sensitive to Vancomycin and Linezolid.

Among the pathogenic Gram negative bacilli, a total number of 52 *Klebsiella pneumoniae*, 29 *Pseudomonas aeruginosa*, 28 *Acinetobacter baumannii complex* and 16

*E.coli* strains were isolated from swabs collected from HCWs. Out of these 125 pathogenic Gram negative bacilli, 47 (37.6%) were Extended Spectrum  $\beta$ -lactamase (ESBL) producers. Amongst these 47 ESBL producers 21(44.7%) were *Klebsiella pneumoniae*, 9 (19.1%) were *Pseudomonas aeruginosa*, 13 (27.7%) were *Acinetobacter baumannii complex* and 4 (8.5%) were *E.coli* strains. All (100%) pathogenic Gram negative bacilli were sensitive to Colistin. After Colistin, the highest sensitivity was observed with Imipenem i.e. 111(88.8%).

In our study, 34 *Candida sp.* were isolated from HCWs. Out of which 17 (50%) were *Candida tropicalis*, 10 (29.4%) were *Candida krusei* and 7 (20.6%) were *Candida albicans*.

### Discussion

The pathogenic bacteria on the hands of health Care Workers (HCWs) is considered as the main mode of transmission of Health Care Associated Infections (HAIs) [12]. In the present study, 80 HCWs and 20 Controls were studied for isolation of micro organisms from palm and articles commonly used by HCWs. The microorganisms isolated from palm before Hand Hygiene and after Hand Hygiene were compared. It was observed that 144 microorganisms were isolated from palm of HCWs before Hand Hygiene and only 6 microorganisms were isolated from palm of HCWs after Hand Hygiene. These 6 microorganisms are nonpathogenic organisms. In earlier studies the incidence of Methicillin resistance among CONS from Nurses hands ranged from 6-26% [13, 14]. In our study we found 9 (20%) *Staphylococcus aureus* were Methicillin resistant *Staphylococcus aureus* (MRSA) and 5 (12.5%) CONS were MRCONS isolated from palm of HCWs before Hand Hygiene.

Out of total 125 pathogenic Gram negative bacilli isolated from HCWs, 47 (37.6%) were Extended Spectrum  $\beta$ -lactamase (ESBL) producers. The most worrisome finding

was out of total 28 *Acinetobacter baumannii* complex strains isolated from HCWs, 13 (46.4%) were ESBL producers.

A total number of 34 *Candida* sp were isolated in our study. Out of which, 27(79.4%) were nonalbicans *Candida* sp and 7 (20.6%) were *Candida albicans*.

From Stethoscope of 26 Resident doctors and 13 Final MBBS students, a total number of 84 microorganisms were isolated. Even the mobiles are frequently used by HCWs while on duty. In the present study, 109 microorganisms were isolated from mobile phones.

Hence, if hand hygiene is not followed properly from hands, the articles used by HCWs can be easily contaminated and transmit the infecting microorganisms to the patients.

### Conclusion

Strict implementation of Infection Control Practices should be done in Health Care Set up to prevent transmission of microorganisms causing Health care Associated Infections (HAI).

### References

1. All egranzi B, Nejad S B et al. Burden of endemic Healthcare associated infection in developing countries: systematic review and meta-analysis. *Lancet*. Vol 377, 2011, p228-241.
2. WHO: Guidelines on Prevention and Control of Hospital Associated Infections. World Health Organization. South East Asian region. Geneva: WHO.2002.
3. Basak S, Rajurkar M N, Mallick S A, Attal RO. Infection Control Practices in Health Care Set-up. Chapter 1 In infection Control edited by Silpi Basak. Intech Publications, May 2013; p 3-29. (Online open access book) <http://dxdoi.org/10.5772/55029>
4. Klevens M R, Edwards J R, Richards JCL, Horan T C, Gaynes R P, Pollock D A, Cardo D M. Estimating health

care-associated infections and deaths in U S hospitals, 2002, Public Health Report. vol. 122, 2007, p160-166.

5. World Health Organization. Report on the burden of endemic health care-associated infections worldwide. WHO Document Production Services. 2011, 978-9-24150-150-7 Geneva.

6. Vincent J L. Nosocomial infections in adult intensive care units. *Lancet*, vol 361, 2003, p 2068-2077.

7. Childs D. Hospital Infections Kill More Than AIDS and Breast Cancer. Available at: <http://www.rense.general1741hosp.htm>.

8. World Health Organization Guideto Implementation of the WHO Multi model Hand Hygiene Improvement Strategy. Available at: <http://www.who.int/patientsafety/en/>.

9. Collee JG, Miles RS, Watt B. Ch. 7. Tests for identification of bacteria. Collee JG, Marimon BP, Fraser AG, Simmons A (eds) 14<sup>th</sup> ed. 2008, p131-149.

10. Bauer A W, Kirby WMM, Sherris J C, Jurek M. Antibiotic susceptibility testing by standardised single disc method. *Am. J. Clin. Pathol*. Vol 45, 1966; p493-496.

11. Clinical and Laboratory Standards Institute (CLSI). Performance Standards for Antimicrobial Susceptibility Testing. 26<sup>th</sup> ed. CLSI supplement M100S, M02-A12, Clinical and Laboratory Standards Institute, 950 West Valley Road, Suite 2500, Wayne Pennsylvania 19087 USA, 2016.

12. Singh S, Singh SA. Prevalence of bacteria contaminating the hands of health care workers during routine patient care: A hospital-based study. *Journal of the Academy of clinical Microbiologists*, vol 18, no.1, 2016, p 60-62.

13. Colburn NF, Cadnum J, Flannery F. et al. Perception vs Reality: Methicillin-Resistant *Staphylococcus aureus* Carriage Among Health Care Workers at a Veterans

Affairs Medical Center .Infect Control Hosp epidemiol.

Vol 3 , 2015, p 1-3.

14. Eksi F, Bayram A, Mehli Met al. Microbial flora on the hands of Health care Workers. African Journal of Microbiology Research, vol 4 no.22, 2010, p2343-2349.