

Prevalence of bacteria contaminating the hands of healthcare workers during routine patient care: A hospital-based study

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ABSTRACT

Background: The pathogenic bacterium on the hands of healthcare workers (HCWs) is considered as the main route of spread of nosocomial infections. The study was aimed to determine the bacterial contamination of hands of HCWs during routine patient care in a large teaching hospital. **Material and Methods:** This study includes a total of 200 consecutive, non-repetitive participants. Doctors, medical students, nurses and attendants from the Department of Anaesthesia and Department of Medicine of the hospital were included, who were actively providing health care. The informed consent was taken from all the participants of the study. The hand impressions of the participants were taken on 5% blood agar and processed as per guidelines. After taking the hand impressions, hand cleaning of each participant was done by standard preparation of 70% isopropyl alcohol-based hand rub. The hand impressions from the participants were again taken on 5% blood agar plates. **Results:** Out of 200 samples collected from HCWs, 95 (47.5%) samples showed growth of microorganisms. Most commonly isolated microorganism was *Staphylococcus aureus* present in 70% of nurses, 60% of students and 40% of attendants. Prevalence of *Acinetobacter* spp. was also found to be high among nurses (20%), followed by attendants, sweepers (16%) and doctors (4%). **Conclusions:** Hands of hospital staff are colonised with pathogenic bacteria, especially Gram-positive such as *S. aureus*. Hand hygiene is an effective method of reducing the bacterial flora on the hands of the HCWs.

Key words: *Acinetobacter* spp., bacterial contamination, healthcare workers, *Staphylococcus aureus*

INTRODUCTION

Healthcare-associated infections (HAIs) are a major concern in the hospitals and defined as infections that develop among patients after admission to the hospital, which was neither present nor in the incubation period at the time of hospitalisation. Such infections may become evident during their stay in the hospital or after a few days of discharge.^[1] HAIs are the major cause of morbidity and mortality of the patient and are responsible for a prolonged duration of stay which in turn increases the cost of healthcare and treatment, which is a big economic burden to the already overburdened economy of the developing countries.^[2] Several factors contribute to the occurrence and severity of these infections. These include compromised immune status of the host, invasive techniques and prevailing antimicrobial resistance of bacteria associated with hospital-acquired infections.^[3]

Hand hygiene is universally acknowledged to be the single most important measure to prevent cross-transmission of microorganism from one patient to another and preventing HAIs.^[4,5] It prevents transmission of pathogens through contact and faecal–oral route. It is one of the basic components of infection control programs. Hand rubbing with a waterless, alcohol-based rub-in cleanser is commonly used nowadays in hospitals instead of hand washing.^[6] Scientific evidence supports employment of hand rubs for routine hand hygiene. It is microbiologically more effective *in vitro* and *in vivo* and saves time, and preliminary data demonstrate better compliance than with hand washing.^[7]

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Hand hygiene has now been recognised as one of the most effective interventions to control the transmission of infections in a hospital.^[8] The proper use of hand hygiene techniques also needs continuing education.^[9] The display of posters provided by the World Health Organisation (WHO) is an effective tool of education. In addition, continuing medical education programs for all level of health care providers are important.^[10]

The present study was undertaken to demonstrate the presence of bacterial flora on the hands of healthcare workers (HCWs) and to observe the reduction of bacteria following hand hygiene measures.^[11]

MATERIAL AND METHODS

Aim

This study included a total of 200 consecutive, non-repetitive HCWs, working in Chhatrapati Shivaji Subharti Hospital, Meerut, from November 2011 to April 2012. Those included were doctors (50), students (50), nurses (50) and attendants (50) from the Department of Anaesthesia and Department of Medicine of the hospital who were actively providing health care. Informed consent was taken from all the participants of the study. All HCWs filled out an identical standardised questionnaire before and after training. The study was approved by the hospital's Ethics Committee as part of the quality assurance program of the division of infection control and hospital epidemiology.

Sample collection

The hand impressions of the participants were taken as sample as per guidelines. During the working hours of the participants, hand impressions were taken by touching the tip of fingers and thumb of both the right and left hands onto the surface of 5% blood agar plates. After taking the hand impressions, hand cleaning of each participant was done by standard preparation of 70% isopropyl alcohol-based hand rub. The hand impressions from the participants were again taken on 5% blood agar plates.

Sample processing

The hand impressions on the 5% blood agar plates were inoculated in whole plate using a sterile inoculating loop as per

the WHO guidelines on hand hygiene in health care.^[12] After inoculation, the plates were incubated aerobically at 37°C for 16–18 h. After obtaining the growth, the bacterial colony was counted in the both the plates of hand impressions taken before and after hand hygiene. The bacterial growths were identified as per standard protocol used for identification of bacteria in the bacteriology laboratory. The criteria used for identification of bacteria were colony morphology, Gram stain, catalase test (for Gram-positive cocci), coagulase test (for suspected *Staphylococcus aureus*) and other standard biochemical tests [Table 1].

Detection of Methicillin resistance among *Staphylococcus aureus* (Methicillin-resistant *Staphylococcus aureus*)

S. aureus was tested for Methicillin resistance using Cefoxitin (30 µg) disc as per the Clinical and Laboratory Standards Institute guidelines.^[13]

RESULTS

Out of 200 samples collected from HCWs, 106 (53%) samples showed no growth while 95 (47.5%) samples showed growth of microorganisms. Thirty doctors (60%) were colonised by coagulase-negative *Staphylococcus* (CoNS), whereas 35 nurses (70%) and 30 students (60%) were colonised by *S. aureus*. Most commonly isolated microorganism was *S. aureus* present in 35 (70%) of nurses, 30 (60%) students and 20 (40%) attendants. Among *S. aureus*, 50 (52.6%) were Methicillin-resistant *S. aureus* (MRSA) which was present among 20 (40%) of nurses, followed by students 18 (36%), attendants 8 (16%) and doctors 4 (8%). Prevalence of *Acinetobacter* spp. was also found to be highest among nurses 10 (20%), followed by students 8 (16%) and doctors 2 (4%). The prevalence rate of pathogenic bacteria is highest in nurses followed by students [Table 1].

Following hand hygiene procedure, the percentage reduction of growth of microorganism was almost 100% except growth of MRSA isolate in one student.

DISCUSSION

The number of bacteria carried on the hands is significant in persons working in a hospital environment as the environment,

Table 1: Distribution of bacterial isolates among the hospital staff before hand hygiene

Category of HCW	Bacterial growth in impressions of the fingertips of both hands (%)					
	<i>Staphylococcus aureus</i>	MRSA	CoNS	<i>Acinetobacter</i> spp.	<i>Klebsiella</i> spp.	<i>Escherichia coli</i>
Doctors (n=50)	10 (20)	04 (8)	30 (60)	02 (4)	0 (0)	0 (0)
Nurses (n=50)	35 (70)	20 (40)	10 (40)	10 (20)	06 (12)	0 (0)
Students (n=50)	30 (60)	18 (36)	14 (32)	08 (16)	06 (12)	02 (4)
Attendants (n=50)	20 (40)	08 (16)	20 (32)	0 (0)	0 (0)	0 (0)
Total (n=200)	95 (47.5)	50 (25)	74 (37)	20 (10)	12 (6)	2 (1)

MRSA: Methicillin-resistant *Staphylococcus aureus*, HCW: Healthcare worker, CoNS: Coagulase-negative *Staphylococcus*

and patients are colonised with bacteria. The majority of the bacteria were non-pathogenic. However, these can be significant in case of an immunocompromised host where the contamination with these bacteria may lead to invasive infections. *S. aureus* is an important pathogen responsible for HAIs all over the world.^[14] Rarely, Gram-negative bacteria such as *Klebsiella* spp., *Escherichia coli* or *Acinetobacter* spp. can be transient flora of the hands which may be acquired by touching contaminated surfaces or infected patients.

In the present study, 95 HCWs (47.5%) carried pathogens on the hand. *S. aureus* was isolated predominantly from 95 (47.5%) HCWs. Among 95 *S. aureus*, 50 (52.6%) were MRSA. MRSA is known to cause infections that lead to an increase in morbidity and mortality. Various studies have shown contamination of the hands of HCWs ranging from 3.78% to 25%.^[15-17]

CoNS, a resident flora, was also obtained in 74 (37%) of the HCWs. Mojtahedi *et al.* showed 21.7% CoNS isolates as part of the microbial flora of HCWs.

Among Gram-negative bacilli, most commonly obtained isolate was *Acinetobacter* spp. 20 (10%) followed by *Klebsiella* spp. 12 (6%) and *E. coli* 2 (1%). Khodavaisy *et al.* have showed *Klebsiella* spp. (12.5%) as the most commonly isolated Gram-negative followed by *Pseudomonas* spp. and *Acinetobacter* spp.^[17] Mojtahedi *et al.* have demonstrated *Pseudomonas* spp. (43.9%) as the most commonly isolated transient flora followed by *E. coli* and others.^[15]

This study also demonstrates that the pathogens are present on hands but can be reduced effectively by proper hand hygiene. It was demonstrated that there was 95–99% reduction in the bacterial load after proper hand hygiene.

CONCLUSIONS

Hands carry normal flora in most of the persons; however, in a hospital setting, the hands of the HCWs get colonised with pathogenic bacteria most commonly MRSA. Hand hygiene is an effective method of reducing the bacterial flora on the hands of the HCWs.

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Conflicts of interest

There are no conflicts of interest.

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