

## Research Article

# Are doctor's hands contributing in spreading nosocomial pathogens? Rapid appraisal from a tertiary care health center of Northern India

Shewtank Goel<sup>1</sup>, Rakesh Tank<sup>2</sup>, Abhishek Singh<sup>3\*</sup>, Sanjeev Kumar Khichi<sup>3</sup>, Ravi Bypareddy<sup>4</sup>,  
Pooja Goyal<sup>5</sup>, Jayaprakash Karkala<sup>6</sup>

<sup>1</sup>Department of Microbiology, Teerthanker Mahaveer Medical College and Research Centre, Moradabad, Uttar Pradesh, India

<sup>2</sup>Department of General Medicine, <sup>3</sup>Department of Community Medicine, SHKM Govt. Medical College, Mewat, Haryana, India

<sup>4</sup>Department of Ophthalmology, All India Institute of Medical Sciences, New Delhi, India

<sup>5</sup>Department of Community Medicine, ESIC Medical College, Faridabad, India

<sup>6</sup>Department of Forensic Medicine, AJIMS, Mangalore, Karnataka, India

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### \*Correspondence:

Dr. Abhishek Singh,

E-mail: mail2aks1@yahoo.co.in

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## ABSTRACT

**Background:** Clinical white coats have very long history of being a symbol of hope and healing for medical professionals; however there has been a concern that white coats may play a big role in transmitting infections within and outside hospital settings. Aim of the study was to assess pattern of pathogenic bacteria on the hands of doctors of a tertiary care hospital along with effect of hand wash on reduction of contamination.

**Methods:** The present study was a hospital based, cross sectional type. Eighty-six doctors of all designations (Junior doctors, n=51; and senior doctors, n=35) were included in this study. The swabs were taken at entry in the wards and also at exit from the wards without washing the hands. Then, swabs were taken after hand washing with tap water and subsequently after alcohol swabs. A total of four wards (2 General Medicine and Surgery wards each) included in the study. Isolated microorganisms were identified using Gram's stain, hemolysis patterns and colony morphology. The data were analyzed using MedCalc statistical software.

**Results:** *Staphylococcus aureus* was isolated in 24.41% at entry and in 52.33% at exit. Similarly *Pseudomonas aeruginosa* and *Klebsiella pneumonia* were not present on the hands of doctors at entry but isolated in 5.81% and 10.46% of doctors at exit. *Pseudomonas aeruginosa* and *Klebsiella pneumonia* were not present on the hands of doctors at entry in both medicine and surgery wards but isolated at exit. Complete removal/reduction of microorganism (100%) was recorded in *Escherichia coli* and *Candida sp* after tap water wash. Decrease in count of *Pseudomonas aeruginosa* up to 80.00% after tap water wash. 88.89 % decrease in microorganism after subsequent alcohol wash was seen in *Staphylococcus aureus*, Coagulase-negative *Staphylococci* and *Klebsiella pneumonia*.

**Conclusions:** It has been observed that simple hand washing (first with water and then with alcohol) is an effective tool to reduce the contamination significantly. Thus, hospital infection control practices including hand washing need to be followed strictly.

**Key words:** Nosocomial pathogens, Doctor, Hands, Patients, Ward and tertiary care hospital

## INTRODUCTION

Nosocomial infections occur worldwide, both in the developed and developing world. They are a significant burden to patients and public health. They are a major cause of death and increased morbidity in hospitalized patients.

The World Health Organization offers several definitions of a nosocomial infection/ hospital –acquired infection: An infection acquired in a hospital by a patient who was admitted for a reason other than that infection. An infection occurring in a patient in a hospital or other health care facility in whom the infection was not present or incubating at the time of admission.<sup>1</sup>

Person-to-person contact among medical staff and between medical staff and patients appears to be the most common route of transmission of virulent strains like *Staphylococcus aureus* (including methicillin-resistant *Staphylococcus aureus*, i.e. MRSA) and *Pseudomonas*.<sup>2</sup>

Simple hand washing has been shown to be effective in reducing the transmission of pathogenic bacteria and viruses among health care workers especially during outbreaks.<sup>3</sup> Many hand washing and scrubbing agents have been evaluated for their efficiency of hand disinfection. Alcohol based hand rubs consisting of ethanol, isopropanol or n-propanol has been shown to achieve between 3 to 6 mean log reductions of hand flora as compared to relatively lower effect by plain soap, chlorhexidine or triclosan hand washing agents.<sup>4</sup>

Clinical white coats have very long history of being a symbol of hope and healing for medical professionals; however there has been a concern that white coats may play a big role in transmitting infections within and outside hospital settings.<sup>5</sup>

The hands and stethoscopes of the doctors are long known as sources of bacterial transfer. Therefore the present study was planned and conducted in a tertiary care hospital in Farrukhabad to assess pattern of pathogenic bacteria on the hands of doctors of a tertiary care hospital along with effect of hand wash on reduction of contamination.

## METHODS

The present study was a hospital based cross sectional study. It was planned and executed in the department of microbiology of a tertiary care hospital in Farrukhabad district, India from February to May 2015. A total of four wards (2 General Medicine and Surgery wards each) included in the study. Eighty-six doctors of all designations (Junior doctors, n=51; and senior doctors, n=35) were included in this study.

The swabs were taken at entry in the wards and also at exit from the wards without washing the hands. Then,

swabs were taken after hand washing with tap water and subsequently after alcohol swabs. Thus, each doctor was sampled four-times for the study.

The samples were collected randomly and the participating doctor was not informed prior to sample collection. However, when a doctor was involved at entry to ward, he was not told about the subsequent swab tests at exit. The doctors who were tested were requested not to inform their colleagues about the study or protocol. Collecting samples of a doctor in front of another was avoided as far as possible.

However, in case two or three doctors came towards together, all were included in the study. This was done to ensure that the participants do not exercise any extra effort in cleaning their hands except their routine practice. List of doctors paying visit to wards was prepared in advance a week before in the departments of medicine and surgery. The names of the doctors to be tested were selected randomly from the duty roster. No one else was informed of the names. A doctor once selected was excluded subsequently.

The cotton swabs, moistened with sterile physiological saline, were used to collect samples from all the fingers and tip of nails, including finger-rings (if worn by the participants) of both hands. The swabs were immediately streaked onto two sets of three plates that consisted of nutrient agar, blood agar supplemented with 5% defibrinated sheep blood and MacConkey Agar.

A gram stain from the swabs was done prior to plating. In case the organism count was very low (<1/high-power field) the swab was cultured in nutrient broth. Plates were incubated as follows: one set aerobically at 37°C and the other set anaerobically for 48 h each. In case of nutrient broth, after 48 hours of incubation, again plating was carried out as above.

Isolated microorganisms were identified using Gram's stain, hemolysis patterns and colony morphology. Gram positive and negative organisms were classified by standard methods.<sup>6,7</sup>

Ethical committee approved the study. Informed consent was obtained from the study participants before sample collection. The data were analyzed using MedCalc statistical software. Results were expressed as percentages and proportions. Chi-square test was applied to test gender difference in perceived quality and satisfaction among study subjects. P value less than 0.05 was considered statistically significant.

## RESULTS

Out of total, swab taken did not show any growth in 34 and 9 doctors at entry and exit respectively. *Staphylococcus aureus* was isolated in 24.41% at entry and in 52.33% at exit. Similarly *Pseudomonas*

*aeruginosa* and *Klebsiella pneumonia* were not present on the hands of doctors at entry but isolated in 5.81% and

10.46% of doctors at exit (Table 1).

**Table 1: Patterns of organisms on the hands of doctors at entry and at exit.**

Organisms	Junior doctors				Senior doctors				Junior+Senior doctors			
	Entry		Exit		Entry		Exit		Entry		Exit	
	N	%	N	%	N	%	N	%	N	%	N	%
<i>Staphylococcus aureus</i>	14	27.45	25	49.02	7	20.00	20	57.14	21	24.41	45	52.33
<i>Coagulase-negative Staphylococci</i>	19	37.25	16	31.37	8	22.86	11	31.42	27	31.40	27	31.40
<i>Escherichia coli</i>	1	1.96	2	3.92	0	0	3	8.57	1	1.16	5	5.81
<i>Pseudomonas aeruginosa</i>	0	0	0	0	0	0	5	14.28	0	0	5	5.81
<i>Enterococci sp.</i>	1	1.96	6	11.76	2	5.71	5	14.28	3	3.49	11	12.79
<i>Klebsiella pneumonia</i>	0	0	7	13.72	0	0	2	5.71	0	0	9	10.46
<i>Candida sp.</i>	0	0	1	1.96	1	2.86	4	11.43	1	1.16	5	5.81
No growth	15	29.41	2	3.92	19	54.28	7	20.00	34	39.53	9	10.46

**Table 2: Patterns of organisms on the hands of doctors at entry and at exit of medicine and surgery wards.**

Organisms	Medicine wards				Surgery wards			
	Ward 1		Ward 2		Ward 1		Ward 2	
	Entry	Exit	Entry	Exit	Entry	Exit	Entry	Exit
<i>Staphylococcus aureus</i>	10	21	4	2	2	3	5	19
<i>Coagulase-negative Staphylococci</i>	7	12	2	4	4	4	14	7
<i>Escherichia coli</i>	0	3	0	1	1	1	0	0
<i>Pseudomonas aeruginosa</i>	0	2	0	1	0	1	0	1
<i>Enterococci sp.</i>	1	3	0	2	2	2	0	4
<i>Klebsiella pneumoniae</i>	0	2	0	2	0	1	0	4
<i>Candida sp.</i>	0	1	0	1	1	2	0	1
No growth	12	1	3	2	5	4	14	2

**Table 3: Number of subjects having organisms on hand swab at exit and the effect of hand wash (with tap water and subsequent alcohol wash) on decrease of contamination.**

Organisms	Doctors			Decrease in microorganism after tap water wash	Decrease in microorganism after subsequent alcohol wash
	Exit	After tap water wash	After alcohol wash		
<i>Staphylococcus aureus</i>	45	16	5	64.44 %	88.89 %
<i>Coagulase-negative Staphylococci</i>	27	9	3	66.67 %	88.89 %
<i>Escherichia coli</i>	5	0	0	100.00 %	Not Applicable
<i>Pseudomonas aeruginosa</i>	5	1	0	80.00 %	Not Applicable
<i>Enterococci sp.</i>	11	3	0	72.72 %	Not Applicable
<i>Klebsiella pneumoniae</i>	9	3	1	66.67 %	88.89 %
<i>Candida sp.</i>	5	0	0	100.00 %	Not Applicable

Out of total, swab taken did not show any growth in 12 and 3 doctors at entry and exit in medicine wards whereas swab taken did not show any growth in 5 and 14 doctors at entry and exit in surgery wards. *Staphylococcus aureus* was isolated in 21% and 3% at entry whereas isolated in 2% and 19% at exit in medicine and surgery wards

respectively. *Pseudomonas aeruginosa* and *Klebsiella pneumonia* were not present on the hands of doctors at entry in both medicine and surgery wards but isolated at exit (Table 2). Complete removal/reduction of microorganism (100%) was recorded in *Escherichia coli* and *Candida sp* after tap water wash. Decrease in count

of *Pseudomonas aeruginosa* up to 80.00% after tap water wash. 88.89% decrease in microorganism after subsequent alcohol wash was seen in *Staphylococcus aureus*, *Coagulase-negative Staphylococci* and *Klebsiella pneumonia* (Table 3).

## DISCUSSION

Nosocomial infections are a serious problem in hospitals causing increased morbidity and mortality among hospitalised patients. It significantly increases the patients' length of stay in hospital resulting in higher hospital costs. Studies investigating personal items such as mobile phones, wrist watches, stethoscopes, pens and ties of doctors have been shown to harbour nosocomial pathogens.<sup>8</sup>

In this study we observed that *Staphylococcus aureus* was isolated in 24.41% at entry and in 52.33% at exit. Similarly *Pseudomonas aeruginosa* and *Klebsiella pneumonia* were not present on the hands of doctors at entry but isolated in 5.81% and 10.46% of doctors at exit. In a study from Turkey, the rate of contamination was more than 90% and, in more than 10% of the cases, the contamination was polymicrobial.<sup>9</sup> In the same study, the rate of MRSA and ceftazidime-resistant bacteria isolation from the hands of health care workers was also high. The same conclusion was drawn from a study in Sri Lanka, when anesthetists were found to harbor bacteria like *Staphylococcus*.<sup>10</sup> In our study, a large proportion of doctors (31.82% at exit) were found to harbor two organisms.

This study revealed that complete removal/reduction of microorganism (100%) was recorded in *Escherichia coli* and *Candida sp* after tap water wash. Decrease in count of *Pseudomonas aeruginosa* up to 80.00% after tap water wash. 88.89% decrease in microorganism after subsequent alcohol wash was seen in *Staphylococcus aureus*, *Coagulase-negative Staphylococci* and *Klebsiella pneumonia*. It was demonstrated that simple tap water hand washing reduces the contamination rate significantly. Health care workers are notorious for their laxity in hand washing.<sup>11</sup> But, what such callousness can cause was shown by Peacock et al. in 1980 by the rapid spread of MRSA in a hospital.<sup>12</sup>

Hands have been implicated as one of the most important transmission source of nosocomial pathogens in the health care setting. Increased clinical activity has been shown to result in increase of total bacterial counts on the hands of medical staff.<sup>13</sup> Therefore maintaining good hand hygiene is important prior to patient handling. Further hand hygiene is considered to be a most simple, inexpensive and effective tool in reducing nosocomial infections. However studies on hand washing compliance, reveal a relatively low or moderate compliance rate (16% to 81%) among doctors and nurses in many countries.<sup>14</sup> An intensive therapy unit study showed that 40% of all patient–nurse interactions resulted

in transmission of *Klebsiella* to the hands of healthcare workers, lasting up to 150 min, even after contact as slight as touching a patient's shoulder.<sup>15</sup> Washing with soap and water virtually eradicated the organism.<sup>16</sup>

This study has several strengths. First, we have conducted this study to assess pattern of pathogenic bacteria on the hands of doctors of a tertiary care hospital along with effect of hand wash on reduction of contamination. This is very simple yet very significant issue. Second, paucity of literature also warranted this study. Third, data collection was done by authors itself to reduce inter observer variation. On the other hand, there have been a few limitations as well. First, small sample size is an evident limitation. Second, antibiotic susceptibility could not be done due to some reasons. Third, the findings emerging out of the current study cannot be generalized or extrapolated to all the hospitals of India.

## CONCLUSION

It was concluded that contaminated hands of doctors are important source of transmission of nosocomial pathogens in the health care setting. The study reveals that doctors are carriers of a large number of pathogens including multidrug resistant organisms. We observed that simple hand washing (first with water and then with alcohol) is an effective tool to reduce the contamination significantly. Thus, hospital infection control practices including hand washing need to be followed strictly.

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