White Coats as a Vehicle for Bacterial Dissemination

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ABSTRACT

Introduction: White coats are known to be potential transmitting agents of multi-drug resistant organisms. This study was conducted to determine the level and type of microbial contamination present on the white coats of medical students in order to assess the risk of transmission of pathogenic microorganisms by this route in a hospital setting.

Materials and Methods: A cross sectional survey of the bacterial contamination of white coats in a tertiary care hospital. 100 medical students working in various specialties were included in the study. Swabs were taken from 4 different areas of the white coat – collar, pocket, side and lapel and processed in the Microbiology department according to standard procedures.

Results: Although most of the white coats had been washed within the past 2 weeks, the sides of the coats were the most highly contaminated areas followed closely by the collar and pockets. Staphylococcus aureus was the most common isolate followed by coagulase negative Staphylococci and Gram negative non fermenters. Most of the Gram positive cocci were resistant to Penicillin, Erythromycin and Clindamycin.

Conclusion: White coats have been shown to harbor potential contaminants and may have a role in the nosocomial transmission of pathogenic microorganisms. Thus, a yearly purchase of white coats and the possession of two or more white coats at any point in time should be made compulsory. There is pressing need to promote scrupulous hand washing before and after attending patients and alternatives to white coats, including universal use of protective gowns, should be considered.

INTRODUCTION

White coats are worn primarily for identification, but there has always been some concern that white coats, like nurses' uniforms and other hospital garments, may play a part in transmitting pathogenic bacteria in a hospital setting, as white coats are known to be potentially contaminated with pathogenic drug resistant bacteria [1]. Since many medical colleges are closely attached to hospital environments and as there is no changing area in the hospitals, students wear their white coats on the way to their colleges and even in the non-clinical and non-practical classes, library, cafeteria and in the resting areas around their colleges. It is not uncommon to see white coats being left on chairs or being carried around outside the hospital premises [2].

It was the interest of this study to find out the level and the type of microbial contamination which was present on the medical student's white coats in our college, in order to assess the risk of transmission of the pathogenic organisms by this route in our hospital. The student's way of handling the coats and cleaning them, as well their perception towards white coat contamination also were investigated.

MATERIALS AND METHODS

This cross sectional study was conducted in the Department of Microbiology of a tertiary care hospital which was attached to a medical college. Approval from the institutional ethical committee was duly taken for this study. 100 undergraduate and postgraduate medical students and interns were randomly selected and they were included in this study, of which 65% were males and 35% were females. Of the 100, 83% were undergraduate students, 10% were interns and 7% were postgraduate students. All the students were working in the outpatient and the inpatient wards of our hospital. All the invited students were asked to read the questionnaire and to sign the consent forms.

A brief, self-administered, structured questionnaire was used to collect demographic data and information on the white coat laundering habits of the participants. The demographic variables included gender, place of staying, the subject's positions (student, intern or post-graduate), their current work locations (paediatrics, medicine, ophthalmology, ENT, skin and STD, microbiology, surgery, public health and obstetrics and gynaecology), the reason for wearing the white coat (to cover clothing, to appear professional, dress code of the hospital, for the usage of pockets or other), length of the usage of the coat (<1 year, 1-2 years, 2-3 years or > 3 years), when the coat was last washed (<3 days, 1 wk, 2-4 weeks or >1 month), the frequency of washing (<3 days, 1 week, 2-4 weeks or > 1 month), type of cleaning (home or laundry), washing agents used (soaps, liquid wash or disinfectants), number of white coats possessed (1, 2, 3 or >3), method of carrying the white coat (cover, bags, hands or shoulder), location of the use of the white coat (hospital only or hospital and college), the wearer's perception of whether the coat was dirty or clean and whether they believed if their white coats carried microbes and were the possible agents of the transmission of pathogens.

Swabs were taken from four different areas of the white coat (collar, pocket, sides and lapels). The swabs which were used were plain, cotton-tipped and sterilized swabs. Normal saline was used to moisten the swabs before collecting the sample by passing the swabs up and down twice on the desired areas and the swabs were sent immediately to the laboratory. The swabs which were received by the Department of Microbiology were

immediately streaked onto blood agar and McConkey's agar and the plates were incubated overnight at 37°C. The colonies which were obtained were identified by using standard techniques [3]. Antibiotic sensitivity testing was done by using Kirby Bauer's disc diffusion method as has been described in the CLSI guidelines 2011 [4].

RESULTS

Basic variables	Number of students (n=100)	%
Gender		
Male	65	65.0
Female	35	35.0
Staying		
Hostel	59	59.0
Home	41	41.0
Year of study		
Student	83	83.0
Intern	10	10.0
PG	7	7.0

[Table/Fig-1]: Basic variables of subjects included in the study

	Number of students (n=100)	%
The reason to wear white coat		
To cover clothing	4	4.0
To keep warm	0	0.0
To appear professional	67	67.0
Dress code of hospital	45	45.0
For usage of pockets	11	11.0
Any other	5	5.0
How do you carry your white coat		
Cover	16	16.0
Bag	80	80.0
Hands	3	3.0
Shoulder	1	1.0
Frequency of usage of white coats		
Only hospital	82	82.0
Hospital & college	18	18.0

[Table/Fig-2]: Attitude towards white coat

When was your white coat last washed	Number of students	%
3 days or less	39	39.0
1 week	32	32.0
2-4 week	26	26.0
1 month or more	3	3.0
How often do you wash your white coat		
Once in 3 days	18	18.0
Once in week	42	42.0
2-4 weeks	27	27.0
More than a month	13	13.0
Type of cleaning		
Laundry	11	11.0
Home wash	89	89.0

[Table/Fig-3]: Practice of washing lab coat

Do you perceive your white coat to be clean if if it has no stains	Number of students	%
No	46	68.0
Yes	32	32.0
Do you perceive your white coat to be clean if collar and pockets are clean		
No	55	55.0
Yes	45	45.0
Do you consider your white coat to be contaminated with or without stains		
No	77	77.0
Yes	23	23.0
Do you think your white coat carries germs		
No	8	8.0
Yes	92	92.0
Do you believe that white coats can be a potential transmitting agent for pathogens:		
No	9	9.0
Yes	91	91.0

[Table/Fig-4]: Knowledge with regards to white coat

Organism	Collar	Pocket	Side	Lapel	Total
Staphylococcus aureus	25	23	26	17	91
Coagulase negative Staphylococci	4	6	5	3	18
Pseudomonas aeruginosa	4	4	6	5	19
Total	33 (25.8%)	33 (25.8%)	37 (28.9%)	25 (19.5%)	128

[Table/Fig-5]: Sites from which organisms were isolated

S. No.	Organism(s)	Number of isolates	Percentage of isolates
1.	Staphylococcus aureus	44	64.7%
2.	Coagulase negative Staphylococci	7	10.3%
3.	Pseudomonas aeruginosa	3	4.4%
4.	Staphylococcus aureus + Coagulase negative Staphylococci	5	7.3%
5.	Staphylococcus aureus + Pseudomonas aeruginosa	5	7.3%
6.	Coagulase negative Staphylococci + Pseudomonas aeruginosa	3	4.4%
7.	Staphylococcus aureus + Coagulase negative Staphylococci + Pseudomonas aeruginosa	1	1.6%

[Table/Fig-6]: Organism isolated from white coats

S. No.	Antibiotic	Resistant	Percentage	Sensitive	Percentage
1	Penicillin G	89	81.6%	20	18.4%
2.	Erythromycin	77	70.6%	32	29.4%
3.	Clindamycin	64	58.7%	45	41.3%
4.	Amoxi-Clav	13	11.9%	96	88.1%
5.	Ciprofloxacin	11	10.0%	98	90.0%
6.	Cefoxitin	5	4.6%	104	95.4%
7.	Vancomycin	0	0%	109	100%

[Table/Fig-7]: Sensitivity pattern of Gram positive cocci isolated from white coats

DISCUSSION

Traditionally, the white coat is thought to bring credibility and dignity to the medical profession [2]. However, white coats have been shown to harbour potential contaminants [1,2, 5,6] and so these may have a role in the nosocomial transmission of pathogenic microorganisms. The high rates of the bacterial contamination of white coats may be associated with the following 2 facts: Firstly, patients continuously shed infectious microorganisms in the hospital environment, and the health care providers are in constant contact with these patients. Secondly, it has been demonstrated that microorganisms can survive between 10 and 98 days on fabrics which are used to make white coats, which include cotton, cotton and polyester, or polyester materials [7,8].

Our hospitals were tertiary care hospitals which were attached to a medical college and a research institute, where the incidence of the nosocomial infections was approximately 10%. All the medical students worked in the clinical wards from the 2nd phase and examined patients. These students indiscriminately used the white coats even outside the hospital premises. Since white coats are implicated as major fomites in the transmission of nosocomial infections, we studied 100 medical students who were working in various specialities. Most of them i.e., 83 were undergraduates, 10 were interns and the remaining 7 were postgraduate students. Of the 65 white coats which belonged to the male subjects, 47(74.3%) were contaminated, while of the 35 white coats which belonged to the female subjects, 22(62.8%) were contaminated. This was in contrast to the findings of a study which was conducted by Muhadi et al., [2] who found in their study, that the coats of females tended to be more contaminated.

The medical students who were residing at home tended to have white coats that were more contaminated (72.9%), whereas those who were residing in the hostel had less contaminated coats (63.1%), which was a worrying prospect, as the hospital organisms were likely to spread in the community. Most of the students were of the opinion that white coats were worn to appear professional (67%) and because it was the dress code of the hospital (45%). However, 82 of the subjects used their white coats only in the hospital premises, while the other 18 used it outside the hospital premises too. Although both the clinical and the non-clinical students had a high level of awareness regarding the contamination of the white coats, they still wore it in different areas of the college such as the library, reading rooms, canteen, classes and even outside the hospital premises when it was not necessary. Providing students with changing areas in at the hospital site may reduce their frequency of using the white coats in the college and in the non-clinical areas [2].

Even though the subjects perceived their white coats to be clean, even without stains, 91 were aware that the coats could act as a mode of transmission of the hospital's pathogenic organisms. The data from the washing practices of the students revealed that most of the students had washed their white coats within the past 1 week (71%). In spite of this, the contamination was high (62%-78%), irrespective of the time gap since the last wash. This was similar to the findings of a study which was done by Wong et al., [1], who found that the microbial counts did not vary with the time in the use of the white coats. A steady state of maximal microbial contamination was attained within the first week of use of the coats and this did not change significantly thereafter. 89 of the white coats were washed at home, whereas 11 were washed in a laundry. The degree of contamination was similar in both the sets.

In the present study, Staphylococcus aureus was the major pathogen which was isolated (64.7%), which is similar to that which was found in the studies of Muhadi et al., [2], Treakle et al., [9] and Wong et al., [1] and different from the findings of a study which was done by Uneke et al., [7], in which diphtheroids were the most common organisms which were isolated. The antimicrobial susceptibility pattern of the gram positive cocci revealed that most of them were resistant to Penicillin (81.6%), Erythromycin (70.6%) and Clindmycin (58.7%). This is consistent with the susceptibility pattern of similar organisms which were isolated from suspected nosocomial infections in our hospital and this indicated a possible link between the contamination of the white coats and the transmission of infections to the susceptible patients. In our study, MRSA was isolated from 4 white coats, which was significantly lower than that which was reported Uneke et al., [7] but similar to the findings of a study which was done by Treakle et al., [9], who reported no MRSA isolation from the white coats.

Coagulase negative Staphylococci were also isolated (10.3%), which are skin commensals and these can be potentially infectious to the patients who are admitted in the hospital. Gram negative bacilli were isolated from the white coats, but these were also significantly lesser in number but were also potentially infectious, as was reported by Zachary, 2001 and Grabsch 2006 [2, 5, 10,11].

Our study has several limitations. Firstly, the sample size was small and statistically significant differences between the colonized and the uncolonized coats could not be brought out. Secondly, the use of swabs for obtaining the samples may have been less effective than using the sweep plate method, as was done in some previous studies. Also, since the swabbing was done by the participant himself/herself, the sufficiency of the time of contact could not be established. Lastly, our study did not include a control group of non-worn white coats and thus the possibility of the coats being contaminated prior to their use could not be ruled out. However, that would have no bearing on the fact that the coats were contaminated with potentially pathogenic organisms and that they could function as fomites for the transmission of pathogenic organisms [9].

The following suggestions may be made on the basis of the findings of this investigation. Firstly, a yearly purchase of white coats and the possession of 2 or more white coats at any point of time should be made compulsory. The wearers of the white coats should be encouraged to wash their white coats weekly. This study provides microbiological evidence to support the exclusion of white coats from the nonclinical areas of the hospital such as the libraries and the dining rooms. A number of earlier studies had demonstrated that the compliance with the hand-hygiene protocols among all the healthcare workers, including the physicians, was poor [7]. A lack of hand hygiene undoubtedly enhances the contamination of the white coats, since they are often touched by the physicians in the course of their work. As a result, there is a pressing need to promote a scrupulous hand washing among the physicians before and after they attended to patients and also to promote alternatives to the white coats, which includes the universal use of protective gowns.

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