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Short Communication

The Medical Overcoat – Is It a Transmitting Agent for Bacterial Pathogens?

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SUMMARY: The aim of this study was to isolate, identify and compare the pathogenic bacteria prevalent on the overcoats of doctors, residents and students from medical and surgical wards, to determine their antimicrobial sensitivity, compare them with isolates from pus collected over the same period, and ultimately make recommendations. Using standard procedures, bacteria were isolated and identified from the hem and pocket mouths of the overcoats of 80 medical personnel, and drug sensitivity tests were carried out. Of the samples from the overcoats, 95% (n = 152) were positive for bacterial isolates like *Pseudomonas aeruginosa*, *Klebsiella* sp., *Escherichia coli*, non-fermenting Gram-negative bacteria, *Staphylococcus aureus*, etc. Six swabs showed double isolates. There was a significant (P = 0.014) association with the category of the participants (30/34 from doctors, 44/48 from residents and 78/78 from students). The isolates were significantly (P < 0.001) more prevalent on overcoats from surgical wards (n = 98, 100%) than on those from medical wards (n = 54, 87%). The pathogens from medical overcoats and those from pus samples were both multidrug resistant, though they were not similar. Hence overcoats may be a transmitting agent for bacterial pathogens. Doctors should be aware of the proper usage and frequency of laundering of overcoats.

The protective effect of the white coat is often overestimated (1). The role of garments as a source of infection has been studied (2-4) with the focus on overcoats of either doctors (2) or medical students (3) only. The present study was undertaken to isolate, identify and compare the pathogenic bacteria prevalent in the overcoats of doctors, residents and students from medical and surgical wards, to determine their antimicrobial sensitivity, compare them with isolates from pus collected over the same period, and to ultimately make recommendations.

A cross-sectional study was designed involving 80 personnel (doctors = 17, residents = 24 and students = 39) from the medical (n = 31) and surgical wards (n = 49) of Government Rajaji Hospital, a tertiary multispeciality hospital of 2,200 beds with a bed occupancy rate of 95% that is affiliated with Madurai Medical College, Madurai, Tamilnadu, India. The capacities of the male and female wards in every unit were 20 and 10 beds, respectively, and the physicians (doctors and residents) were in charge of 10 patients each.

The overcoats used were invariably half-sleeved, white in color, made of cotton-polyester material, and had two pockets at the bottom, one on each side. The overcoats were sampled using sterile-saline-moistened swabs from the hem and pocket mouths (Figure 1). Pus samples were collected from the patients with open wounds in the wards of the doctors included in the study. The samples were transported to the Microbiology Department within 30 min without any transport medium being employed, inoculated into appropriate solid and liquid media while adhering to all sterile precautions, and incubated overnight to facilitate the growth of the organisms. The colonies on solid media were identified by biochemical methods. Plates showing no growth after 48 h of incubation were declared negative. Sensitivity tests were performed using Kirby Bauer's disc diffusion method for the antimicrobials commonly used in the hospital. The antimicrobial sensitivity of the isolates from the pus and overcoats was compared. A pre-tested self-administered anonymous questionnaire was also distributed to the participants to determine overcoat usage. Association was tested with a chi-square test. The SPSS software package (Windows version 14; SPSS, Chicago, Ill., USA) was used for all statistical analyses, and a P-value < 0.05 was considered significant.

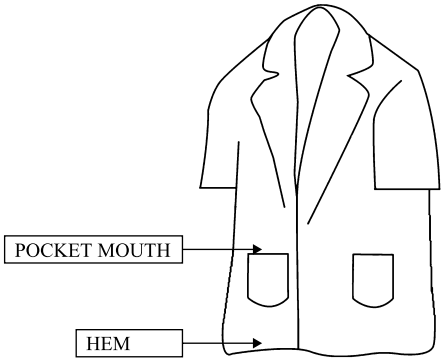

Fig. 1. Overcoat showing sites of sampling.

Of the samples from overcoats, 95% (152/160) were positive for one or the other bacteria (30/34 from doctors, 44/48 from residents and 78/78 from students). Six of these showed double isolates. Out of the 158 isolates, 82 (51.90%) were from the hem and 76 (48.10%) from the pocket mouths. The isolates obtained were non-fermenting Gram-negative bacilli (20.25%), *Coliforms* (13.29%), *Pseudomonas aeruginosa* (10.76%), *Klebsiella aerogenes* (6.96%), *Citrobacter* sp. (4.43%), *Micrococcus* (3.8%), *Escherichia coli* (3.16%), *Staphylococcus epidermidis* (15.82%), *Staphylococcus aureus* (1.27%) and aerobic spore bearers (20.25%). The percentage of culture positive samples was significantly (P < 0.001) higher in the samples from surgical wards (n = 98, 100%) than

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Table 1. Antimicrobial resistance pattern by percentage

	Klebsiella		*E. coli*		NFGNB		*Coliforms*		*Citrobacter*		*Pseudomonas*		*S. epidermidis*		*S. aureus*	
	Coat (10)	Pus (44)	Coat (2)	Pus (15)	Coat (15)	Pus (17)	Coat (17)	Pus (10)	Coat (5)	Pus (14)	Coat (14)	Pus (19)	Coat (16)	Pus (16)	Coat (2)	Pus (18)
Cotrimoxazole	40	84.1	0	93.3	53.3	76.5	11.8	70	80	85.7	50	89.5	37.5	81.3	0	66.7
Ciprofloxacin	40	81.8	0	93.3	46.7	76.5	5.9	80	0	92.9	0	63.2	25	81.3	0	66.7
Ampicillin	90	93.2	50	100	93.3	94.1	41.2	100	100	100	57.1	94.7	81.3	87.5	50	100
Cloxacillin	–	–	–	–	–	–	–	–	–	–	–	–	75	81.3	0	88.9
Cephelexin	70	95.5	0	100	80	94.1	11.8	90	100	92.9	21.4	100	75	81.3	0	77.8
Cefotaxime	30	84.1	0	93.3	46.7	76.5	0	50	20	85.7	0	78.9	50	56.3	0	77.8
Ceftriaxone	50	88.6	0	93.3	53.3	88.2	5.9	70	20	78.6	71.4	78.9	75	75	0	77.8
Gentamicin	20	70.5	50	93.3	13.3	82.4	11.8	90	0	78.6	21.4	73.7	43.8	87.5	50	55.6
Amikacin	20	50	0	40	26.7	35.3	11.8	40	0	42.9	0	57.9	–	–	–	–
Doxycycline	10	77.3	0	86.7	13.3	70.6	0	60	80	64.3	35.7	94.7	12.5	50	0	66.7
Erythromycin	–	–	–	–	–	–	–	–	–	–	–	–	75	100	50	100

NFGNB, Non- fermenting Gram-negative bacilli.
Figures in parenthesis indicate number of isolates.

in those from medical wards (n = 54, 87%). A comparison of the antimicrobial resistance pattern of isolates from overcoats and pus is given in Table 1.

The questionnaire survey revealed that while 62.5% (n = 50) of the participants were aware of the overcoat as a potential agent in the transmission of microbes, only 22.5% (n = 18) used separate overcoats for post-operative and high risk wards, and 47.5% (n = 38) exchanged overcoats with their colleagues. Further, 87.5% (n = 70) carried their overcoats back home and only 27.5% (n = 22) left their overcoats at the hospital.

Moreover, 42.5% of participants washed their overcoats within 4 days of usage, 52.5% between 5 and 7 days, while the rest washed them once a month. The percentage of bacterial isolates increased with the duration of usage of the overcoat. For instance, in overcoats used for up to 3 days and in those used for 15-30 days, the percentage of isolates of *Klebsiella* increased from 5.36 to 9.09%, non-fermenting Gram-negative bacilli from 12.5 to 27.27%, *Coliforms* from 14.29% to 18.52% and *Pseudomonas* from 8.93 to 12.12%.

The percentage of isolates was the same (95%) in both the hems and the pocket mouths of overcoats. However, *K. aerogenes* and *S. epidermidis* were isolated more from pockets than from hems, while *E. coli* was isolated only from the hems. This variation could be related to the frequent contact of hems with the patients' beds and the exposure of pockets to infectious materials handled with the hands.

During the period of study, the pathogens isolated were mainly non-fermenting Gram-negative bacilli, *Coliforms* and *P. aeruginosa*. Only 1.27 % of the isolates were *S. aureus* in this study, in contrast to 25 % in the reference study where pathogenic Gram-negative bacilli were not isolated (2). This may be due to the varied hygienic conditions prevalent in this hospital environment.

Positive samples were more from students followed by residents and doctors and the association was significant (P = 0.014). This can be attributed to the long hours of usage by students, their visits to various wards for learning purposes, irregular laundering, and their habit of carrying them outside while traveling. The significantly ($P < 0.001$) higher percentage of isolates from surgical wards is attributable to the types of cases admitted in surgical wards like open wounds, ulcers, etc.

An increased count of pathogenic bacteria was observed in overcoats used for longer durations without being laundered. This result is in contrast with the previous study, which suggested that contamination of the protective clothing did not increase when it was used over periods of up to 11 days (4). Further, it is documented that nosocomial bacteria can survive for many days on hospital fabrics (5). Hence, the importance of the regular laundering of overcoats, at least once in 3 days, is stressed.

Though the organisms isolated from coat and pus samples were both multidrug resistant, their antimicrobial sensitivity patterns differed markedly, suggesting that the bacteria in the overcoats could have been picked up from other sources, especially from the environment – the canteen, auditorium, college, roads, during travel and hostel rooms/homes where the overcoats were usually carried. Further typing, including molecular typing of the organisms, could not be carried out due to technical constraints.

Educating health professionals on the consequences of nosocomial infections, and advocating simple preventive measures such as washing hands before and after patient examination, using sterile aprons in post-operative wards, laundering overcoats at least once in 3 days and leaving them at the hospital would help to reduce the occurrence of bacterial contamination through overcoats.

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