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Isolation of pathogenic bacteria from hospital staff apparel in Nigeria

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Abstract

A survey of bacteria contamination of hospital staff apparel in use in Anambra State, Nigeria, was carried out to determine the extent of contamination by clinically important bacteria. Of a total of 125 swab samples of hospital staff apparel, 72 (58%) showed bacterial contamination including 32 (70%) of 46 samples from hand gloves, 28 of 45 (62%) samples from protective gowns, and 12 of 34 (35%) samples from face-shields. The potentially pathogenic bacteria isolated were *Salmonella spp, Proteus vulgaris, Shigella dysenteriae, Pseudomonas aeruginosa* and *Staphylococcus aureus*. The isolation of clinically important bacteria from the apparel suggests the need for improved infection control measures.

Introduction

Nosocomial infections or infections acquired in hospital are likely to be common in developing countries and an important cause of morbidity and mortality. Otero (1) inferred that the most important and most frequent mode of transmission of nosocomial infections is by contact and it is recognized that many hospital-acquired infections are preventable. Transmission of infection within health care facilities has been widely reported (2-6). The International Society for Infectious Diseases has produced guidelines in an effort to minimize the incidence of nosocomial infections and the associated problems providing practical measures intended to improve quality of patient care, minimize risk and reduce costs in the hospital. Various types of gowns and other protective apparel are worn to provide barrier protection for the personnel and reduce transmission of pathogens. However, it is possible that such apparel could be sources for nosocomial infections. (7-11) A recent study reported that 65% of nurses who had performed patient care activities on patient with methicillin-resistant *Staphylococcus aureus* (MRSA) in a wound or urine contaminated their nursing uniforms or gowns with MRSA. (8) The objective of this study was to evaluate the bacteria contamination of hospital staff apparel worn by personnel while attending to patients in Nigerian hospitals.

Materials and Methods

Sample Collection

Sterile cotton wool swab sticks wetted by dipping in normal saline were used to collect samples from hospital staff apparel. A total of 125 samples comprising 45 samples from protective gowns, 46 samples from hand groves and 34 samples from face-shield were collected. The samples were collected from apparel worn by hospital personnel at the maternity ward, male and female convalescing wards, laboratory units, surgical theaters, dental and pharmacy units of Amaku General Hospital, Awka and Nnamdi Azikiwe University Teaching Hospital, Nnewi, all in Anambra State, Nigeria. As many portions as possible of each of the apparel were swabbed and more than one swab stick was used for each apparel. The swab samples were sent to the laboratory for analysis.

Isolation Procedure

The swab samples were each used within two hours of their collection to inoculate plates of nutrient agar (oxoid), blood agar (oxoid) MacConkey agar (LAB M) Deoxycholate citrate agar (DCA) (LAB M) and tubes of nutrient broth. The plates and the tubes were incubated for 24h at 37°C. Bacteria colonies that developed on the plates were isolated while the nutrient broth culture was used to inoculate fresh plates of blood agar, MacConkey agar, DCA and tubes of selenite F broth. The plates and tubes were incubated for 24 h at 37°C. Bacteria colonies that developed on the plates were again isolated while the Selenite – F broth culture was used to inoculate fresh plates of DCA, which were incubated for 24h at 37°C after which colonies that developed were isolated. Salmonella-like colonies that developed on DCA plates were sub-cultured into Tripple sugar iron agar (TSIA) (LAB M) slants, urea agar slant, lysine broth and incubated for 24h at 37°C.

All the isolates were obtained in pure cultures and biochemical tests were used to identity them (12,13,14,15). Serological characterization by standard slide agglutination test Liu *et al.* (16), Collee et al (14) using commercial polyvalent O, H and specific antisera was used to enhance the speciation of some of the clinically important isolates. The polyvalent O and H specific antisera were used to speciate Salmonella while only O anti-sera was used to speciate Pseudomonas. The characteristic musty odour, the distinctive greenish-blue appearance of the colony and the surrounding medium, the oxidase test, lysine decarboxylation and gelatinase test were some of the basic morphological and biochemical tests used to identify *Pseudomonas*. The tube and slide coagulase test were among the tests used to identify Staphylococcus.

Results

Of a total of 125 swab samples of hospital staff apparel, 72 (58%) showed bacterial contamination including 32 (70%) of 46 samples from hand gloves, 28 of 45 (62%) samples from protective gowns, and 12 of 34 (35%) samples from face-shields. The types of bacteria isolated and the rate of their isolation from the different apparel are presented in table 1.

Table 1: Types of bacteria and the rate of their isolation from hospital staff apparel

BACTERIA ISOLATED	PROTECTIVE GOWNS N = 45		FACE SHIELD N = 34		HANDGLOVE N = 46		TOTAL N = 125
	N	%	N	%	N	%	Overall percent isolation rate
Escherichia coli	3	6.7	0	0	6	13.0	7.2
Enterobacter spp	5	11.1	0	0	5	10.8	8.0
Bacillus spp	8	17.8	6	17.6	4	8.7	14.4
Shigella dysenteriae	0	0	0	0	1	2.2	0.8
Klebsiella aerogenes	2	4.4	0	0	2	4.3	3.2
Citrobacter spp	6	13.3	3	8.8	4	8.7	10.4
Proteus vulgaris	0	0	0	0	2	4.3	1.6
Salmonella spp	0	0	0	0	2	4.3	1.6
Pseudomonas aeruginosa	3	6.7	0	0	4	8.7	5.6
Staphylococcus aureus	1	2.2	3	8.8	2	4.3	4.8

Staphylococcus aureus and *Bacillus* spp were isolated from the three types of apparel examined and *Bacillus* spp had the highest over all isolation rate (14.4%). The clinically important bacteria isolated from the apparel include: *Staphylococcus aureus, Shigella spp, Proteus spp, Klebsiella spp, Pseudomonas spp* and *Salmonella spp*. The only *Shigella spp* isolated was identified as *Shigella dysenteriae,* isolated from gloves in use on the female ward. *Pseudomonas aeruginosa* was isolated from gowns in use in the laboratory, and gloves in the pharmacy unit and male convalescing wards. Proteus *vulgaris* was isolated from hand gloves at the female ward and the isolates were identified as. *Klebsiella aerogenes* was isolated from gowns and gloves at both male and female wards. *Salmonella spp* were isolated from gloves in use on the female ward and the isolates were identified as *S. enteritidis* and *S. typhimurium. Bacillus spp* were isolated from all the sections of the two hospitals from where samples were collected except the surgical theatre unit.

Discussion

This study found that hospital staff apparel are variously contaminated by bacteria many of which are recognized pathogens. Although the direct involvement of hospital staff apparel in a case of disease transmission was not investigated in this work, the isolation of *Salmonella spp, Proteus vulgaris, Shigella dysenteriae, Pseudomonas aeruginosa* and *Staphylococcus aureus* is a concern for possible nosocomial transmission. Apparel is an example of a fomite and Prescott et al (17) noted that formites are involved in the transmission of pathogens in health care environments. Lucas and Mendes (2), isolated similar organisms in addition to *Streptococcus faecalis, Micrococcus spp* and *Alkaligenes faecalis* from sanitary dressings.

The isolation of *P. aeruginosa* from protective gowns and hand gloves may be important epidemiologically. *P. aeruginosa* has been shown to be a very important opportunistic pathogen in hospitals and its opportunistic ability has been demonstrated especially in patients with burns or eye problems. Duguid *et al,* (3), reported that the presence of *P. aeruginosa* in ward air, dust and in eschar shed from the burns, suggests that its infection may be airborne. They however reported also that contact spread has been demonstrated and transmission may occur directly or indirectly via the hands of medical staff or contaminated apparatus. *P. aeruginosa* has also been shown to be resistant to some of the common disinfectants used in hospitals. It should be remembered that some of the patients in the hospital environment are immunocompromised.

Face-shields are supposed to be used once and hand gloves changed after attending to one patient. But we observed during the sampling that face-shields and hand gloves are used and reused. We also noticed that some of the protective gowns were left on the workbenches in the lab or under the drawers of the bench. It was also observed that once the packet of face-shield or hand glove is opened, the entrance of dust particles inside the packets is no longer guaranteed. These may explain why *Bacillus spp* were isolated in higher numbers from the three types of apparel examined as they are easily transmitted via dust.

The isolation of many members of the enterobacteriaceae may be as a result of untreated water sources in the hospitals and or due to poor hygienic practices in the wards more so as many of the isolations were made from samples collected from the wards. Some of the visitors especially those who attend their sick relatives at the hospitals may be sources of transfer of these enteric organisms to the health care facilities. The isolation of *Staphylococcus aureus* from the three types of apparel considered may be a consequence of their carriage by hospital personnel.

This work suggests that there are poor hygienic practices in some of our hospitals and the apparel is not adequately cared for. The isolation of these potentially pathogenic bacteria from the apparel suggests that they should be used and handled more carefully in hospital environments to avoid their being involved in nosocomial infection. It is recommended that face-shields and hand gloves should not be re-used even after being treated with disinfectant except the ones sterilized by autoclaving. Hands should be washed with water and detergents after using or handling apparel on routine basis.

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