

Original article

Antibiotics Susceptibility Profile of *Staphylococcus Aureus* Isolated from the Anterior Nares of Hospital Personnel in Yaounde, Cameroon.

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Abstract:

PURPOSE / AIM

Hospital personnel are often colonized with resistant strains of *Staphylococcus aureus* (SA). These strains could be transmitted to patients, complicating treatment options particularly in resource-limited areas where antimicrobial susceptibility assessment is not systematic. In view of guiding empiric treatment in such patients, we assessed antimicrobial susceptibility profile of *Staphylococcus aureus* isolated from the anterior nares of hospital personnel of three health institutions in Yaounde, Cameroon in a cross sectional study. We also assessed risk factors associated with the presence of Methicillin Resistant *Staphylococcus aureus* (MRSA).

METHODS

The antibiotic susceptibility profile of fifty eight *Staphylococcus aureus* strains isolated from hospital personnel to sixteen commonly used antibiotics was assessed using the Kirby Bauer disk diffusion method. Methicillin resistant strains were determined by the Oxacillin Minimum Inhibitory concentration technique.

RESULTS

All the isolates were resistant to penicillin, ampicillin, and amikacin. No resistance was recorded for netilmicin, vancomycin, and low for gentamicin, rifampin and cephalotin. Eight (13.8%) of the isolates were found to be MRSA. We found 85% of MRSA to be resistant to more than six of the tested antibiotics. No association was found between demographic variables or personal habits and nasal colonization with methicillin-resistant strains.

CONCLUSION

A relatively high proportion of *Staphylococcus aureus* isolates in this study were resistant to commonly used antibiotics. This calls for regular monitoring of susceptibility patterns.

KEY WORDS:

Staphylococcus aureus, Hospital personnel, resistance, MRSA

Résumé :

OBJECTIFS

Les professionnels exerçant en milieu hospitalier sont le plus souvent colonisés par des souches résistantes de *Staphylococcus aureus* (SA) qui peuvent être transmises aux patients, compliquant ainsi la prise en charge thérapeutique, surtout en situation de ressources limitées ou l'évaluation de la susceptibilité bactérienne aux antimicrobiens n'est pas systématique. Dans l'optique d'optimiser le traitement chez ces patients, une étude transversale a été menée pour évaluer le profil de susceptibilité antimicrobienne du *Staphylococcus aureus* isolés des narines antérieures du personnel hospitalier dans trois formations sanitaires de Yaoundé, Cameroun. Nous avons aussi étudié les facteurs de risque associés à la résistance du *Staphylococcus aureus* à la méticilline.

MÉTHODES

Le profil de susceptibilité des souches de *Staphylococcus aureus* à 16 antibiotiques couramment utilisés au Cameroun a été étudié chez 58 personnels hospitaliers à l'aide de la méthode des disques de diffusion de Kirby Bauer. La résistance du *Staphylococcus aureus* à la méticilline a été déterminée par la technique de Concentration Inhibitrice Minimale d'Oxacilline.

RÉSULTATS

Tous les isolats étaient résistants à la pénicilline, l'ampicilline, et à l'amikacine. Aucune résistance n'a été observée à la netilmicine, la vancomycine, et une résistance faible à la gentamicine, la rifampine et la cephalotine. Jusqu'à 8 (13.8%) de ces isolats étaient résistants à la méticilline, parmi lesquelles 85% étaient résistants à plus de six des antibiotiques testés. Aucune association n'a été identifiée entre les données démographiques ou les habitudes du personnel, et la colonisation nasale aux souches résistantes à la méticilline.

CONCLUSION:

La phamacorésistance des isolats de *Staphylococcus aureus* était modérément élevée aux antibiotiques couramment utilisés au Cameroun, suggérant ainsi une surveillance régulière du profil de susceptibilité aux antimicrobiens.

MOTS CLÉS:

Staphylococcus aureus; Personnel hospitalier; Résistance, MRSA

INTRODUCTION

Nosocomial infections have become a very important public health issue and *Staphylococcus aureus* (SA) is one of several pathogens that have emerged as a major culprit. Carriage of *Staphylococcus aureus* appears to play a significant role in the epidemiology and pathogenesis of infections [1, 2]. Several studies have recognized hospital personnel as an important reservoir of healthy carriers [3]. Prevalence rates of 16.8% to 56.1% have been documented amongst this group [4-7]. More so, that, hospital personnel often harbor more resistant strains of SA. Retrospective studies have shown that over 20% of nasal isolates from hospital personnel exhibit multiple drug resistant and may be a significant reservoir for onward transmission to patients, who are more likely to be infected due to their weakened immune status. If the patient is immunocompromised, microorganism that are not normally pathogenic, are capable of causing disease. Transmission of strains from hospital personnel to patients is usually by exogenous spread and occurs mostly during routine patient care [8].

These resistant strains when transmitted to patients, may complicate the latter's treatment options particularly in resource-limited areas where antimicrobial susceptibility assessment is not systematic. Investigations of hospital-acquired outbreaks involving neonates and patients colonized with multi-drug resistance *Staphylococcus aureus* strain using typing demonstrated epidemiologically related strains between health personnel and the latter [9]. Other studies have reported clear molecular and epidemiological evidence of Methicillin Resistance *Staphylococcus aureus* (MRSA) transmission from health care workers to patients [10]. Hospitalized patients with *Staphylococcus aureus* infection have been shown to have five times the risk of in-hospital mortality compared with inpatients without this infection [10].

Considering the relevance of *Staphylococcus aureus* as an important pathogen associated with nosocomial infections, the role played by hospital personnel in transmission, and the dearth in data on susceptibility patterns, this study aimed at guiding empiric antimicrobial treatment in patients in a setting where susceptibility testing is not systematic. We also assessed the risk factors associated with the presence of methicillin resistant strains of *Staphylococcus aureus* among the study population.

METHODOLOGY:

In this study we analyzed fifty eight *Staphylococcus aureus* isolates from a previous study. These isolates were obtained from medical and non-medical personnel of three health institutions in Yaounde [11]. In brief, sterile dry cotton swabs (Nuova Aptaca S.R.L, Canelli, Italy), were used to collect sample from the

anterior nares of subjects recruited, after obtaining informed consent and filling a standard questionnaire. A swab was circled through both nostrils of each participant while applying an even pressure. The collected samples were transported in an enrichment medium (m-staphylococcus broth) containing 10% NaCl to the Bacteriology laboratory of an international research Centre in Yaounde. Ethical clearance was obtained from the Faculty of Medicine and Biomedical sciences ethical committee.

Once in the laboratory, samples were streaked onto plates with Mannitol- salt agar, and incubated aerobically at 37°C. Plates were read after 24 hours and 48 hours of incubation. Characteristic isolates were aseptically isolated and characterized using established microbiological techniques for presumptive and definitive identifications. Presumptive identification methods were colony morphology, Gram stain characteristics, coagulase and catalase tests. Definitive identification methods included the presence of DNA (DNase test), the presence of protein A and clumping factor (SLIDEX® Staph plus, BioMerieux, Marcy - l'Etoile, France), and biochemical properties (API Staph identification System, BioMerieux, Marcy - l'Etoile, France)

A. Antimicrobial susceptibility testing:

The antibiotic susceptibility patterns of isolated *Staphylococcus aureus*, as well as an ATCC 25923 control strain, to sixteen different types of locally used antibiotic were determined by the Kirby Bauer disc diffusion method [12]. Isolates were also tested for methicillin resistance using the Oxacillin Minimum Inhibitory Concentration technique. Inhibition zone diameters for each antimicrobial was measured and interpreted as outlined by the performance standards for antimicrobial susceptibility testing [13].

B. Statistical Analysis:

Data collected were entered into a spreadsheet and analyzed using SAS Version 8 (SAS Institute, Cary, NC, USA). The proportion of isolates resistant to the antibiotics assayed, were described. To assess risk factors for MRSA carriage, proportions of personnel having MRSA were compared using Fisher's exact tests while the age and duration in workplace of those carrying MRSA were compared to those not carrying MRSA using Mann-Whitney U tests. The levels of statistical significance were set at a p-value < 0.05.

RESULTS:

Our analysis shows that, of all antibiotics tested, strains were 100% resistant to penicillin, ampicillin, and amikacin. These rates were followed by trimethoprim (74.8%) and erythromycin (61.2.7%). Isolates were

100% susceptible to netilmicin and vancomycin, 98.3% to rifampin and cephalothin (table 1).

TABLE I: ANTIMICROBIAL SUSCEPTIBILITY PROFILES OF *S. AUREUS* ISOLATES FROM HEALTH PERSONNEL SCREENED

Antibiotic (potency)	Number/58	Resistance (%)
Amikacin(30µg)	58	100
Ampicillin (10µg)	58	100
Cephalotin(30µg)	1	1.7
Clindamycin(20µg)	5	8.5
Ciprofloxacin(5µg)	6	10.2
Doxycycline (30µg)	19	32.2
Erythromycin(15µg)	36	61.2
Gentamicin(10µg)	3	6.1
Netilmicin(30µg)	0	0
Oxacillin(0.016-256µg)	8	13.8
Penicillin(6µg)	58	100
Pristimycin(15µg)	3	6.1
Pristimycin(15µg)	1	1.7
Rifampin(30µg)	6	10.2
Spiramycin(100µg)	44	74.8
Trimethoprim(5µg)	0	0
Vancomycin(10µg)	0	0

The prevalence of methicillin resistance in the study population as determined by oxacillin inhibition technique was 13.8% (8/58). Except for one isolate, all the MRSA strains were resistant to more than six of the tested antibiotics.

The association between risk factors and MRSA carriage is illustrated in table 2 and 3.

DISCUSSION

In this study we describe the resistance patterns of *Staphylococcus aureus* strains isolated from the anterior nares of hospital personnel in Yaounde, Cameroon. High prevalence of resistance to some locally used antibiotics was documented. Apart from

vancomycin and netilmicin all strains were found to be resistant to at least one of the other antibiotics employed in the study. The percentage of strains resistant to more than four of the antibiotics used was 44.7%, while 85% of MRSA were resistant to more than six. No demographic or clinical factors studied were associated with the carriage of MRSA.

All the isolates were resistant to penicillin, ampicillin, and amikacin. These high rates of resistant by *Staphylococcus aureus* to some of these locally used antibiotics in our study, has been previously documented. Similar results were reported from studies profiling the antimicrobial susceptibility of *Staphylococcus aureus* isolates in Nigeria and Cameroon [3, 13]. These rates were followed by trimethoprim (74.8%) and erythromycin (61.2%).

Changing patterns of *Staphylococcus aureus* resistance to drugs continues to pose a problem to health care providers globally despite the development of new antibiotics. These high rates of resistance have been attributed to factors such as misuse of these drugs by health professionals, unskilled practitioners among others [4, 15]. The prevalence of resistant strains in health personnel is of public health importance as this group may transmit this bacterium to patient during routine patient care, complicating the latter's treatment option. Increased period of hospitalization, high morbidity and increased treatment cost has been associated to disease severity due to drug resistance [16].

Ciprofloxacin, gentamicin and rifampin, vancomycin, netilmicin, exhibited high levels of sensitivity ranging from 90% to 100%. A study carried out in Dschang, Cameroon, reported a susceptibility of 91.7% to gentamicin, 81.3% to ciprofloxacin and 100% to vancomycin [13]. Susceptibility to gentamicin might be due to the route of administration which hinder its frequent misuse while the high sensitivity observed in ciprofloxacin, has been attributed to the fact that it is a relatively expensive drug, therefore less available for abuse [17].

MRSA poses a serious therapeutic problem and reports of its frequency in Cameroon are limited. Methicillin resistance was detected in 8 (13.8%) of the 58 isolates tested. The rate of MRSA was relatively low compared to the 21-30% reported in a previous study for Nigeria, Kenya, and Cameroon that screened samples from multiple body sites [18]. In our study, only the *mecA* gene using Methicillin was tested as a marker for methicillin resistance. This rate however falls within the 0-59% range documented while reviewing 104 studies describing MRSA nasal carriage by Health care workers. Although numerous research has documented that colonization of Health care workers by MRSA is directly associated to factors such as length of time in the profession, methods and frequency of hand wash[19], this study in accordance

with some previous studies [20,21] , found no such association (p-values were all >0.05).

TABLE II: RISK FACTORS FOR CARRIAGE OF MRSA

Characteristics		Total	No.P(%)	p-value
Sex	Female	36	6(16.67)	0.426
	Male	22	2(9.09)	
Marital Status	Married	28	3(10.71)	0.746
	Single	30	5(17.24)	
Interval Of hand Washing	>1 hour	36	6(16.67)	0.155
	1-2hours	22	2(9.09)	
Method of Hand wash	Water	42	5(11.90)	0.385
	Water/disinfectant	16	3(18.75)	
Staph History	No	25	4(16.00)	1.000
	Yes	11	1(9.09)	
	Not Known	22	3(13.64)	
Cigarette Consumption	No	54	8 (14.81)	0.543
	Yes	4	0(0.00)	
Alcohol Consumption	Yes	22	4(18.18)	0.351
	No	36	4(11.11)	

No. number of subjects tested, P: positives, p-value from a Pearson Chi Square test

TABLE III: ASSOCIATION OF MRSA CARRIAGE WITH EACH OF AGE AND DURATION AT CURRENT WORKPLACE

Characteristic	Methicillin Resistant (N=8)	Methicillin Susceptible (N=50)	Mann-Whitney U p-value
Age (years) -mean ± SD	35.1 ± 8.1	37.2 ± 10.4	0.549
Duration at workplace (years) - mean±SD	3.9 ± 2.5	7.4 ±7.0	0.300

CONCLUSION

A relatively high proportion of *Staphylococcus aureus* isolates from health personnel in this study were resistant to antibiotics commonly used in this setting. Although the prevalence of methicillin resistance was low, results obtained call for regular monitoring of susceptibility profiling as a guide to empiric antimicrobial therapy for *Staphylococcus aureus* infection in this setting.

ACKNOWLEDGMENT

Authors acknowledge the technical assistance provided by the Center for the Study and Control of Communicable Diseases (CSCCD) of the Faculty of Medicine and Biomedical Sciences University of Yaounde 1, the Biyem-Assi, District hospital, Yaounde reference hospital and the Yaounde Central hospitals, from where study subjects were recruited.

Potential Conflicts of interest: All authors report no conflict of interest relevant to this article.

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