Nosocomial infections: methicillin resistant staphylococcus auerus in wound infection in Ibadan, Nigeria

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Summary

In a study of 188 cases of wound infection seen in the University College Hospital, Ibadan, between December 1994 and April 1995, 78 strains of *Staphylococcus aureus* were methicilin resistant (MRSA). The disc sensitivity pattern of the MRSA was determined using the method of Kirby et al., and the MICs of common antibacterial agents to the MRSA were determined by agar dilution method. Vancomycin, ofloxacin and ciprofloxacin offered the best effective treatment for MRSA wound infections, and are recommended as reserved drugs while gentamicin and cotrimoxazole are first line drugs.

Keywords: *MRSA, Wound Infection, Ibadan.*

Résumé

Dans Une etude de 188 cas d'infections des blessures examines au Centre Hospitalier Universitaire d'Ibadan, entre Decembre 1994 et Avril 1995, 78 souche *Staphylocoque aureus* avaient été resistance à la Methicillin (MRSA). Le disque du mode de sensibilite du MRSA avait ete determine en utilisant la methode de Kirby et al, et le MIC des agents antibacteriens commun à la MRSA a ete determiné par la methode de la dilution de l'agar. La Vancomycin, l'ofloxacin et la ciprofloxacin ont donnés les traitements les plus effectifs pour les MRSA des infectious de blessures et ont ete recommendés comme les medicaments de reserves pendant que la gentamicin et la co.trimoxazole peuvent etre utilises comme les medicaments de premiere lignes.

Introduction

A wound is an area of the body with compromised tissue integrity. A wound infection should have either a purulent discharge in or exuding from the wound or a painful spreading erythema indicative of cellutis [1]. The World Health Organization gave the prevalence rate of nosocomial infection as 3.0 – 20.7% [2]. The prevalence rate was found to be 4.9% in Ibadan [1]. Surgical wound infection is a good index of nosocomical infection, 30.3% of cases have been found to be caused by *Staphylococcus aureus* in our environment [1]. The percentage of methicillin resistant *Staphylococcus aureus* (MRSA) among all hospital have been increasing worldwide. In the USA, it rose from 2.4% in 1975 to 29% in 1991 [3] and in Nigeria, it rose from 1% in 1972 to 27% in 1995 [4]. In the light of this high prevalence rate (27%) of MRSA in Ibadan, we have reviewed the antibiotic sensitivity pattern of strains isolated from wounds.

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Materials and methods

Seventy-eight strains of *Staphylococcus aureus* isolated between December 1994 and April 1995 from 188 consecutive wound swabs from patients in the University College Hospital (U.C.H.), Ibadan, were studied. Confirmation of the isolates as *Staphylococcus aureus* was by the positive coagulase (tube and slide) and positive deoxyribonuclease test. Oxford *Staphylococcus aureus* was included as control. The MRSA were then identified from the lot by the following tests:

Disc Diffusion Test: Bacterial suspension prepared to the turbidity of a Macfarland Standard No. 1 (approximate concentration 3×10^8 CFU per ml) was used for inoculation of both salt (5% NaCl containing (supplemented) Muller–Hinton agar plates) and plain Muller–Hinton agars (unsupplemented). Discs containing 5 ug of methicillin were placed on each plate. The supplemented agar plates were incubated at 37 °C. The diameters of zones of inhibition were measured after 24 hours incubation.

A range of methicillin (Smith-Kline Beecham Co. England) concentrations 0.125 ug – 64 ug per ml prepared in two-fold dilution steps were incorporated into Muller-Hinton agar (Oxoid).

An MIC 32 multipoint inoculator (Dynatech Laboratories Alexander VA, USA) delivered an inoculum of approximately 3×10^8 CFI per spot from the standard suspension. The agar plates were then incubated at 37 °C aerobically for 24 hours. The minimum inhibitory concentration (MIC) was taken as the lowest concentration of antibiotic that inhibited visible growth of the strain after 24 hours of incubation.

All MRSA strains were tested for individual sensitivity to eight antibacterial agents by the method of Kirby et al [5], with ciprofloxacin 5 ug, ofloxacin 10 ug, vancomycin 30 ug and penicillin 10 ug. Standardization was by using 2 ml medium in each petridish (9 cm diameter) and the same inoculum size of 0.5 MacFarland standard and inclusion of standard *Staphylococcus aureus* NCTC 6571 in test organisms.

The MICs of ofloxacin, azithromycin, vancomycin, fusidic acid, ciprofloxacin, gentimicin, penicillin and cotrimoxazole for each of the isolates were determined by the agar dilution method as described by Waterworth [6]. Inoculation of the antibiotic containing media was done by using an inoculum replicating apparatus which delivered about 0.01 ml of test broth.

Result

There were 188 wound swabs processed during the study period of these, 181 (96.3%) yielded bacteria after 24 hours of culture at 36-37 °C. About 78 of these (43.1%) yielded *Staphylococcus aureus*, 19 (24.4%) of which were methicillin resistant (Table 1).

Table 1:   Frequency of MRSA strains among *Staphylococcus aureus* isolated from wounds.

Categories		No	%
A.	Methicillin resistant MIC > 8 Ug/ml	19	24.4
B.	Borderline (intermediate) Methicillin resistance MIC Between 4 & 8 ug/ml.	19	24.4
C.	Methicillin sensitive	40	51.2
	Total	78	100

Table II shows the disc sensitivity pattern of the MRSA strains. This reveals that all the MRSA were sensitive to vancomycin, ofloxacin and ciprofloxacin, about 80% sensitivity to genticmicin, cotrimoxazole and fusidic acid and none sensitive to penicillin. Table III shows the MICs of antibiotics to MRSA.

Table 2:   The disc sensitivity pattern of the MRSA strains.

Antibiotic discs	Tested = n	Sensitive = n (%)	Resistant = n (%)
Vancomycin	19	19 (100)	0 (0)
Fusidic acid	19	15 (78.9)	4 (21.1)
Ofloxacin	19	19 (100)	0 (0)
Gentamicin	19	17 (89.5)	2 (10.5)
Ciprofloxacin	19	19 (100)	0 (0)
Cotrimoxazole	19	15 (78.9)	4 (21.1)
Azithromycin	19	2 (10.5)	17 (89.5)
Penicillin	19	0 (0)	19 (100)

Table 3:   MIC of MRSA From Wound

Antibiotic concentration (µg/ml)	0.025	0.05	0.1	0.25	0.5	1	2	4	8	16	32	64	128
Methicillin									3.1	57.8	39.1		
Penicillin		*									15.2	84.8	
Vancomycin		*	15	57	28								
Fusidic acid	75.6	*								11.4	13		
Gentamicin			*	8.0	8.2				6.0		5.8		
Cotrimoxazole		76.2	*	2.1							21.7		
Ciprofloxacin				*	29.1	70.9							
Ofloxacin				*	86.2	13.8							
Azithromycin					*		10		2.0	48.6	38.0	1.4	

MIC observed with Oxford Staphylococcus aureus (NCTC 6571)

Discussion

Stasphylococcus aureus was found to be responsible for 43.1% of all wound infection seen in U.C.H. Ibadan, between December 1994 and April 1995. In a similar study at the same institution between 1989 and 1991, it was responsible for 30.3% of all surgical wound infection [1]. In this study, wound infections from other specialties like Medicine and Paediatrics were included. This may account for the increase in the prevalence rate.

Methicillin resistance is easily missed on routine sensitivity testing of *Staphylococcus* strains [2]. The most satisfactory method for demonstrating MRSA is incubation of the organism specimen isolates at 30 °C. However, where a separate incubator for use at the lower temperature is not available, good result can be obtainable at 37 °C, or even by prolonging the incubation time, using ordinary media and temperature of 37 °C, for up to 48 hours instead of the usual 24 hour overnight period. Adhering to these recommendation will facilitate easy detection of MRSA and hence good drug management of wound infections in our environment, since the treatment of MRSA infection has a severe personal impact on the patient and considerable cost implications for the patient and the Hospital.

Penicillinase-resistant penicillin such as flucloxacillin, oxacillin and methicillin can be used successfully to treat borderline methicillin resistant *Staphylococcus aureus*, as the rate of hydrolysis and inactivation is assumed to be too slow to be translated into clinical resistance. In our study, 24% of the isolates fell into this category. For the MRSA isolates in Ibadan, vancomycin, ofloxacin and ciprofloxacin offer the best effective treatment for wound infections. However, these groups of drugs and other quinolones are very expensive and are usually out of the reach of most of our patients. Since gentimicin, cotrimoxazole and fusidic acid offer an 80% effectivity against MRSA, we would recommend either gentimicin or cotrimoxazole for our patients with wound infection while the quinolones should be used as reserved drugs.

With methicillin sensitive *Staphylococcus aureus*, the nasal carrier is of fundamental importance as a source, however, with MRSA, skin lesions and abnormal skin is paramount [10]. The precise mode of spread of MRSA has not been clearly delineated, the infected or colonized patient is the ultimate source of methicillin-resistant *Staphylococcus aureus*.

We suggest further studies in our environment on the surveillance of MRSA infections to avoid impending outbreak.

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