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Prevalence and Antimicrobial Susceptibility of *Staphylococcus aureus* at the Kenyatta National Hospital, Nairobi

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A cross sectional study of 115 patients admitted at the Department of Orthopedics, Kenyatta Hospital, Nairobi, Kenya was carried out to determine the prevalence and antibiotic susceptibility of *Staphylococcus aureus* isolated from infected wounds. The prevalence of *Staphylococcus aureus* was 33.0 %. The drugs tested and their corresponding sensitivity were amoxycillin (13.2 %), co-amoxiclav (39.5 %), oxacillin (55.3 %), erythromycin (44.7 %), gentamicin (60.5 %), ciprofloxacin (62.2 %) minocycline (86.8 %), cefuroxime (57.9 %) and clindamycin (84.2 %). These results show the sensitivity profile of *Staphylococcus aureus* and can be used to choose suitable drugs in the management of wounds for hospitalized patients.

Key words: Prevalence, antimicrobial susceptibility, *Staphylococcus aureus*

INTRODUCTION

Staphylococcus aureus is one of the top four bacteria involved in the causation of nosocomial infections along with *Escherichia coli*, *Enterococcus faecalis*, and *Pseudomonas aeruginosa* [1]. It is normal resident flora to the nares and bowels of 30-50 % of the general population and the organism is carried by about 90 % of hospital staff [1]. The organism is a cause of many diseases such as skin infections, conjunctivitis, septicemia, endocarditis, osteomyelitis, pneumonia, mastitis, enteritis, food poisoning, toxic shock syndrome and scalded skin syndrome [2]. Nasal carriage of *S. aureus* has been identified as the most important risk factor for the acquisition of *S. aureus* infection, although this may depend on a wide array of factors that may either be environmental or patient related. The postulated sequence of events which leads to infection is initiated with *S. aureus* nasal carriage, which is then disseminated via hand carriage to other body parts [3].

Resistance of *S. aureus* against several drugs occurs through different mechanisms one of which is through the acquisition of a chromosomal gene (*mec* A) that encodes an alternative target protein which is not activated by methicillin. The majority of the strains are resistant to several of the most commonly used antimicrobial agents including macrolides, aminoglycosides, and β-lactam antibiotics, including the latest generation of cephalosporins [4].

A study was carried on specimens obtained from infected wounds of hospitalized patients in the Orthopedic Department at Kenyatta National Hospital (KNH). Identification of the bacteria was done using recommended culture techniques and biochemical tests. Analytical profile index (API) was employed to assist in identification of some of the organisms. The study also evaluated the sensitivity pattern of nine drugs.

MATERIALS AND METHODS

A sample size of 115 patients was considered for the study after calculating using Fishers's formula [5]. Each specimen was inoculated on both blood agar and MacConkey agar. Growth was observed after 24 h following incubation at 37 °C. The inoculated blood agar was put in a candle jar to facilitate growth of some organisms. Identification was done using biochemical tests such as those for catalase, urease, indole, methyl-red, Voges-Proskaeur (IMVIC), coagulase, esculin, optochin

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and oxidase. For those that were difficult to identify, analytical profile index was used. Characteristics of culture also played a significant role in identification.

Drug sensitivity testing was carried out using Kirby and Bauer Disk diffusion techniques on Muller Hinton Agar and Blood Agar. Sensitivity was shown by a zone of inhibition around the discs. The diameter of the zone was measured and compared to standard values [6]. Reading was done 24 h after the second inoculation and standard organisms were tested concurrently as control. These standard organisms were Oxford Strain NCTC 6571 for *Staphylococcus aureus*, ATCC 25922 for *Enterobacteriaceae* and NCTC 10662 for *Pseudomonas aeruginosa.*

RESULTS

A total of 167 organisms were isolated. The prevalence was 42.6 % *Pseudomonas* spp, 33.9 % *Proteus* spp, 33.0 % *S. aureus*, 7.8 % *Klebsiella* spp, 13.0 % *E. coli*, 6.1 % *Streptococcus faecalis* and 2.6 % *Enterobacter* spp. Other rare organisms such as *Citrobacter freundii*, *Acinetobacter baumanii* and *Serratia* spp yielded 0.9 % each (Table 1).

Table 1: Prevalence of organisms isolated from wounds of patients at KNH.

Organism	No. of patients	% prevalence
Pseudomonas spp	49	42.6
Proteus spp	39	33.9
Staphylococcus aureus	38	33.0
Eschericia coli	15	13.0
Klebsiella spp	9	7.8
Streptococcus faecalis	7	6.1
Enterobacter spp	3	2.6
Alcaligenes spp	2	1.7
Streptococcus pyogenes	2	1.7
Citrobacter freundii	1	0.9
Serratia spp	1	0.9
Acinetobacter baumanii	1	0.9
Total No. of patients	**115**	

Out of the nine antibiotics tested against *S. aureus*, sensitivity varied as follows; amoxycilin (13.2 %), co-amoxiclav (39.5 %), oxacillin (55.3 %), erythromycin (44.7 %), gentamicin (60.5 %), ciprofloxacin (62.2 %), minocycline (86.8 %), cefuroxime (57.9 %) and clindamycin (84.2 %) as shown in Table 2.

DISCUSSION

Prevalence: The high prevalence of *Staphylococcus aureus* (33.0 %) in infected wounds was probably due to lack of proper clinical practices amongst hospital staff. Transmission can be reduced by wearing protective clothing such as gloves and facemasks. Dressing materials and equipment should be sterile and the surrounding environment kept clean. *Staphylococcus aureus* is the causative agent of other diseases and its presence among hospitalized patients poses a significant risk to staff and patients.

Antimicrobial sensitivity: Resistance against amoxycilin and co-amoxiclav is mainly due to β-lactamase production. The results show that these drugs should not be used to treat wounds that are infected with *S. aureus*. Significant resistance was shown against other drugs due to multidrug resistant genes (*mec* A) that encode for alternate target proteins. Some of the drugs such as clindamycin, minocycline, ciprofloxacin, cefuroxime, gentamicin and oxacillin showed >50 % activity. These drugs are readily available within the hospital except minocycline and should preferably be utilized. Good quality and affordable generics of ciprofloxacin exist in the market while clindamycin attains high concentrations in the bone and is therefore suitable for treating osteomyelitis. All the other organisms isolated were stored in skimmed milk awaiting availability of suitable sensitivity discs.

CONCLUSION

The results show that *Staphylococcus aureus* is a very common organism among infected wounds. In addition, resistance to the tested drugs is very significant. This scenario points to the urgent need to effect rational antibiotic use and proper clinical practices in wound management.

Table 2: Antibiotic susceptibility of *Staphylococcus aureus* isolated from wounds of patients at KNH

Drug	Count (percentage)			
	Resistant	Intermediate	Sensitive	Total
Amoxycillin	33 (86.3)	0	5 (13.2)	38 (100)
Co-amoxiclav	23 (60.5)	0	15 (39.5)	38 (100)
Oxacillin	17 (44.7)	0	21 (55.3)	38 (100)
Erythromycin	20 (52.6)	1 (2.6)	17 (44.7)	38 (100)
Gentamicin	15 (39.5)	0	23 (60.5)	38 (100)
Ciprofloxacin	14 (35.1)	1 (2.0)	23 (60.5)	38 (100)
Minocycline	4 (10.5)	1 (2.6)	33 (86.8)	38 (100)
Cefuroxime	15 (39.5)	1 (2.6)	22 (57.9)	38 (100)
Clindamycin	3 (15.8)	0	16 (84.2)	19 (100)

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