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Antimicrobial Susceptibility Pattern of *Staphylococcus aureus* to Non-Betalactams.

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ABSTRACT

Staphylococcus aureus is one of the most important human pathogens and has been a leading cause of hospital and community acquired infections. The increasing resistance pattern to beta lactam group of antimicrobials needs a consideration to other groups of antimicrobials for the treatment. The study was designed to find out the susceptibility pattern isolated from various clinical samples to antimicrobials other than beta lactams. A total of 250 strains of *Staphylococcus aureus* isolated from various clinical samples from January 2012 to August 2013 were included in the study. Susceptibility testing was performed by Kirby-Bauer disc diffusion method according to Clinical and Laboratory Standards Institute guidelines to non-beta lactam antimicrobials including Aminoglycosides, Quinolones, Cotrimoxazole, Linezolid, Erythromycin, Clindamycin and Nitrofurantoin. Most frequently, *Staphylococcus aureus* is isolated from Pus 44% followed by Urine 43%, Sputum 11.2% and Blood 0.8%. 86% of *Staphylococcus aureus* were sensitive to Amikacin, 78% to Linezolid, 70% to Gentamicin, 58% to Erythromycin, 53% to Cotrimoxazole, 46% to Nitrofurantoin, 37% to Ciprofloxacin and 34% to Norfloxacin. Given the widespread resistance to beta lactams, Aminoglycosides and Linezolid can be considered as suitable treatment options for *Staphylococcus aureus* infections.

Keywords: *Staphylococcus aureus*, non-beta lactam antimicrobials, susceptibility pattern, Aminoglycosides, Clindamycin.

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INTRODUCTION

Staphylococcus aureus has emerged as one of the most important pathogens and has been the leading cause of hospital and community acquired infections [1]. It can cause illness ranging from minor skin infections to life threatening diseases such as pneumonia, meningitis, osteomyelitis, endocarditis, toxic shock syndrome, bacteremia and sepsis [2,3]. Serious infectons are a worldwide phenomemon and occur in both the hospital and community settings. Initially, penicillin was an effective therapy option for *S.aureus* infections. However the emergence of penicillin resistance in *S.aureus* isolates has had an impact on how such infectons are treated [4].

Resistance in Methicillin resistant *Staphylococcus aureus* (MRSA) is related to a chromosomal mecA gene that specifies the production of an abnormal penicillin binding protein called PBP2a or PBP21. Penicillin-binding proteins are membrane- bound enzymes, which targets for all beta-lactam antibiotics. PBP2a has a decreased affinity for binding to beta-lactam antibiotics resulting in resistance not only to methicillin but also to all beta-lactams including penicillins and cephalosporoins. The mecA gene complex also contains insertion sites for plasmids and transposons that facilitate acquisition of resistance to other antibiotics. Thus, cross resistance to non-beta lactam antibiotics such as erythromycin, clindamycin, gentamicin, cotrimoxazole and ciprofloxacin is common [1] .

Since the development of resistance to multiple antibiotics by the pathogenic strain of *Staphylococcus aureus* is an ever increasing problem especially with the increasing pattern to beta lactam groups of antimicrobials, it has become necessary in the selection of appropriate treatment of these infections and leads to the needs in consideration to other antimicrobials [1]. Thus the study was designed to find out the susceptibility pattern of *Staphylococcus aureus* isolated from various clinical samples to antimicrobials other than betalactams.

MATERIALS AND METHODS

A total of 250 strains of *Staphylococcus aureus* were isolated from various clinical samples from January 2012 to August 2013 were included in the study.

Staphylococcus aureus were identified by golden yellow pigment production, beta heamolysis on blood agar, catalase, coagulase, mannitol fermentation and urease tests [5].

Antimicrobial susceptibility testing was performed by Kirby Bauer disc diffusion method according to Clinical and Laboratory Standard Institute guidelines to non-beta lactams antimicrobials including Aminoglycosides, Quinolones, Cotrimoxazole, Linezolid, Erythromycin, Clindamycin and Nitrofurantoin. The zone of inhibition was measured and the results were interpreted [6].

RESULTS

Among 250 strains of *Staphylococcus aureus*, 44.6% were isolated from pus followed by 43.4%from urine, 11.2% from sputum and 0.8% from blood.

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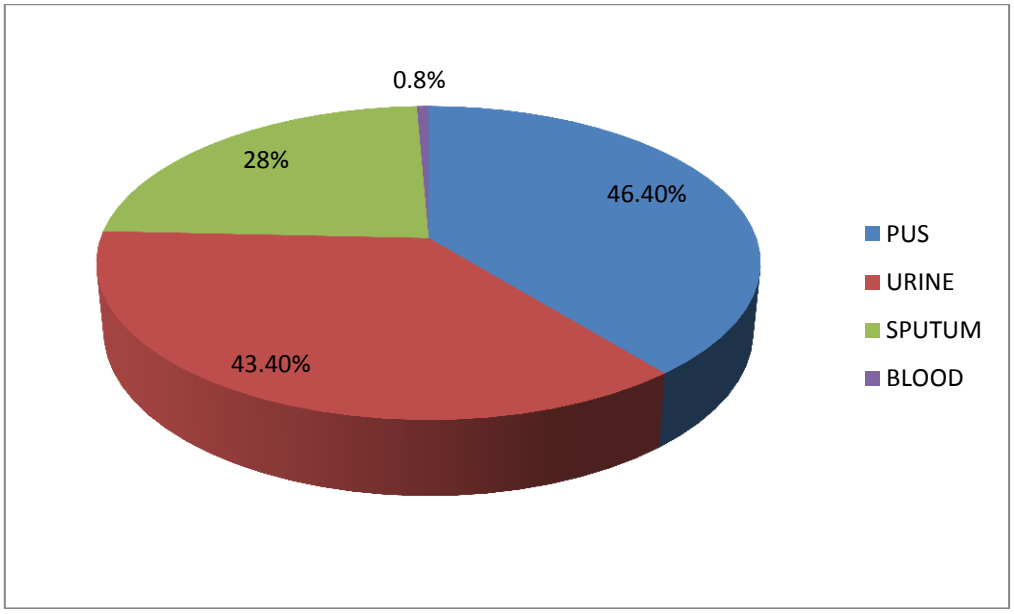
Figure 1: Shows the distribution of *Staphylococcus aureus* isolated from various clinical samples



86.2% of the strains showed susceptibility to amikacin, 83% to clindamycin, 78.8% to linezolid, 70.7% to gentamicin. Ciprofloxacin and norfloxacin showed the least susceptibility rate with 37.24% and 34% respectively. 46.25% of the urine isolates were susceptible to nitrofurantoin.

Table 1: Shows the susceptibility pattern of *Staphylococcus aureus* to different antimicrobials other than beta lactams.

ANTIBIOTICS	SENSITIVE %	MODERATELY SENSITIVE %	RESISTANT %
AMIKACIN	86.2	2.7	11
GENTAMICIN	70.7	7.7	21.4
CIPROFLOXACIN	37.24	6.2	56.5
NORFOLXACIN	34	5.1	60.82
COTRIMOXAZOLE	53.3	1.8	44.78
LINEZOLID	78.8	3.8	17.3
ERYTHROMYCIN	58.2	10.4	31.3
CLINDAMYCIN	83	0	16.98
NITROFURANTOIN*	46.25	1.25	52.5

*Urinary isolates only

DISCUSSION

Serious infections caused by *Staphylococcus aureus* are a worldwide phenomenon and occur in both community and hospital settings. In this study we found out that *Staphylococcus aureus* was most frequently isolated from pus sample which accounts 44.6% among clinical samples.

Development of resistance to frequently used beta lactam antimicrobials, limited the effective treatment options. These infections can be successfully treated by drugs other

than beta lactams. We observed that the *Staphylococcus aureus* isolates were more susceptible to Aminoglycosides compared to other antimicrobials. 83% of the isolates were susceptible to amikacin and 77% were susceptible to gentamicin. The difference is seen as each of the aminoglycosides have a slightly different mechanism of resistance due to their different aminoglycoside modifying enzymes chromosomal mutation.

Next to aminoglycosides, Clindamycin showed 83% susceptibility rate. Clindamycin belongs to the macrolide-streptogramin B (MLS_B) family, is frequently used for the treatment of skin and soft tissue infections caused by *Staphylococcus aureus*. Inducible clindamycin resistance should be considered in mind as these isolates are found to be resistant to erythromycin but susceptible to clindamycin. This can be detected using D-test by placing erythromycin and clindamycin discs adjacent to each other with 15mm apart edge to edge [7] .

Linezolid showed the susceptibility rate of 78.8% in our study which is also recommended by Hannan A et al. this is a Oxazolidinone class of antibiotics, which inhibits the bacterial protein synthesis by binding to the 50S ribosomes. It is proved to be very active against all Staphylococcal strains, irrespective of susceptibility to other antibiotics [3].

53.3% of the isolates were susceptible to Cotrimoxazole and Quinolones showed very less susceptibility rates of less than 50% which should be cautiously used for the treatment. Continuous surveillance using susceptibility tests should be carried out as antibiotic susceptibility profile varies from time to time, and control measures should be put in place in hospitals.

CONCLUSION

We conclude that with the widespread resistance to Beta lactam antibiotics, Aminoglycosides and Linezolid may currently be considered suitable treatment options for *Staphylococcus aureus* infections.

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