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Prevalence And Antibiotic Resistance Pattern Of Linezolid And Vancomycin Resistant Gram-Positve Cocci Isolated From Surgical Site Infections

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***Abstract*— The aim of this study was to determine the prevalence and antimicrobial resistance profiles of Gram-positive cocci isolated from surgical site infections. Out of 320 bacterial isolates, 268 (83.75%) were identified as *Staphylococcus* spp. and 52 (16.25%) were identified as *Enterococcus* spp. Among staphylococci, 71.64% were coagulase-positive and 28.36% were coagulase-negative. The antimicrobial resistance of all isolates was tested with a disc diffusion method. The majority (69%) of coagulase-positive staphylococci were methicillin-resistant *Staphylococcus aureus* (MRSA) while 31% were methicillin-sensitive *Staphylococcus aureus* (MSSA). All staphylococci were found to be susceptible to vancomycin and only two isolates were found to be resistant to linezolid. On the other hand, high level (28%) of resistance to vancomycin was observed in enterococci and no enterococcal isolates exhibited resistance towards linezolid. Results revealed that all investigated isolates were resistant to ampicillin and tetracycline. High prevalence of erythromycin and ciprofloxacin resistance was observed in 91 and 77% of isolates, respectively, while only 18 and 28% of the isolates were resistant to amikacin and clindamycin, respectively.**

Keywords— Antibiotic resistance; Gram-positive cocci; Surgical site infection.

I. INTRODUCTION

Surgical site infections are caused by endogenous or exogenous bacteria especially Gram-positive skin-dwelling microorganisms [1]. *Staphylococcus epidermidis* is skin and mucosal commensal coagulase-negative bacterium while *Staphylococcus aureus* is a coagulase-positive bacterium that was reported as the most common cause of surgical site infections [2]. The ability of these bacteria to acquire resistance towards antimicrobial drugs compromise the success of therapy [3]. It has been reported that rates of methicillin-resistance are more than 70% in many populations worldwide [4]. Linezolid is a synthetic drug and a member of the oxazolidinone class of antibiotics. It acts as a protein synthesis-inhibitor by binding to the ribosomal peptidyl transferase center (PTC) and stopping the growth of bacteria. Linezolid is often used for treatment of serious infections caused by Gram-positive bacteria resistant to other antibiotics [5]. With the increase of staphylococcal- resistance to methicillin, the glycopeptide antibiotic vancomycin is often a treatment of choice in infections with methicillin-resistant *S. aureus* (MRSA) as the last drug for the treatment of infections due to severe MRSA and other resistant Gram-positive strains [6]. Three classes of vancomycin-resistant *S. aureus* have emerged that differ in vancomycin-susceptibilities: vancomycin-intermediate *S. aureus* (VISA), heterogenous vancomycin-intermediate *S. aureus* (hVISA), and high-level vancomycin-resistant *S. aureus* (VRSA) [7]. The emergence of antibiotic resistance is a key public health distress that may lead to increased mortality [8]. Surgical site infection is one of the most common problems associated with increased morbidity and mortality for patients who undergo operative procedures [9]. This work addresses the prevalence and antibiotic resistance pattern of Gram-positive cocci isolated from surgical site infections.

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II. Materials And Methods

A. *Culture of specimens*

Samples from suspected surgical site infections were obtained aseptically using a sterile wet cotton swab and were inoculated on blood agar. The inoculated plates were incubated in aerobic atmosphere at 35–37°C for 24-48 h and subcultured on mannitol salt agar and Bile Aesculin Azide Agar.

B. *Identification of isolated bacteria*

The suspected staphylococci isolates were identified by Gram staining, β-hemolytic colonies on blood agar, catalase and coagulase production, and yellow colony surrounded by yellow zone on mannitol salt agar [10]. Identification of enterococci isolates to the genus level was based on Gram staining, blackening of Bile Aesculin Azide Agar (Oxoid), culture on nutrient broth at 10°C, 45°C, and with 6.5% NaCl [11].

C. *Antibiotic Susceptibility Testing*

The susceptibility of the isolates was tested by the disk diffusion method on Mueller-Hinton agar using the following antibiotic discs: penicillin (10 U), gentamicin (10 µg), amikacin (30 µg), erythromycin (15 µg), tetracycline (30 µg), ciprofloxacin (5 µg), levofloxacin (5 µg), clindamycin (2 µg), oxacillin (1µg), linezolid (30 µg) and vancomycin (30 µg).

III. Results

Out of 320 specimens suspected of developing surgical site infection, 268 (83.75%) have culture-confirmed *Staphylococcus spp*. infections and 52 (16.25%) *Enterococcus* spp. infections. Of staphylococci isolates, 71.64% were coagulase-positive and 28.36% were coagulase-negative. Based on their susceptibility to oxacillin, 31% of coagulase-positive staphylococci were methicillin-sensitive *Staphylococcus aureus* (MSSA) while 69% were methicillin-resistant *Staphylococcus aureus* (MRSA). Results revealed that All staphylococci were found to be susceptible to vancomycin and only two isolates were found to be resistant to linezolid. Almost all (99.375%) isolates were susceptible to linezolid and only two isolates exhibited resistance to linezolid. Results showed absence of vancomycin resistance in all investigated staphylococcal isolates. On the other hand, 28% of investigated enterococci exhibited resistance to vancomycin and no enterococcal isolates exhibited resistance towards linezolid. Resistance to penicillin, tetracycline, erythromycin and ciprofloxacin was the most common resistance pattern among the investigated isolates. Results revealed that 100% of the investigated isolates were resistant to penicillin and tetracycline. Overall, among the 320 investigated isolates, 91% were resistant to erythromycin, 77% to ciprofloxacin, 65% to oxacillin, 64% to levofloxacin, 56% to gentamycin, 28% to clindamycin and 18% to amikacin (Fig. 1).

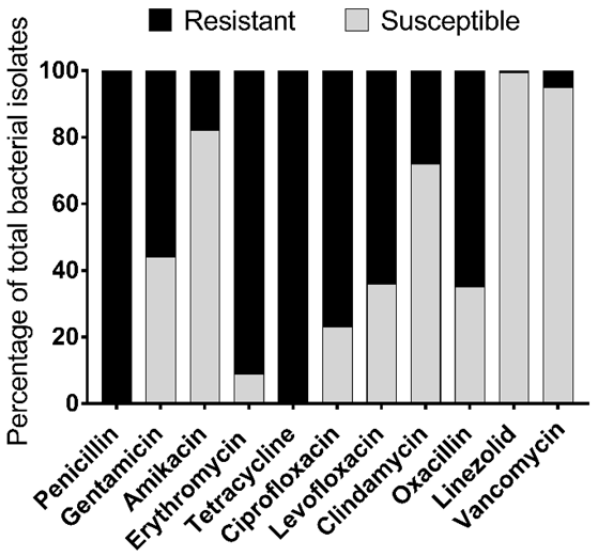

Fig. 1. Antibiotics resistance profile of Gram-positive cocci isolated from surgical site infections.

IV. CONCLUSION

This study revealed high prevalence of *staphylococcus* spp. in surgical site infections and most of *S. aureus* isolates were MRSA. All assessed staphylococci resistant to vancomycin while all assessed enterococci isolates were resistant to linezolid. The investigated isolates exhibited resistance to penicillin and tetracycline.

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