Abstract: The prevalence of β-lactamase producing *Staphylococcus aureus* infections and their antimicrobial susceptibility pattern are reported in this study. Beta-lactamase production was detected using a standard starch paper technique on all the isolates. And *In-Vitro* antimicrobial susceptibility study was conducted by agar disc diffusion method. One hundred *S. aureus* isolates obtained from different clinical specimens were studied. Out of total 100 strains of *S. aureus*, 80% were found to be β-lactamase producer, which probably accounted for 100% and 96% resistant rate obtained for penicillin and ampicillin respectively. Among the β-Lactamase producing organisms, susceptibility to antibiotics were: erythromycin (82.5%), Cephalexin (71%) Ceftriaxone (70%), Cloxacillin (66%), Others were chloramphenicol, Gentamicin, tetracycline and streptomycin with 62.5%, 61%, 30% and 53.8% susceptible respectively. This thus suggests that clinicians should enlighten patients on the consequences of indiscriminate use of Penicillin and other antimicrobial agents.

**Key words:** Staphylococcus aureus • β-lactamase • Antimicrobial resistance

**INTRODUCTION**

*Staphylococcus aureus* has emerged as one of the most important human pathogens and has over the past several decades, been a leading cause of hospital and community-acquired infections [1]. It is associated with a variety of clinical infections including septicemia, pneumonia, wound sepsis, septic arthritis, osteomyelitis and post-surgical toxic shock syndrome with substantial rates of morbidity and mortality [2, 3]. One of the reasons for the success of this human pathogen is its great variability, occurring at different periods and places with diverse clonal types and antibiotic resistance patterns within regions and countries. Although infections caused by antibiotic-resistant *S. aureus* bring about serious problems in the general population, such infections can be particularly devastating for the very young, the elderly and the immunocompromised [4].

The best known mechanism of bacterial resistance is resistance to β-lactam, which may be chromosomally or plasmid mediated and they may be constitutive or inductive. β-lactamase (also known as penicillinase) is an enzyme that cleaves the β-lactam ring and inactivates the antibiotic. Therefore, empiric therapy for suspected staphylococcal infections should always include a β-lactamase stable antibiotic. To overcome bacterial resistance, some drugs combine a β-lactam antibiotic and a β-lactamase inhibitor, thus creating a stable, new compound with good activity against Staphylococcus [5]. The characterization of *S. aureus* and monitoring of antimicrobial susceptibility patterns are important for clinicians in selecting empiric antimicrobial therapy and providing useful information on the surveillance of this pathogen. This study is designed to find out the antimicrobial susceptibility patterns of β-lactamase producing *S. aureus* isolates obtained from various clinical samples.

**MATERIALS AND METHODS**

This study was carried out at department of Medical Microbiology, Obafemi Awolowo University Teaching
Hospital Complex, Ile-Ife, Nigeria. One hundred Staphylococci isolates obtained from different clinical specimens were studied for β-lactamase production and antimicrobial sensitivity pattern, identification of the organism was based on growth in blood agar and macConkey agar media, colonial morphology, Gram stain and positive results for calalase and coagulase. Coagulase positive Staphylococci were considered as S. aureus. β-lactamase production was assessed by standard starch paper technique [6].

Antibiotic susceptibility testing was performed using the disc diffusion method. The antibiotics included: ampicillin (10µg), penicillin (1i.u), chloramphenicol (10µg), cloxacillin (5µg), erythromycin (5µg), Gentamicin (10µg), streptomycin (10µg)tetracycline (10µg), ceftriaxone (30µg) and cephalexin (30µg).

**RESULTS**

The prevalence of β-lactamase producing strains of S. aureus studied was 80%.

Table 1 shows the result of overall antimicrobial susceptibility patterns irrespective of β-lactamase production.

Results of antimicrobial susceptibility patterns of β-lactamase producing strains are shown in Table 2, while Table 3 shows antimicrobial susceptibility patterns of non β-lactamase producing strains. Among the β-lactamase producing S. aureus, all (100%) isolates were resistant to penicillin. The isolates were also highly resistant to penicillin (96%). Resistance to tetracycline was also widespread; 70% of isolates tested were resistant, 46% of isolates were resistant to streptomycin and 39% resistant to gentamicin. The prevalence of resistance to chloramphenicol was 37.5% and only 34% of isolates were resistant to cloxacillin. Resistance to ceftriazone and cephalexin were 30% and 29% respectively. The isolates (β-lactamase producing strains) had the least percentage resistance to erythromycin.

**DISCUSSION AND CONCLUSION**

Staphylococcal infections are prevalent in various communities and healthcare institutions both in developed and developing countries [7]. Staphylococci are know to have a remarkable genetic versatility which allows for adaptation to the presence of antibiotics, such that many strains can be multiresistant to several classes of drugs [8]. This study was designed to highlight the current antimicrobial susceptibility pattern of Staphylococcus with respect to β-lactamase production in order to guide clinician as to the choice of antimicrobial agents.
An overall prevalence of 80% of β-lactamase producers was recorded for *S. aureus* strains out of one hundred isolates studied. This value is in line with the previously reported prevalence of 70.8% by Rotimi et al. [9], 83.7% by Odugbemi et al. [10] and 86.2% by Kesah et al. at LUTH, Lagos, Nigeria [11]. Beta-lactamase production by staphylococci is the recognized mechanism of resistance to β-lactamase antibiotics, such as penicillin G and ampicillin, as such the high prevalence of β-lactamase production by *S. aureus* isolated explains the high resistance to penicillin and ampicillin obtained in this study.

It is believed that 70-80% of staphylococci worldwide are penicillinase producers and as a result are resistant to penicillin G, V and acylureido penicillins [8]. High rate resistance seen in non β-lactamase producing isolates to penicillins may be due to lack of penicillin receptors (PBPs) or inaccessibility of receptors because of permeability barriers of autolytic enzymes in the cell wall, which can result in inhibition without killing bacteria may also contribute to high resistance rate seen in non β-lactamase producers [12].

In this study, the resistance rate of β-lactamase producing isolates to the two cephalosprins (ceftriazone and cephalaxin) were 30% and 29% respectively. But the resistance rate was greatly reduced in non β-lactamase producing strains. The organism had 5% resistance to both ceftriazone and cephalaxin. This agrees with the work of Takashi et al. [5]. Which reported that *S. aureus* develops resistance to cloxacillin (β-lactamase stable) was 34% by the β-lactamase producing strains. This shows that susceptibility should not be assumed for cloxacillin, in vitro efficacy is needed to validate therapeutic usage.

According to the findings of this investigation, β-lactamase producing *S. aureus* was found to have highest percentage susceptibility to erythromycin (82.5%). But the percentage susceptibility of non β-lactamase producing strains to erythromycin was 80%. This results is in consonance with the study of kesah et al. [11].

In has to be noted that erythromycin was found to be the best antistaphylococal drug in this study. However, kesah et al. [11] and Brooks et al. [12] recommended vancomycin for empiric therapy in life threatening staphylococcal infection. Nevertheless, inability to get vancomycin in this work to confirm their report is regretted.

In light of these findings, diagnostic medical microbiology laboratories should perform antibiotic susceptibility tests in addition to tests for the B-lactamase production. This will help in monitoring the sensitivity patterns of isolates in the environment as a barometer for antibiotic policy formulation.

**REFERENCES**

