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Antibiotic Susceptibility of *Staphylococcus aureus* Isolates from Clinical Samples in Aminu Kano Teaching Hospital, Kano, Nigeria

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Abstract: Bacterial colonies can differ greatly in their morphologies. These differences can help us in identifying different species of bacteria. The clinical isolates of *Staphylococcus aureus* are subjected to antibiotic susceptibility, to observe the susceptibility of the isolates against some conventional antibiotics. One hundred and ten (110) pathogenic *Staphylococcus aureus* strains were used in this study. Antibiotic susceptibility tests were carried out by disc agar diffusion test. *Staphylococcus aureus* ATCC 25923 was used as a reference control organism. From this study, males were more infected than females, having 60 (61.8%) and 42 (38.2%) respectively. The age group with the highest number of isolates was (0-10) years while blood culture had the highest frequency of *Staphylococcus aureus* isolates with a frequency of 42 (38.1%). The sensitivity pattern of *Staphylococcus aureus* to the following antibiotics; clindamycin, ciprofloxacin, erythromycin, cloxacillin, cephalexin, co-trimoxazole, tetracycline and amoxyclav were 85 (77.3%), 72 (65.5%), 66 (60%), 51 (46.4%), 46 (41.8%), 43 (39.1%), 43 (39.1%) and 33 (30%) respectively. This study showed that Clindamycin, Ciprofloxacin and Erythromycin were the most active antibiotics against *Staphylococcus aureus*. Thus it is believed that these antibiotics should be used in the treatment of *Staphylococcus aureus* infections in this region. The study provided epidemiologic data and there is the need for consistent on-going antimicrobial resistance surveillance for important and commonly isolated clinically significant pathogens of staphylococcal species to form the basis for developing and implementing measures that can reduce the burden of antimicrobial resistance and prevent a probable impending public health problem.

Keywords: *Staphylococcus aureus,* Antibiogram, Clinical Samples, Treatment

1. Introduction

Prior to the introduction of penicillin for the treatment of *Staphylococcus aureus* infections in the 1940s, the mortality rate of individuals with staphylococcal infections was about 80% [13]. However within two years of the introduction of penicillin to medical use, penicillin-resistant strains were discovered. By 1960, about 80% of all *Staphylococcus aureus* strains were found to be resistant to penicillin [3].

Antibiotic resistance leads to prolonged hospital stay and increased costs in terms of treatment. In addition to these, it causes life threatening infections such as in cases of pyomyositis and chronic osteomyelitis. The majority of the methicillin resistant *Staphylococcus aureus* strains worldwide have become resistant to multiple antibiotics including beta-lactams; tetracyclines, macrolides and more recently fluoroquinolones [2].

Staphylococci have a record of developing resistance quickly and successfully to antibiotics. This defensive response is a consequence of the acquisition and transfer of antibiotic resistance plasmids and the possession of intrinsic resistance mechanisms [6]. The importance of *Staphylococcus aureus* as a persistent nosocomial and community acquired pathogen has become a global health concern. It has a remarkable capability of evolving different mechanisms of resistance to most antimicrobial agents [8].

The emergence of antibiotic resistant bacteria constitutes a major problem in antibiotic therapy. This could be attributed to unrestricted use of antibiotics in a particular environment. The aim of the present study is to establish the incidence of *S. aureus* in clinical specimens and its antibiotic sensitivity pattern against some conventional antibiotics.

2. Materials and Methods

2.1. Study Area

This study was carried out in Medical Microbiology Laboratory of Aminu Kano Teaching Hospital and was restricted to the *Staphylococcus aureus* Isolates obtained from various clinical samples processed in the laboratory.

2.2. Sample Size

The prevalence of *Staphylococcus aureus* in clinical isolate was found to be 7% in a study of conventional and rapid methods for identification of *Staphylococcus aureus* from clinical specimens at Zaria, Nigeria [11]. Thus for this study the prevalence was used to calculate sample size as follows

$$n=\frac{Z^2Pq}{d^2}$$

Where
n= number of samples
Z = statistic for level of confidence at 95% = 1.96
P = prevalence = 7% (0.07)
D = allowable error of 5%, (0.05)
q=1-p

$$n = \frac{1.96^2\times 0.07(1-0.07)}{0.05^2} = 100.03 \text{ hence } n\approx 110$$

2.3. Bacteria Isolates

A total of 110 consecutive non-duplicated *Staphylococcus aureus* isolates were obtained from various clinical samples such as wound swab, blood culture, eye swab, ear swab, throat swab, catheter tips and vaginal swab samples and was identified using standard bacteriological procedures [1]. The quality control and rejection criteria of specimen [5] were followed. *Staphylococcus aureus (*ATCC 25923) was used as control in every test run.

2.4. Ethical Consideration

Ethical permission was obtained from the ethical committee of Aminu Kano Teaching Hospital before the commencement of the study.

2.5. Antimicrobial Susceptibility Testing

2.5.1. Preparation of Turbidity Standard Equivalent to 0.5 McFarland Scale

Approximately 85 ml of 1% sulfuric acid (H_2SO_4) was added to a 100ml volumetric flask. Using a volumetric pipette, 0.5ml of 1.175% anhydrous barium chloride ($BaCl_2$) was added drop wise to the 1% sulfuric acid (H_2SO_4) while constantly swirling the flask. The volume was brought to100 with 1% H_2SO_4,

After which it was stirred or mixed for approximately 3 to 5 minutes while examining visually, until the solution appears homogeneous and free of clumps [1].

2.5.2. Modified Kirby- Bauer Disc Diffusion Method

A bacterial suspension adjusted to 0.5 McFarland standard was inoculated onto Muller Hinton agar using sterile cotton swab. Filter paper discs containing the antibiotics above were then aseptically placed on the inoculated Muller Hinton agar. All plates were incubated at 35°C for 24hours. The diameter of zone of inhibition was then measured according to the Clinical Laboratory Standard Institutes, guidelines [9].

2.6. Antibiotic Discs

The susceptibility testing of isolates to some conventional antibiotics was carried out by the disk diffusion method according to the clinical laboratory guideline [9]. The antibiotics to be tested include Amoxyclav (10mcg), Clindamycin (2mcg), Cefalaxin (10mcg), Ciprofloxacin (10mcg), Cloxacillin (1mcg), Co-trimoxazole (25mcg), Tetracycline (30mcg) and Erythromycin (15 mcg). *Staphylococcus aureus* (ATCC 25923) was used as control in every test run.

3. Results

Of the One hundred and ten isolates tested, 68 were from male patients (61.8%) and 42 from female patients (38.2%) (Table 1). The age group 0-10 years has the highest percentage of the isolates (44%). This is followed by 61-70, 21-30, 11-20, 51-60 years with 27.2%, 20%, 5.5% and 1.8% respectively. The least was found in the age group of 31-40 and 41-50 years with both having 0.9% each (Table 2).

The source of isolates with the highest frequency was blood culture (38.1%), followed by wound swab and eye swab with 32.7% and 8.2% respectively. Catheter tip, ear swab and throat swab have 4.6% each. The source with the least number of isolates were high vaginal swab and semen with both having 3.6% each (Table 3).

The result of the antibiotic susceptibility testing of the bacterial isolates showed the susceptibility of the isolates to Clindamycin, Ciprofloxacin, Erythromycin, Cloxacillin, Cephalexin, Co-Trimoxazole, Tetracycline and Amoxyclav (Table 4).

Table 1. *Showing distribution of Staphylococcus aureus Isolates according to gender (N=110).*

GENDER	FREQUENCY	PERCENTAGE (%)
Male	68	61.8
Female	42	38.2
Total	110	100

Table 2. *Showing distribution of Staphylococcus aureus Isolates according to age group.*

AGE GROUP (YEARS)	FREQUENCY	PERCENTAGE (%)
0 -10	48	44
11-20	6	5.5
21-30	22	20
31-40	1	0.9
41-50	1	0.9
51-60	2	1.8
61-70	30	27.2
Total	110	100

Table 3. *Showing distribution of Staphylococcus aureus according to source of isolates.*

SOURCE	FREQUENCY	PERCENTAGE (%)
Blood cultures	42	38.1
Wound swab	36	32.7
Eye swab	9	8.2
Catheter tips	5	4.6
Ear swab	5	4.6
Throat swab	5	4.6
High vaginal swab	4	3.6
Semen	4	3.6
Total	110	100

Table 4. *Showing antibiotic susceptibility pattern of the bacterial isolates.*

Antibiotics	No. susceptible	Rate(%)	No. Resistant	Rate(%)
Clindamycin	85	77.3	25	22.7
Ciprofloxacin	72	65.5	38	34.5
Erythromycin	66	60	44	40
Cloxacillin	51	46.4	59	53.6
Cephalexin	46	41.8	64	58.2
Co-trimoxazole	43	39.1	67	30.9
Tetracycline	43	39.1	67	39.1
Amoxyclav	33	30	77	70

4. Discussion

The advance and increase of bacterial strains that are resistant to antibacterial drugs has emerged as a global problem [14]. In this study, males (61.8%) were more infected than females (38.2%), the reason for this is not clearly understood but this agrees with previous studies conducted at Aminu Kano Teaching Hospital [4].

Also in this study the highest frequency of isolates of *Staphylococcus aureus* (44%) was observed in the (0-10) year age group in which neonates and infants were included, concurring with previous studies conducted at Aminu Kano Teaching Hospital [4]. It is believed that their immunity is not properly developed at this stage to cope with bacterial infections hence they are vulnerable and easily infected especially when hospitalized. A study in Ilorin reported wound infections of 38% as the highest frequency of *Staphylococcus aureus* isolates [10]. This is in contrast to the present study where the highest frequency was reported in blood culture (38.1%), followed by wound swab (32%).

Staphylococcus aureus develops resistance very quickly and successfully to different antimicrobials over a period of time. The highest frequency of susceptibility in this study occurred with Clindamycin and Ciprofloxacin having 77.3% and 65.5% respectively. The least was Amoxyclav and this could be seen in report from a previous study conducted in Kano [7]. It had been observed that the indiscriminate use of antibiotics without prescriptions in the developing countries such as Nigeria where there are no regulatory policies in this respect has rendered the commonly used antibiotics completely ineffective in the treatment of *Staphylococcus aureus* infections [12].

5. Conclusion

This study also showed that Clindamycin, Ciprofloxacin and Erythromycin were the most active antibiotics against *Staphylococcus aureus*. Thus it is believed that these antibiotics should be used in the treatment of *Staphylococcus aureus* infections in this region. Moreover, this study has provided epidemiologic data and there is the need for consistent on-going antimicrobial resistance surveillance for important and commonly isolated clinically significant pathogens of staphylococcal species to form the basis for developing and implementing measures that can reduce the burden of antimicrobial resistance and prevent a probable impending public health problem.

Recommendation

Government should put more strict rules on the sale of antibiotics and awareness campaign on the significance of consulting doctor before taking medication and completing regimens when prescribed should be made. Clindamycin, Ciprofloxacin and Erythromycin should be used to manage *Staphylococcus aureus* infections in this environment.

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