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Antibiotic Resistance Profile of Gram Positive Bacteria Isolated from Wound Infections in Minna, Bida, Kontagora and Suleja Area of Niger State

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Abstract Antibiotics resistance profiles of gram positive bacteria isolated from wound infections in four (4) General Hospitals (Bida, Kontagora, Minna and Suleja) in Niger State was carried out. Organisms isolated from surgical wounds were *Staphylococcus aureus* and *Streptococcus pyogenes*. Five hundred (500) samples (i.e. Two hundred (200) samples in Minna, One hundred (100) samples each from Suleja, Kontagora and Bida) of wound exudates from surgical wounds sites were analysed for their resistance pattern. From the five hundred (500) samples collected from all the locations, one hundred and twenty one samples (121) had *Strept. pyogenes*, one hundred and ninety seven (197) samples had *S. aureus*. *S. aureus* was more frequently isolated (62%) than *Strept. pyogenes* (38%) from wounds in all the locations. Both bacteria were tested for sensitivity to Tarivid, Pefloxacin, Ciprofloxacin, Augmentin, Gentamycin, Streptomycin, Ceporex, Nalidixic acid, Septrin, Ampicillin, ampiclox 30µg, zinacef 20µg, Amoxacillin, rocephin and erythromycin. Of the five hundred (500) wound samples from various locations 318 (64%) yielded growths while 182 samples (36%) yielded no growths. Most of all the isolates were sensitive to ciprofloxacin, pefloxacin and Tarivid while others were resistant to remaining antibiotics. *S. aureus* showed a higher resistance profile to most antibiotics used than *Strept. pyogenes.*

Keywords Antibiotic, Resistance, Sensitive, Surgical Wounds, Gram Positive

1. Introduction

All surgical wounds are contaminated by both pathogens and body commensals ranging from bacteria and fungi to other parasites[1-4]. The common gram positive organisms are the β – haemolytic streptococcus – *Streptococcus pyogenes* and *Staphylococcus aureus*. The gram negative aerobic rod is *Pseudomonas aeruginosa*. The facultative anaerobes include *Enterobacter* species, *Escherichia coli*, *Klebsiella* species and *Proteus* species. The fungi are *Candida* species and *Aspergillus* species[5,6], but the development of infection in the site depends on complex interplay of many factors[7]. These may be microbial virulence[1], patient risk factors like diabetes, cigarette smoking, obesity, and coincident remote site infections or colonization[8] and operation-related risk factors including prolonged hospital stay before surgery, duration of the operation, tissue trauma, poor homeostasis, and foreign materials in the wound.

The presence of foreign materials increases the risk of serious infection even with relatively small bacterial inoculums[9]. The widespread uses of antibiotics, together with the length of time over which they have been available have led to major problems of resistant organisms, contributing to morbidity and mortality[4,10]. Antimicrobial resistance can increase complications and costs associated with procedures and treatment. Antimicrobial resistance among pathogens of wound infections is on the increase. The control of wound infections has become more challenging due to widespread bacterial resistance to antibiotics and to a greater incidence of infections caused by methicillin-resistant *S. aureus* (MRSA) and polymicrobic flora [4,10,11].

Knowledge of the causative agents of wound infection in a specific geographic region will therefore be useful in the selection of antimicrobials for empiric therapy. The objective of the present study is to determine the antibiotic resistance profile of gram positive bacteria isolated from surgical wounds in Minna, Bida, Kontagora and Suleja areas of Niger State.

2. Materials and Methods

2.1. Collection of Samples

Wounds samples were collected from five hundred (500)

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patients that undergo surgical operation in four (4) general hospitals in Minna, Bida, Kontagora and Suleja areas of Niger State. 200 samples were collected from general hospital in Minna while 100 samples were collected each from Bida, Kontagora and Suleja general hospitals. The wound types included boils, whitlow, abscesses, cervicitis, trauma wounds, burns, systemic ulcers, insect bites and swelling of no specific etiology. These samples were transferred to the Microbiology laboratory of Federal University of Technology, Minna for further analysis.

2.2. Characterization and Identification of the Isolates

The collected samples were streaked on freshly prepared nutrient agar plates and incubated aerobically and anaerobically at 37℃ for 24 hours. Bacterial colonies differing in size, shape and colour were selected from the different plates and further subcultured on nutrient agar by the streak plate technique and incubated at 37℃ for 24 hours after which, were maintained on agar slants for further characterization and identification. The bacterial isolates were characterized based on colonial and cell morphology, growth on differential/selective media and biochemical tests which include Gram's reaction, indole tests, methyl red, Voges-Proskauer, Citrate Utilization, Motility, endospore, utilization of carbohydrates such as glucose, sucrose, mannitol, lactose and fructose, oxidase, catalase, coagulase and starch hydrolysis test[12]. The bacterial isolates were identified by comparing their characteristics with those of known taxonomy using the schemes of[13].

2.3. Susceptibility of Isolates to Various Antibiotics

Antibiotic sensitivity test were carried out on all isolates using paper (New Man England) disc diffusion technique. A total of 10 antibiotics were tested and 0.2ml of 12h peptone water culture of test organism was used to inoculate each organism on a dry sterile nutrient agar plate. The resistant profiles of bacteria isolated from surgical wounds were determined by standard methods. The antibiotic discs used are gram positive sensitive.

3. Results

3.1. Microorganisms Isolated from Samples at Each Location

Table 1 shows the gram positive bacteria isolated from wound samples in various general hospitals examined. *S. aureus* and *Strept. pyogenes* were the bacteria isolated. *S. aureus* had the higher occurrence in all four locations (62%) while *Strept. pyogenes* had occurrence of 38%.

3.2. Antibiotic Resistance of Bacteria in Minna

Antibiotics resistance of bacteria isolated in Minna General Hospital is presented in Table 2. *S. aureus* had a total resistance of 397 while *Strept. pyogenes* had 138. *S. aureus* had a total susceptibility of 483 while *Strept. pyogenes* had 322 in all the antibiotics examined.

3.3. Antibiotic Resistance of Bacteria in Bida

Antibiotics resistance of bacteria isolated in Bida General Hospital is presented in Table 3. *S. aureus* had a total resistance of 162 while *Strept. pyogenes* had 124. *S. aureus* had a total susceptibility of 238 while *Strept. pyogenes* had 166 in all the antibiotics examined.

3.4. Antibiotic Resistance of Bacteria in Kontagora

Antibiotics resistance of bacteria isolated in Kontagora General Hospital is presented in Table 4. *S. aureus* had a total resistance of 269 while *Strept. pyogenes* had 65. *S. aureus* had a total susceptibility of 231 while *Strept. pyogenes* had 205 in all the antibiotics examined.

3.5. Antibiotic Resistance of Bacteria in Suleja

Antibiotics resistance of bacteria isolated in Suleja General Hospital is presented in Table 4. *S. aureus* had a total resistance of 147 while *Strept. pyogenes* had 33. *S. aureus* had a total susceptibility of 43 while *Strept. pyogenes* had 157 in all the antibiotics examined.

Table 1. Microorganisms isolated from samples at each location

Location	Number of Samples	*S. aureus*	*Strept. pyogenes*
Minna	200	88 (65%)	47 (35%)
Kontagora	100	50 (65%)	27 (35%)
Suleja	100	19 (50%)	19 (50%)
Bida	100	40 (59%)	28 (41%)
Total	500	197 (62%)	121 (38%)

NB: Values in parenthesis are % occurrence of isolate

4. Discussion

Staphylococcus aureus is the leading cause of wound infection both surgical and accidental followed by *S. epidemidis* and they are pyogenic, meaning that they characteristically cause purulent discharge, otherwise known as pus[14]. Treatment of staphylococcal infection has been problematic because of the development of resistance to different antimicrobial medications by production of either plasmid encoded beta-lactamase, modification of penicillin binding proteins[14]. *S. aureus* showed resistance to Erythromycin, Zinacef, Amoxacillin, Ampiclox and Septrin in all the locations except in Bida. The percentage resistant ranged from 60 – 68%[15]. The ability of staphylococci to persist in adverse environments and their extraordinary potential to develop antimicrobial resistance may contribute to resistance patterns in sites of isolation and locations[16]. In the year 2000, a new method of reducing the problem of resistance was developed, that is using the combination of two substances that act synergistically. Despite the uses of synergistic antibiotics e.g. ampiclox, *S. aureus* was able to develop resistance to this drug in all the locations (Bida, Minna, Suleja and Kontagora). Also, the resistance pattern of S. aureus and *S. epidermidis* in Minna, Bida, Kontagora and Suleja is not in agreement with the study of[17].

Table 2. Antibiotics Resistance of Gram Positive Bacteria from Minna General Hospital

Antibiotics	*S. aureus*		*Strept. pyogenes*	
	R	Su	R	Su
PEF	13	75	3	44
CN	39	49	11	36
APX	54	34	27	20
Z	60	28	30	17
AML	60	28	24	23
RO	31	57	4	43
CPX	10	78	1	36
S	20	68	7	40
SXT	50	38	16	31
E	60	28	15	32
TOTAL	397	483	138	322

Key: PEF = Pefloxacin, CN = Gentamycin, APX = Ampiclox, Z = Zinacef, AML = Amoxacillin, RO = Rocephin, CPX = Ciprofloxacin, S = Streptomycin, SXT = Septrin, E = Erythromycin, R = Resistant, Su = Susceptible

Table 3. Antibiotics Resistance of Gram Positive Bacteria from Bida General Hospital

Antibiotics	*S. aureus*		*Strept. pyogenes*	
	R	Su	R	Su
PEF	9	31	4	24
CN	11	29	11	17
APX	22	18	17	21
Z	25	15	20	8
AML	21	19	18	10
RO	12	28	10	18
CPX	11	29	5	23
S	15	25	7	21
SXT	18	22	14	14
E	18	22	18	10
TOTAL	162	238	124	166

Key: PEF = Pefloxacin, CN = Gentamycin, APX = Ampiclox, Z = Zinacef, AML = Amoxacillin, Ro = Rocephin, CPX = Ciprofloxacin = Streptomycin, SXT = Septrin, E = Erythromycin, R = Resistant, Su = Susceptible

Table 4. Antibiotics Resistance of Gram Positive Bacteria from Kontagora General Hospital

Antibiotics	*S. aureus*		*Strept. pyogenes*	
	R	Su	R	Su
PEF	13	37	4	23
CN	16	34	5	22
APX	26	24	8	19
Z	29	21	7	20
AML	27	23	7	20
RO	27	23	5	22
CPX	28	22	6	21
S	27	23	7	20
SXT	36	14	9	18
E	40	10	7	20
TOTAL	269	231	65	205

Key: PEF = Pefloxacin, CN = Gentamycin, APX = Ampiclox, Z = Zinacef, AML = Amoxacillin, Ro = Rocephin, CPX = Ciprofloxacin, S = Streptomycin, SXT = Septrin, E = Erythromycin, R= Resistant, Su = Susceptible

Table 5. Antibiotics Resistance of Gram Positive Bacteria from Suleja General Hospital

Antibiotics	*S. aureus*		*Strept. pyogenes*	
	R	Su	R	Su
PEF	13	6	2	17
CN	11	8	0	19
APX	11	8	4	15
Z	13	6	5	14
AML	16	3	6	13
RO	15	4	7	12
CPX	14	5	1	18
S	18	1	1	18
SXT	17	2	3	16
E	19	0	4	15
TOTAL	147	43	33	157

Key: PEF = Pefloxacin, CN = Gentamycin, APX= Ampiclox, Z = Zinacef, AML = Amoxacillin, RO = Rocephin, CPX = Ciprofloxacin, S = Streptomycin, SXT = Septrin, E = Erythromycin, R= Resistant, Su = Susceptible

The susceptibility of *S. aureus* to Ciprofloxacin, Streptomycin and Pefloxacin was generally high compared to other antibiotics. The susceptibility of *S. aureus* to pefloxacin may be due to its uncommon use or being a new medication[18].[18] reported that any latest or new drug use in clinics, take an average of 7 – 10years before microorganisms can be resistant to them. Susceptibility of *S. aureus* to Ciprofloxacin, Streptomycin and Pefloxacin may also be due to their mechanism of action. This suggests that the penicillinase-resistant anti-staphylococcal agents should be selected as a first choice when treating infections[19].

Recently, the frequency of isolation of MRSA from wound infections has been increasing[20]. The results of this study, however, were not compatible with the report of[20] regarding the susceptibility of *S. aureus* to some antimicrobial drugs, and this apparent conflict will need to be evaluated in more detail using many more clinically isolated strains. Among the antibiotics tested for *S. epidermidis*, ciprofloxation showed the highest rates of efficacy.

The resistance of *Strept. pyogenes* to Zinacef, Ampiclox and amoxicillin may be due to acquisition of resistant gene from other culture stains[14]. The resistance of this organism to these drugs in Minna and Bida was not in line with the findings of[21] but the susceptibility of these antibiotics in other locations (Suleja and Kontagora) to *Strept. pyogenes* was in agreement with[21]. The susceptibility of *Strept. pyogenes* to these drugs in Suleja and Kontagora may be due to synergetic effect of ampiclox. *S. pyogenes* is a very important bacterial pathogen in children and adults causing community-acquired diseases, such as upper respiratory tract infections (tonsillitis), skin infections, soft tissue infections and wounds infections which are among the most frequent reasons for seeking of medical advice[14]. The resistance of *S. aureus* and *Strept. pyogenes* to Erythromycin found in all the location was also similar to the findings of[22].

5. Conclusions

The findings of this study suggest that bacterial resistance

in surgical wound infections is becoming serious menace in all the study area.

Staphylococcus aureus is still the most frequently involved pathogen, showing high resistance rates of bacteria isolated from surgical wounds.

Tarivid, ciprofloxacin and Pefloxacin are the best therapeutic options to treat these infections because of the less resistant caused by these organisms.

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