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Antibiotics Sensitivity Pattern of Bacterial Isolates at the Health Centre, Adekunle Ajasin University, Akungba-Akoko, Ondo State

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Abstract
Background: This study was a four years retrospective review of the records of the routine microbiological, culture and sensitivities of different samples (urine, aspirates, stool, semen, high vaginal swabs etc.) collected from patients(mainly staff and students) that attended the Health Centre of Adekunle Ajasin University, Akungba-Akoko for treatments of bacteria related infections.**Methodology:** An ethical clearance was obtained from the committee saddled with the responsibilities with the assurance of the confidentiality of the identity of the patients. Clinical Laboratory records of 1008 cases of Samples taken through standard procedures were selected for the study to examine them for spectrum bacterial isolates, age and sex distribution of cases of infections and the antibiotic susceptibility pattern of isolates.**Results:** Out of 1008 samples, 437(43.4%) did not give significant bacterial growth, while 571 (56.6%) gave bacterial growth of different species. *Staph aureus* has the highest occurrence of 22.4%, followed by *E. coli* 15.5% and *Salmonella* spp has the least. The antibiotics with very good in vitro sensitivity include the Quinolones, Nitrofurantoin, Gentamicin, Erythromycin Tobramycin and Clindamycin. Paradoxically Ceftriaxone did not show a remarkable sensitivity pattern.**Conclusion:** The most common bacterial isolates are *Staphylococcus aureus* and *E. coli* and the antibiotics identified as having the highest *in vitro* sensitivity pattern are recommended for first line management of septicaemia infections where they are indicated, in blind therapy.
Keywords: Bacterial isolates, Antibiotic sensitivity, AAU, Akungba-Akoko.

INTRODUCTION

Infection is one of the leading causes of hospital visits and admission throughout the world [1, 3, 4], untreated local infection can lead to septicaemia which is characterized as systemic inflammatory response syndrome (SIRS) and defined by the presence of two or more of the following criteria: temperature greater than 38^0 C or less than 35^0 C, heartbeat great than 90 beats/minute, Respiratory rate greater than 20 cycles/minutes or P_A CO_2 less than 32 mmHg (4.3 kpa), Leucocyte count greater than $12x10^9$/Litre, less than $4x10^9$ Litre or greater than 10% immature (band) forms, in combination with either a culture – proven infection or an infection identified by visual inspection.[4]

Infections, if not adequately or properly managed, can lead to chronic ill-health, poor quality of life or even death. Thus there is a need for the use of suitable anti-microbial agents to control and contain the effects of infection. The use of appropriate antimicrobial agents can prevent the sequelae of infections such as infertility as a consequence of pelvic inflammatory disease (in females), urethritis and epididymo- orchitis (in males).

To be appropriate, the choice of an antimicrobial agent should be contingent or based on the type of pathogenic microorganism flora common in an area and known sensitivity pattern in that region. This is as a result of the phenomenon of resistant to antibiotics which have been found useful as an aid to the right choice of antibiotics. [6, 7, 8].

This paper, reviews retrospectively the bacterial isolates, the antibiotics sensitivity and resistant pattern from specimen obtained from patients attended to at the University Health Centre, Akungba Akoko.

MATERIALS AND METHODS

Cultural method

The bacterial isolates used in the study were Clinical isolates from specimens including Mid-Stream Urine, High Vaginal Swab, Seminal fluid, Urethral Swab and Sputum.

Routine Cultural Methods, using Multipurpose Media like Blood agar, Chocolate agar and Mac-Conkey Agar were used for swabs and aspirates, with Sabouraud dextrose agar included for High Vaginal and Urethral Swabs. Mid-Stream Urine samples were cultured on CLED, and Chocolate agar.

All cultured media incubated aerobically at 37^0C for 18-24 hours but High Vaginal and Urethral Swabs have duplicate culture plates incubated in increased carbon dioxide atmosphere for 18-24 hours.

The bacterial isolates were identified microbiologically by standard methods and their sensitivity to various common antibiotics was determined by the Modified Kirby-Bauer technique as reported by Monica Cheesbrough (2000).

Antibiotic sensitivity testing

The sensitivity testing was carried out by the Modified Kirby-Bauer techniques. Four to five pure isolated colonies of 18-24 hours agar plate culture of the same morphological type were selected by touching the tip of

each colony with a wire loop and transferring them to a tube containing sterile physiological saline.

Such tube was then incubated at 37^0 C for 2-3 hours to produce moderately cloudy suspension that was standardized by diluting in saline to give visually equivalent to the McFarland 0.5. This equates to approximately 10^8 organisms per ml. (NCCL 1997).

A sterile cotton-tipped applicator was dipped on to the adjustment suspension and inoculated onto a dried sensitivity agar (SA) plate (Lab. M) by streaking the swab over the entire surface of the agar. The multi disc containing these antibiotics (under studied) was placed on to the SA plate, using a sterile forceps. The plate was then inverted and placed in the incubator at 37^0 C for 16-18 hours and thereafter examined. The diameter of growth inhibition was then measured with a transparent ruler and recorded. Antibiotic which caused inhibition with minimum diameter of 10mm was taken to be sensitive and those below 10mm were taken to be resistant.

RESULT

Table 1: Sex Distribution of Patients

Sex	Number of Patients	Percentage
Male	308	30.6%
Female	700	69.4%
Total	**1008**	**100.0%`**

Females accounted for 69.4% (700) of the participants

Table 2: Age Distribution of Patients

Age	Number of Patients	Percentage
1-17years	24	2.4%
18years and above	984	97.6%
Total	**1008**	**100.0%**

The majority 97.6% (984) of the specimen received were from adults above 18years old

Table 3: Types of Specimen

Specimen	Number	Percentage%
MSU	522	51.8
HVS	311	30.9
Seminal Fluid	33	3.3
Urethral Swab	21	2.1
Sputum	43	4.3
Stool	23	2.3
Surface Swab	42	4.2
Body Fluids Aspirates	11	1.1
Blood Culture	2	.2
Total	**1008**	**100**

Mid-stream urine (MSU) specimen accounted for 51.6% (522), High Vaginal swab 30.9% (311) while Blood Culture was the least with 0.2% (2)

Table 4: Types of Organisms Isolated

Organism	No	Percentage %
No Growth	437	43.4
Staph. aureus	226	22.4
Streptococcus spp	38	3.8
Pseudomonas spp	16	1.6
Klebsiella spp	15	1.5
Candida albicans	104	10.3
Escherichia coli	156	15.5
Proteus spp	10	1.0
Mixed *Candida* spp /*Staph aureus*	3	0.3
Salmonella spp	3	0.3
Total	**1008**	**100**

Four hundred and thirty-seven (43.4%) of the specimen yielded no growth, *Staph aureus* accounted for 22.4% (226) of the isolated organisms while *Salmonella* spp were the least with 0.3% (3).

Table 5: Sensitivity Pattern of Isolates to Antibiotics

No	Antibiotics	Percentage (%) Sensitivity Of Isolates						
		S. aureus	*Streptococcus* spp	*Pseudomonas* spp	*Klebsiella* spp	*E. coli* / coliforms	*Proteus* Spp	*Salmonella* spp
1	Levofloxacin	S- 87.70	S-100.0	S-66.67	S-100.0	S-92.06	S-100.0	S-50.0
		R-12.30	R-0.0	R-33.33	R-0.0	R-7.94	R-0.0	R-50.0
2	Ampicillin	S-13.16	S-12.5	S-0.0	S-0.0	S- 4.55	S- 0.0	S- 0.0
		R-86.86	R-87.5	R-100.0	R-100.0	R- 95.45	R-100.0	R- 100.0
3	Streptomycin	S- 51.47	S- 64.0	S- 8.33	S- 44.44	S- 47.31	S- 50.0	S- 0.0
		R- 48.53	R- 36.0	R- 91.67	R- 55.56	R- 52.69	R- 50.0	R- 100.0
4	Septrin	S- 13.89	S- 13.04	S- 0.0	S- 12.5	S- 14.02	S-0.0	S- 50.0
		R- 86.11	R- 86.96	R- 0.0	R- 87.5	R- 85.98	R-100.0	R- 50.0
5	Chloramphenicol	S- 37.9O	S- 56.52	S- 22.22	S- 33.33	S- 41.18	S- 66.67	S- 100.0
		R-62.10	R- 43.48	R- 77.78	R- 66.67	R- 58.82	R- 33.33	R- 0.0
6	Augmentin	S-25.23	S-50.0	S-0.0	S-0.0	S-22.86	S-0.0	S-0.0
		R-74.77	R-50.0	R-100.0	R-100.0	R-77.14	R-0.0	R-100.0
7	Ofloxacin	S-88.77	S-93.55	S-85.71	S-84.62	S-85.25	S-80.0	S-66.67
		R-11.23	R-6.45	R-14.29	R-15.38	R-14.75	R-20.0	R-33.33
8	Ampiclox	S-14.63	S-50.0	S-0.0	S-25.0	S-17.65	S-0.0	S-0.0
		R-85.37	R-50.0	R-100.0	R-75.0	R-82.35	R-100.0	R-100.0
9	Pefloxacin	S-72.48	S-80.0	S-81.82	S-62.5	S-76.25	S-100.0	S-100.0
		R-27.52	R-20.0	R-18.18	R-37.5	R-23.75	R-0.0	R-0.0
10	Nitrofurantoin	S-43.1	S-37.5	S-12.5	S-20.0	S-68.0	S-40.0	S-100.0
		R-56.9	R-62.5	R-87.5	R-80.0	R-32.0	R-60.0	R-0.0
11	Erythromycin	S-56.67	S-69.23	S-14.29	S-50.0	S-27.27	S-90.0	S-0.0
		R-43.33	R-30.77	R-85.71	R-50.0	R-72.73	R-10.0	R-100.0
12	Gentamycin	S-55.72	S-65.71	S-46.67	S-41.67	S-68.35	S-85.71	S-33.33
		R-44.28	R-34.29	R-53.33	R-58.33	R-31.65	R-14.29	R-66.67
13	Ciprofloxacin	S-83.7	S-94.44	S-85.71	S-50.0	S-71.11	S ----	S-100.0
		R-16.3	R-5.56	R-14.29	R-50.0	R-28.89	R ----	R-0.0
14	Ceftriaxone	S-23.71	S-47.06	S-44.44	S-66.67	S-45.28	S ----	S-33.33
		R-76.29	R-52.94	R-55.56	R-33.33	R-54.72	R ----	R-66.67
15	Amoxicillin	S-17.74	S-27.78	S-0.0	S-0.0	S-20.41	S-0.0	S-0.0
		R-82.26	R-72.22	R-100.0	R-100.0	R-79.59	R-100.0	R-100.0
16	Nalidixic Acid	S-13.64	S-0.0	S-0.0	S-50.0	S-47.76	S-0.0	S ----
		R-86.36	R-100.0	R-100.0	R-50.0	R-52.36	R-100.0	R ----
17	Penicillin	S-18.57	S-25.0	S-0.0	S-50.0	S-52.17	S-0.0	S ----
		R-81.43	R-75.0	R-100.0	R-50.0	R-47.83	R-100.0	R ----
18	Clindamycin	S-76.19	S-100.0	S ----	S ----	S-50.0	S ----	S ----
		R-23.81	R-0.0	R ----	R ----	R-50.0	R ----	R ----
19	Tetracycline	S-23.97	S-27.78	S-6.67	S-20.00	S-19.69	S-0.0	S-0.0
		R-76.03	R-72.22	R-93.33	R-80.00	R-80.31	R-100.0	R-100.0

KEYS: S-SENSITIVITY
R-RESISTANT

DISCUSSION

In this study, females constituted the largest number of participants with 700 (69.49) while the male accounted for 308 (30.6%). There were 24 (2.4%) minors while adults $\geq$ 18 years accounted 984 (97.6%).

This is similar to what was found in a study of 71 patients with enterococcal infection in Ngwu, Yobe State which showed a higher female to male ratio of 40 (56.3%) to 31 (43.7%) while children and adolescents (up to 19 years) constituted 7 (9.8%). We however could not classified the age of our patients further as most cases were only labeled as " adults" probably due to pressure to quickly attend to these patients and shorten duration of consultation in order to reduce waiting time. However, it may indicate a poor attitude for proper documentation by practitioners in our Centre, and a need to adhere closely to ethical guidelines of the Medical and Dental council on proper documentation of clinical cases [2, 3].

The largest specimen received were Mid-stream urine 522 (51.8%) High Vaginal Swab 311 (30.9%) Sputum. 43 (4.3%) and Surface swab 42 (4.2%). This may be due to females being the greater number of participants. It is most likely that many of these women were investigated for urinary and lower genital tracts infections, disease conditions known to be more common in the females due to biological susceptibility [4, 5].

A total of 571 (56.6%) specimen grew pathogenic organisms of which 104 (10.3%) were *Candida albicans* and other fungi while 437 (43.4%) yielded no growth or insignificant growth. This is similar to that of Nwedioha *et al* where 82% (1640) of 2000 genital swab specimens were positive for cultures and *Candida albicans* but differs in the positive cultures for *Candida* where they got 60% (1200). This difference may be accounted for by the number of samples. It may also be due to the difference in the population characteristics

between the Teaching Hospital and the University Health Centre which attends mainly to students. It also differs from that of Mordi *et al* in Benin who found no growth in only 6 (0.7%) of 832 samples [6].

The result however is comparable to those of Olatunji *et al* in Sagamu who found growth in 20(40%) and 50 (80.6%) of induced and spontaneous abortion cases of 132 Endocervical swab specimen [7]. It however showed a higher yield than that of Omoigberale *et al* in Benin who found positive cultures in only 226 (32.3%) of 700 Urine samples of pregnant women [8].

The commonest organisms isolated here were *Staphylococcus aureus* 226 (22.4%), *E. coli* and unspecified coliform organisms 156 (15.5%) and *Candida albicans*. A similar pattern too was found by other authors. Mordi *et al* in Benin found *Staphylococcus aureus* in 548 (41.8%), *Pseudomonas aeruginosa* 105 (12.5%) *E. coli* 98(11.8%) and *Klebsiella Pneumonia* 95(11.4%), but *Candida albican*s accounted for 5(0.5%) of 832 samples of aspirates, superficial lesions and secretions. [6]

Also Mordi *et al* found *Staphylococcus aureus* to be 65.5%, *Klebsiella* species 18.8% and *Escherichia coli* 15.6% of 32 positive culture of 96 Seminal fluid samples in Benin [9], while Omole – Ohonsi *et al* found *Candida albicans* in 81 (94%) and *Staphylococcus aureus* in 5 (6%) of 86 positive cultures among 160 pregnant women with Vaginal discharge [10].

Similar microbial pattern had also been founded by Wariso *et al* (Port Harcourt), Ayoola *et al* (Ibadan) and Olowu *et al* (Ile Ife) [11, 12, 13]. Wariso *et al* in a study of 2458 specimen of which growth was obtained from 2310 (94%), found Staphylococcus to be 730(31.6%), *E. coli*, 600 (25.97%) and *Pseudomonas* spp. 490(21.21%), others are *Klebsiella* spp 250(10.82%), *Proteus* spp, non – haemolytic Streptococcus 30 (1.29%) B – haemolytic Streptococcus 10 (0.43%) and *Candida albicans*, 10 (0.43%), Mixed infections were also seen in some cases, the actual number was however not reported. In our studies we found mixed infection of *Staphylococcus aureus* and *Candida albicans* in 3 (0.3%) patients.

Ayoola *et al* in a study of 102 patients in which septicaemia was confirmed in 39 infants found *E. coli* to be 14(14%), *Staph aureus* 13(13%), *Klebsiella* species 4(4%), *Streptococcus* species 3(3%), *Proteus* spp 2(2%), *Pseudomonas* species 2(2%) and *Salmonella* species 1 (1%). In our studies we found *Salmonella* spp to be 3 (0.3%). Olowu *et al*, in a study of 79 children investigated for nosocomial bacteriuria, in which 19 were positive culture found *Klebsiella* species to be 9(47.37%), *Staphylococcus aureus* 6(31.58%), *E. coli* 2(10.53%), *Pseudomonas* spp 1(15.26%) and *Citrobacter* spp (5.26%). We did not find *Citrobacter* in our study perhaps the preponderance of adults in our study account for this difference.

In this study there was significant association in the finding of microbial organisms between the males and the female with $X^2 = 122{,}550$ and $P<0.001$. This is similar to the finding of significant differences in uropathogens between male and females by Erhabor *et al* in a study of uropathogens in 187 persons in Port Harcourt with a P value of 0.01 [4].

The preponderance of *Staphylococcus aureus* in this study may be due to the ubiquity of the organism on the human body, as the organism is found on the skin and cavities like the ear, nose, mouth, urethra, vagina and anus [5, 6, 9].

The presence of gram negative organisms like *Escherichia coli*, unspecified coliforms, *Klebsiella* and others may indicate the increasing significance of these organisms as etiological agents for infections in the community.

The presence of *Candida albicans* may be an indicator of the use of family planning pills among a sexually active students population family planning pills being steroids may depress immunity and thus create a conducive atmosphere for colonization by opportunistic commensals like *Candida* organisms. Moreover, the acidic environment of the vagina favours the growth of *Candida* organisms and any factor that may alter the normal balance to favour colonization (e.g. reduction in oestrogen level as age advances) [5, 10].

The antibiotics with very good in vitro sensitivity include the Quinolones, Nitrofurantoin, Gentamicin, Erythromycin Tobramycin and Clindamycin. Paradoxically Ceftriaxone did not show a remarkable sensitivity pattern.

In this study, the quinolones show a high level of sensitivity pattern. Gentamycin and Erythromycin showed moderate susceptibility pattern, so also were Streptomycin, Chloramphenicol, and Nitrofurantoin. Levofloxacin demonstrated sensitivity to *Streptococcus* spp and *Proteus* spp while it showed 87.7% to *Staphylococcus aureus* and 92.06% to *E. coli*. This pattern of high sensitivity was also observed in other Quinolones like Ofloxacin, Pefloxacin and Ciprofloxacin.

Ceftriaxone showed low sensitivity to *Staph aureus* (23.71%), mild sensitivity to *Streptococcus* spp (47.06%), *Pseudomonas* spp (44.44%) and *E. coli* 45.28%. It showed moderate sensitivity to *Klebsiella* (66.67%). Mordi *et al* (Benin) and Adejoke *et al* (Kano) observed similar pattern of sensitivity to quinolones and the older generation antibiotics like Cotrimoxazole, Ampicillin, Ampiclox, Amoxicillin/Clavulanate and Penicillin, but differ to the pattern in the sensitivity of the Cephalosporins [6, 9, 15].

Gentamycin showed moderate to high sensitivity, except to *Salmonella* spp where it was low (33.33%). This pattern was also observed by Mordi *et al* and Adeleke *et al* [16, 9, 15]. The finding of low to moderate sensitivity to ceftriaxone agree with that of Akindele *et al* in Ibadan who found moderate to low sensitivity of *Klebsiella* spp

to the Cephalosporins in neonates [16, 17].

The poor susceptibility to the older generation of antibiotics also corroborate those of Jombo *et al* in Nguru, Yobe state [1], Wariso *et al* in Port Harcourt [11] and Erhabor *et al* also in Port Harcourt [14].

The poor susceptibility to Ceftriaxone gives room for serious concern as the third generation Cephalosporins were reserved for serious infections. The development of resistance to them may leave practitioners with very few choices in cases of severe infections.

Other antibiotics like Azithromycin, Tobramycin and Colistin showed good susceptibility profile but were tested on very few samples that would make no statistical significance. We wish to recommend further studies in other centres to determine the general sensitivity pattern in Ondo state. Meanwhile we suggest that practitioners in higher institutions in Ondo state and other Hospitals make use of the present sensitivity pattern to guide their choice of antibiotics prescriptions.

The most common bacterial isolates are *Staphylococcus aureus* and coliform organisms as the antibiotics identified as having the highest *in vitro* sensitivity pattern are recommended for first line management of septicaemia infections where they are indicated, in blind therapy.

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