Antibiotic susceptibility profile of isolates from pregnant women with asymptomatic bacteriuria attending antenatal clinics in three hospitals in Kano, Nigeria

Mojirayo T. Durowaiye [1], Josiah A. Onaolapo[2], Rukayat A. Oyi[2], James C. Igwe[3]

[1] Department of Pharmaceutical Microbiology, University of Ibadan, Ibadan, Nigeria
[2] Department of Pharmaceutics and Pharmaceutical Microbiology, Ahmadu Bello University, Zaria, Nigeria
[3]Department of Medical Biotechnology, National Biotechnology Development Agency, Abuja, Nigeria

Corresponding Author: Mojirayo Durowaiye
Email: mojihambolu@yahoo.com Phone: +2348065409700

ABSTRACT

Background: Pregnancy enhances the progression from asymptomatic to symptomatic bacteriuria which could lead to pyelonephritis and adverse obstetric outcomes. This study is aimed at determining the prevalence of asymptomatic bacteriuria and antibiotic susceptibility testing of uropathogens from pregnant women.

Objectives: This experimental study was done to determine the antibiotic susceptibility profile of uropathogens from antenatal patients.

Method: Three hundred and ten asymptomatic women attending antenatal clinics were sampled for the presence of bacteria. Antibiotic susceptibility test of isolates were carried out using Kirby-Bauer disc diffusion method.

Result: The prevalence of asymptomatic bacteriuria was found to be 15.2%, and *Proteus spp* (49.0%) the most prevalent organism. Antimicrobial susceptibility profile of *Proteus spp.* and *E. coli* to some commonly prescribed antibiotics showed resistance to amoxicillin, ciprofloxacin, ceftriaxone, nitrofurantoin, gentamicin, levofloxacin, cotrimoxazole, amoxicillin/clavulanic acid, nalidixic acid and tetracycline (47-100%). *S. aureus* showed resistance to ceftriaxone, nitrofurantoin, amoxicillin/clavulanic acid, nalidixic acid and tetracycline (66.7-100%). The multiple antibiotic resistance index (MARI) observed in this study with reference to the tested antibiotics showed that 99.96% of the *Proteus spp*. isolates have MAR Index of 0.2 to 1.0, while 99.97% of the *E. coli* isolates have MAR Index of 0.2 to 1.0.

Conclusion: These call for rational use of antibiotics in antenatal clinics to limit the emergence and transmission of multiple antibiotic resistant strains, more so when there is a change of pattern in the prevailing organism in asymptomatic bacteriuria which must be treated in pregnancy in order to prevent adverse maternal and neonatal complications.

Keywords: Asymptomatic bacteriuria, multiple antibiotic resistance, pregnant women

Le profil de la susceptibilité antibiotique des isolats chez les femmes enceintes avec la bactériurie asymptomatique assistant aux cliniques anténatals dans trois hôpitaux à Kano, Nigeria

Auteur correspondant: Mojirayo Durowaiye
Email mojihambolu@yahoo.com Téléphone: +2348065409700

RESUME

Contexte: La grossesse augmente la progression de la bactériurie de l'état asymptomatique à l'état symptomatique qui pourrait conduire à la pyélonéphrite et ses effets obstétriques adverses. Cette étude vise à déterminer la prévalence de la bactériurie asymptomatique et le test de susceptibilité antibiotique des uropathogènes chez les femmes enceintes.

Objectifs: Cette étude expérimentale a été faite pour déterminer le profil de susceptibilité antibiotique des uropathogènes chez les patients anténataux.

Méthode: Trois cent dix femmes asymptomatiques assistant aux cliniques anténatales ont servi d'échantillons pour tester la présence de bactérie. Des tests de susceptibilité antibiotique des isolats ont été conduits à l'aide de la méthode de diffusion de disque Kirby-Bauer.

Résultat: La prévalence de la bactériurie asymptomatique a été établie à 15.2%, et *Proteus spp* (49.0%) l'organisme le plus prévalent. Le profil de susceptibilité antimicrobienne de *Proteus spp.* et *E. coli* à certains antibiotiques couramment prescris a montré de la résistance à l'amoxicilline, ciprofloxacine, ceftriaxone, nitrofurantoin, gentamicine, levofloxacine, cotrimoxazole, amoxicilline/ acide clavulanique, acide nalidixique et tétracycline (47-100%). *S. aureus* a montré de la résistance à ceftriaxone, nitrofurantoin, amoxicilline/ acide clavulanique, acide nalidixique et tétracycline (66.7-100%). L'indice de résistance antibiotique multiple (MARI) observé dans cette étude avec la référence aux antibiotiques testés ont montré que 99.96% des isolats *Proteus spp*. ont l'indice MAR de 0.2 à 1.0, alors que 99.97% des isolats *E. coli* ont l'indice MAR de 0.2 à 1.0.

Conclusion: Ceci nécessite l'usage rationnelle des antibiotiques dans les cliniques anténatales pour limiter l'émergence et la transmission de multiples souches résistantes aux antibiotiques, d'autant plus que lorsqu'il y a un changement de comportement dans l'organisme dominant dans la bactériurie asymptomatique qui doit être traitée pendant la grossesse afin d'éviter des complications maternelles et néonatales adverses.

Mots-clés: bactériurie asymptomatique, résistance antibiotique multiple, femmes enceintes

INTRODUCTION

Asymptomatic bacteriuria is a condition in which urine culture reveals a significant growth of pathogens that is greater than 10^5 bacteria/ml, but without the patient showing symptoms of urinary tract infection (UTI) such as burning during micturition or frequent urination.[1] This is common in pregnancy.[2] Pregnancy enhances the progression from asymptomatic to symptomatic bacteriuria which could lead to pyelonephritis and adverse obstetric outcomes such as premature birth, low birth weight [3] and higher foetal mortality rates.[4,5] Acute pyelonephritis, foetal growth restriction and still birth in pregnant women have been associated with asymptomatic bacteriuria.[6,7,8]

Asymptomatic bacteriuria may not require treatment because the bacteria may not be causing harm, certain group of people such as pregnant women and their unborn fetuses may be at risk of complications.[9, 10, 11] Globally, asymptomatic bacteriuria affects 2-10% of all pregnant women.[5] Epidemiologic studies in Nigeria have shown the prevalence of asymptomatic bacteriuria among pregnant women to be as high as 21.0%, 45.3%, 78.7%, and 86.6%. [12,1,13,14]

The present study was designed to enumerate the prevalence of asymptomatic bacteriuria in pregnant women attending antenatal clinics in three (3) major hospitals in Kano, to determine the most prevalent uropathogen, and to determine the antibiotic susceptibility pattern of the urine isolates to commonly prescribed antibiotics. Multiple antibiotic resistance index (MARI) is the ratio of number of antibiotics to which an isolate is resistant to the total number of antibiotics tested.[15] The resistance pattern of the multiple antibiotics resistance indices of isolates from pregnant women attending antenatal clinics was calculated based on the ratio of the number of antibiotics to which the isolates were resistant to from a total of eleven (11) commonly prescribed antibiotics in the various hospitals.

MATERIALS AND METHOD

Three hundred and ten (310) urine samples of pregnant women (not showing clinical symptoms of urinary tract infection) attending antenatal clinics in three major hospitals (Aminu Kano Teaching Hospital, Mohammed Abdullahi Wase Specialist Hospital and Murtala Specialist Hospital) in Kano Nigeria were randomly collected and used in this study.

Collection of specimen

On each routine antenatal visit, a clean-catch mid-stream urine specimen was collected from each patient[16] into sterile universal bottles. These were transported over an ice bath and refrigerated before analysis was carried out within 24 hours.

Specimen processing

From each specimen, a loopful (0.01ml) of urine was inoculated on blood agar plates and cystein lactose electrolyte deficient (CLED) agar plates. The plates were allowed to dry and then incubated aerobically at 37^0C for 24 hours [17] and observed for formed colonies. Colonies formed were counted on the CLED agar plates; this was multiplied by the inoculum volume (0.01ml). Bacterial count of 10^5 cfu/ml and above was considered as significant for bacteriuria.

Identification of isolates

Each of the formed colonies were subcultured and then streaked on the surface of already prepared selective media i.e. Mac Conkey agar, Cetrimide agar, Mannitol salt agar, Eosin methylene blue agar, Urea agar and Saubroud dextrose agar. The streaked plates were then incubated at 37^0C for 24 hours. The colonies that developed were observed, noting their characteristics. The isolates were also identified morphologically and biochemically. [18, 19] The Ornithine decarboxylase and Indole production tests were used to differentiate *Proteus* (the most prevalent uropathogen isolated) into specie type. *Proteus mirabilis* were ornithine decarboxylase positive, and Indole negative while *Proteus vulgaris* were ornithine decarboxylase negative and indole positive.

Susceptibility test

The susceptibility of the various isolates to eleven (11) commonly prescribed antibiotics at the antenatal clinics were determined according to Bauer [20], and Wolf [21] with modifications by CLSI-Clinical Laboratory Standards Institute.[22]

Multiple antibiotic resistance index

The multiple antibiotic resistance index (MARI) is calculated based on the ratio of the number of antibiotics to which the isolates were resistant to from a total of eleven (11) commonly prescribed antibiotics in the various hospitals.

RESULT

Forty seven (47) out of the three hundred and ten (310) urine samples analyzed were positive for significant bacteriuria, with a prevalence of 15.2% (Table 1). These forty seven (47) positive culture yielded single bacterial

isolates. *Proteus spp*. was isolated from twenty three (23) urine samples: twenty (20) were *Proteus mirabilis*, and three (3) were *Proteus vulgaris*. *Escherichia coli* was isolated from seventeen (17) samples, *Staphylococcus aureus* was isolated from three (3) samples. *Pseudomonas aeruginosa* and *Klebsiella spp.* were both isolated from two (2) samples each (Table 1).

Table 1: Prevalence of Uropathogens in urine samples of pregnant women attending antenatal clinic.

Organism	Number		Percentage (%) prevalence	
Proteus mirabilis	20	23	42.6	49.0
Proteus vulgaris	3		6.4	
Escherichia coli	17		36.0	
Staphylococcus aureus	3		6.4	
Klebsiella spp.	2		4.3	
Pseudomonas aeruginosa	2		4.3	

Proteus spp. isolates were completely resistant to amoxicillin/clavulanic acid **(**Beta-lactam antibiotic) and tetracycline. Other antibiotics with high resistance profile are Cotrimoxazole, Nitrofurantoin, Gentamicin, Amoxicillin and Ceftriaxone with percentage resistance of 95.7%, 82.6%, 74.0%, 65.2%, and 56.5% respectively (Table 2). The quinolones and fluoroquinolones displayed the highest antimicrobial activity of 82.6% (ciprofloxacin), 60.8% (levofloxacin), 73.9% (ofloxacin), and 52.1% (nalidixic acid).

E. coli isolates were totally resistant to was observed to tetracycline, while a high resistance of 94.1%, 88.2%, 82.4% and 70.6% was observed to amoxicillin/clavulanic acid, cotrimoxazole, nitrofurantoin and gentamicin respectively (Table 2). A relatively high percentage resistance of 58.8% was observed to the flouroquinolones (ciprofloxacin and levofloxacin) and also ceftriaxone (a cephalosporin). Nalidixic acid and amoxicillin displayed a resistance profile of 53.0% and 47.0% respectively. Ofloxacin showed the highest antimicrobial activity (potency) of 70.6%, and a percentage resistance of 29.4%.

In *S. aureus* isolates, absolute resistance was observed to tetracycline also. The fluoroquinolones (ciprofloxacin and levofloxacin) displayed the highest antimicrobial activity of 100% respectively. Ofloxacin and cotrimoxazole both showed antimicrobial activity of 66.7%. High resistance profile of 66.7% was observed to ceftriaxone (a cephalosporin), nitrofurantoin, amoxicillin/clavulanic acid and nalidixic acid respectively (Table 2).

Table 2: Summary of Percentage sensitivity of *Proteus spp., E. coli* and *S. aureus* isolates from urine samples of pregnant women attending antenatal clinic in Kano, Nigeria to 11 commonly prescribed antibiotics.

Isolate		AMX	CIP	CEF	LEV	NIT	OFL	GEN	COT	ACA	NAL	TET
Proteus spp.	S	8.7	39.1	13.1	30.4	8.7	60.9	13.0	4.3	0.0	13.0	0.0
	I	26.1	43.5	30.4	30.4	8.7	13.0	13.0	0.0	0.0	39.1	0.0
	R	65.2	17.4	56.5	39.2	82.6	26.1	74.0	95.7	100.0	47.9	100.0

Isolate		AMX	CIP	CEF	LEV	NIT	OFL	GEN	COT	ACA	NAL	TET
E. coli	S	11.8	23.5	5.9	17.6	5.9	17.6	0.0	0.0	5.9	17.6	0.0
	I	41.2	17.6	35.3	17.6	11.8	11.8	11.8	11.8	0.0	29.4	0.0
	R	47.0	58.8	58.8	58.8	29.4	70.6	88.2	88.2	94.1	53.0	100.0

Isolate		AMX	CIP	CEF	LEV	NIT	OFL	GEN	COT	ACA	NAL	TET
S. aureus	S	33.3	33.3	0.0	66.7	33.3	33.3	100.0	33.3	33.3	33.3	0.0
	I	33.3	66.7	33.3	33.3	0.0	33.3	0.0	33.3	0.0	0.0	0.0
	R	33.3	0.0	66.7	0.0	66.7	33.3	0.0	33.3	66.7	66.7	100.0

S: sensitive, R: resistant, CEF: ceftriaxone, NAL: nalidixic acid, GEN: gentamicin, I: intermediate, OFL: ofloxacin, TET: tetracycline, AMX: amoxicillin, ACA: Amoxicillin/Clavulanic acid, CIP: ciprofloxacin, COT: cotrimoxazole, LEV: levofloxacin, NFT: nitrofurantoin

The resistance pattern of the multiple antibiotics resistance indices of *Proteus spp*. isolated from pregnant women attending antenatal clinics is shown in Tables 3 and 4. The isolates have multiple antibiotics resistance index > 0.2, this means resistance of isolates to more than two antibiotics simultaneously.

Table 3: Multiple antibiotic resistance index (MARI) and resistance pattern of isolated *Proteus spp.* isolates

S/No	Resistance Pattern	Isolate Lab No	MAR Index	Resistance category
1	AMO,CEF,NFT,COT,ACA,TET	P1	0.5	MDR
2	AMO,CEF,LEV,NFT,OFL,GEN,COT,ACA	P2	0.7	MDR
3	CEF,LEV,NFT,GEN,COT,ACA ,TET	P3	0.6	MDR
4	AMO,CEF,NFT,COT,,GEN,NAL, ACA,TET,OFL,LEV	P4	1.0	MDR
5	CEF,NFT,COT,ACA ,GEN,NAL,OFL,LEV	P5	0.7	MDR
6	AMO,CIP,ACA ,TET	P6	0.3	MDR
7	NFT,GEN,COT,ACA	P7	0.3	MDR
8	CEF,NFT,GEN,COT,ACA,NAL,TET	P8	0.6	MDR
9	AMO,CEF,GEN,COT,ACA,NAL,TET	P9	0.6	MDR
10	AMO,NFT,COT,ACA ,TET	P10	0.4	MDR
11	AMO,CEF,LEV,NFT,COT,ACA ,NAL,TET	P11	0.7	MDR
12	AMO,CEF,LEV,NFT,GEN,COT,NAL,TET	P12	0.7	MDR
13	AMO,CIP,LEV,NFT,OFL,GEN,COT,ACA,TET	P13	0.8	MDR
14	CEF,LEV,OFL,NFT,GEN,COT,ACA,TET,NAL	P14	0.8	MDR
15	CEF,NFT,GEN,COT,ACA,NAL,TET	P15	0.6	MDR
16	CEF,NFT,GEN,COT,ACA,NAL,TET	P16	0.6	MDR
17	AMO,COT,ACA,TET	P17	0.3	MDR
18	AMO,NFT,COT,ACA,TET	P18	0.4	MDR
19	AMO,NFT,GEN,COT,ACA,	P19	0.6	MDR
20	AMO,OFL,GEN,COT,ACA,NAL,TET	P20	0.6	MDR
21	AMO,LEV,NFT,GEN,COT,ACA,NAL,TET	P21	0.7	MDR
22	CEF,NFT,GEN,COT,ACA,TET	P22	0.5	MDR
23	AMO,NFT,GEN,COT,ACA,TET	P23	0.5	MDR

AMO: Amoxicillin, LEV: Levofloxacin, NFT: Nitrofurantoin, GEN: Gentamicin, NAL: Nalidixic acid, COT: Cotrimoxazole, CEF: Ceftriaxone, ACA: Amoxicillin/Clavulanic acid, TET: Tetracycline, OFL: Ofloxacin, CIP: Ciprofloxacin, P: Proteus isolates, MDR: Multidrug Resistance

Table 4: Multiple Antibiotic Resistance Index and profile of occurrence of *Proteus spp.* isolates

MAR Index	No of *Proteus Isolates*	Percentage
0.2	-	-
0.3	3	13.04
0.4	1	4.34
0.5	4	17.39
0.6	7	30.43
0.7	3	13.04
0.8	3	13.04
0.9	1	4.34
1.0	1	4.34
Total	23	99.96

The Multiple Antibiotic Resistance Index (MARI) of the *Proteus spp*. isolates shows that 99.96% were resistant to 3 or more antibiotics.

The resistance pattern of the multiple antibiotics resistance indices of *E. coli* isolated from pregnant women attending antenatal clinics is shown in Tables 5 and 6. The isolates have multiple antibiotics resistance index > 0.2, this means resistance of isolates to more than two antibiotics simultaneously.

Table 5: Multiple antibiotic resistance index (MARI) and resistance pattern of isolated *E. coli*

S/No	Resistance pattern	Isolate Lab No	MAR Index	Resistance category
1	COT, ACA, TET	Ec1	0.2	MDR
2	AMO,CEF,LEV,OFL,GEN,COT,TET	Ec2	0.6	MDR
3	AMO,CIP,LEV,NFT,COT,ACA,TET	Ec3	0.6	MDR
4	CIP,CEF,LEV,GEN,COT,ACA,TET	Ec4	0.6	MDR
5	CIP,CEF,LEV,NFT,OFL,GEN,COT,ACA,NAL,TET	Ec5	0.9	MDR
6	NFT,COT,ACA,NAL,TET	Ec6	0.4	MDR
7	CIP,CEF,LEV,NFT,OFL,GEN,COT,ACA,TET	Ec7	0.8	MDR
8	AMO,CIP,CEF,LEV,NFT,GEN,COT,ACA,NAL,TET	Ec8	0.9	MDR
9	AMO,CIP,NFT,GEN,COT,AC A,NAL,TET	Ec9	0.7	MDR
10	AMO,NFT,COT,ACA,NAL,T ET	Ec10	0.5	MDR
11	AMO,NFT,ACA,TET	Ec11	0.3	MDR
12	CEF,NFT,GEN,COT,ACA,TET	Ec12	0.5	MDR
13	NFT,GE N,COT,ACA,TET	Ec13	0.4	MDR
14	AMO,CIP,CEF, TET,NAL,COT,LEV,GEN,ACA,NFT	Ec14	0.9	MDR
15	CIP,CE F,LEV,NFT,OFL,GEN,COT,ACA,TET	Ec15	0.8	MDR
16	CIP,CEF,L EV,NFT,OFL,GEN,COT,ACA,NAL,TET	Ec16	0.9	MDR
17	AMO,CIP,CEF,LEV,NFT,OFL,GEN,COT,NAL,COT,ACA	Ec17	1.0	MDR

AMO: Amoxicillin, LEV: Levofloxacin, NFT: Nitrofurantoin, GEN: Gentamicin, NAL: Nalidixic acid, COT: Cotrimoxazole, CEF: Ceftriaxone, ACA: Amoxicillin/Clavulanic acid, TET: Tetracycline, OFL: Ofloxacin, CIP: Ciprofloxacin, Ec: *Escherichia coli* isolates, MDR: Multidrug Resistance.

Table 6: Multiple Antibiotic Resistance Index and profile of phenotypic occurrence of *E. coli* isolates

MAR Index	No of *E. coli* Isolates	Percentage (%)
0.2	1	5.88
0.3	1	5.88
0.4	2	11.76
0.5	2	11.76
0.6	3	17.64
0.7	1	5.88
0.8	1	5.88
0.9	5	29.41
1.0	1	5.88
Total	17	99.97

The Multiple Antibiotic Resistance Index (MARI) of the *E. coli* isolates shows that 99.97% were resistant to 2 or more antibiotics.

DISCUSSION

In this study, the prevalence of asymptomatic bacteriuria was found to be 15.2%; this is lower than 21.0% from the study in Ibadan [12], 23.9% in Sagamu [23], 45.3% reported in Benin City [1], and 78.9% in Abakaliki [13], all in Nigeria. The lower prevalence may be associated with the antenatal teachings (which often lay emphasis on good personal hygiene practice like regular hand-washing, etc) given at each routine antenatal clinic in the three major hospitals used in this study. Also majority of the patients in this study practice the religion in which they often wash their hands and other body parts before saying their regular daily prayers. This could have helped to reduce bacteria load and transmission. The organisms isolated from the urine samples of these pregnant women were *Proteus spp. (Proteus mirabilis and Proteus vulgaris), Escherichia coli, Staphylococcus aureus, Pseudomonas aeruginosa* and *Klebsiella spp*.

The occurrence and apparent prevalence of these microorganisms (some of which are pathogenic) in a vast number of women, especially those pregnant, gives cause for concern as they are prone to several complications as well as foetal risks. *Proteus spp.* (a major soil contaminant) was observed to be the most prevalent micro-organism (49%), this may have been introduced into the urinary tract of these women (especially the house-wives who are more busy with house chores exposing them to soil contact like sweeping, farming, etc) while they clean up using their hands after defecating or urinating. In time past *Proteus spp.* was observed to be among the least organism likely to cause asymptomatic bacteriuria, this study has shown that *Proteus spp. (*especially *Proteus mirabilis)* could be a major uropathogen causing urinary tract infection; this is at variance with other studies in the country, and it suggests a changing pattern in the prevalence of organisms causing infection in the population.[25] This is followed by *Escherichia coli* (36%); this organism is observed to thrive well in the urinary stasis condition found in most pregnant women, and also poor hygiene practice after defecating and urinating.

The result of antimicrobial susceptibility of *Proteus spp.* to eleven (11) commonly prescribed antibiotics showed high resistance to eight antibiotics such as Amoxicillin, Ceftriaxone, Nitrofurantoin, Gentamicin, Cotrimoxazole, Amoxicillin/Clavulanic acid, Nalidixic acid and Tetracycline (47.9-100%). The result of susceptibility of *Escherichia coli* to eleven commonly prescribed antibiotics showed high resistance to ten antibiotics such as Amoxicillin, Ciprofloxacin, Ceftriaxone, Levofloxacin, Nitrofurantoin, Gentamicin, Cotrimoxazole, Amoxicillin/clavulanic acid, Nalidixic acid and Tetracycline (47-100%). *Staphylococcus aureus* showed high resistance to five antibiotics out of eleven: Ceftriaxone, Nitrofurantoin, Amoxicillin/clavulanic acid, Nalidixic acid and Tetracycline (66.7-100%).

The βeta-lactams and cephalosporins are a group of antibiotics considered as safe in pregnancy. In *Proteus spp.* isolates, resistance of 100%, 65.2% and 56.5% were observed to Amoxicillin/clavulanic acid, Amoxicillin and Ceftriaxone respectively. In *E. coli* isolates, resistance of 94.1%. 58.8%, and 47.0% was also observed to

Amoxicillin/clavulanic acid, Ceftriaxone and Amoxicillin respectively. The fluoroquinolones are contraindicated in pregnancy, however in a life threatening situation, the risk-benefit ratio can be considered and administered. In *Proteus spp.* isolates, resistance was observed to Levofloxacin (39.2%), Ofloxacin (26.1%), Ciprofloxacin (17.4) and Nalidixic acid (47.9%). In *E. coli* isolates, resistance was observed to Levofloxacin (58.8%), Ciprofloxacin (58.8%), Ofloxacin (29.4), and Nalidixic acid (53.0%).

The multiple antibiotic resistance index (MARI) observed in this study with reference to the tested antibiotics showed that 99.96% of the *Proteus spp.* isolates have MAR index of 0.2 to 1.0, while 99.97% of the *E. coli* isolates have MAR index of 0.2 to 1.0. This observation suggests that the isolates in this study may probably have originated from an environment where antibiotics are often used irrationally.[15, 25] Broad-spectrum antibiotics are sometimes reported to be given in place of narrow-spectrum antibiotics as a substitute for culturing and sensitivity testing, with the consequent risk of selection of antibiotic-resistant mutants. The occurrence of these uropathogenic isolates in pregnant women gives cause for concern as they are prone to several complications as well as foetal risks. There is need for early routine screening of all antenatal patients presenting or not presenting with clinical symptoms of urinary tract infection. Proper routine culture test should be carried out; the strip urinalysis method which is been utilized by most clinicians for assessing the urine of these pregnant women which cannot quantify the extent of infection as well provide adequate antimicrobial therapy as in the case of a culture test should be discouraged in antenatal clinics.

CONCLUSION

Using 10^5cfu/ml as significant level of bacteriuria, the prevalence of asymptomatic bacteriuria was found to be 15.2% (n=310). There is also a changing pattern in the prevalence of the organisms causing asymptomatic bacteriuria: *Proteus spp*. is seen to be the most prevalent uropathogen isolated, while previously reported organisms include *S. aureus*, and *E. coli*. Multiple antibiotic resistance was observed to some of the commonly prescribed antibiotics that are considered as safe in pregnancy. Asymptomatic bacteriuria must be treated in pregnancy in order to prevent adverse complications. Rational use of antibiotics should be encouraged in all antenatal clinics to help limit the emergence and transmission of multiple antibiotic resistant strains. There is need for the development of new and effective antibiotics that are safe in pregnancy.

ACKNOWLEGDEMENT

The authors are grateful to Mr. Nasir Abdullahi for collecting the urine samples from the various antenatal clinics and his technical assistance. The authors have no conflict of interest to declare.

REFERENCES

1. Imade PE, Izekor PE, Eghafona NO, Enabulele I, Ophori, E (2010). Asymptomatic bacteriuria among pregnant women. *North American Journal of Medical Science*, 2(6): 263-266.
2. Gilbert DN, Moelleving Jr RC, Eliopoulos GN, Sander NA (2005). Sandford guide to Antimicrobial therapy. 32nd Hyde Park, Vermont: Antimicrobial Therapy, Inc. pp 22-23.
3. Connolly A, Thorp JM Jnr (1999). Urinary tract infection in pregnancy. *Urology Clinical North America* 26(4): 779-787.
4. Nicolle LE (1994). Screening for asymptomatic bacteriuria in pregnancy. Canadian guide on preventive healthcare, Ottawa Health, Canada; pp 100-106.
5. Delzell JE Jr, and Leferre, ML (2000). Urinary tract infections during pregnancy. *American Family Physician* 61(3): 713-721.
6. Zhao J and Wu LF (2004). Study of the causes of fetal growth restriction with unclear etiologies. *Zhonghau Fu Chan Ke Za Zhi*, 39: 329-33.
7. Ryan KJ, Berkowitz R, and Barbieri RL (1990). Kistner's Gynaecology: Principle and Practice. 5th Edn. Appleton. Boston, pp 300-302.
8. Hill JB, Sheffield JS, Mc Intire DD, and Wendel GD (2005). Acute pyelonephritis in pregnancy. *Obstetrics and Gynaecology*. 105: 18-23.
9. Guyton CA (1996) Medical physiology. 9th Edn. W.B. Saunders Company. Philadelphia, pp: 372-373.
10. Lindsay EN (2003). Screening for asymptomatic bacteriuria in pregnancy. Canadian Guide to Clinical preventive Health care, 1: 100-106.
11. Bloomberg B, Olsen BE, Hinderaker SG, Langeland N, and Gasheka P (2005). Antimicrobial resistance in urinary bacterial isolates from pregnant women in rural Tanzania: Implications for public health. *Scandinavian Journal of Infectious Diseases*, 37:262-268.
12. Ogbolu DO, Akinloye O, Terry Alli OA, Akinloye OM (2006). Asymptomatic bacteriuria of pregnancy in Ibadan, Nigeria: a re-assessment. *British Journal of*

biomedical science; **63**(3): 109-112.

13. Amadi ES, Enemuo OB, Uneke CJ, Nwosu OK, Onyeagba RA, and Ugbogu OC (2007). Asymptomatic bacteriuria among pregnant women in Abakaliki, Ebonyi State, Nigeria. *Journal of Medical Science*. 7(4): 698-700.
14. Akerele J, Abhulimen P, and Okonofua (2001). Prevalence of asymptomatic bacteriuria, among pregnant women in Benin City, Nigeria. *Journal of Obstetrics and Gynaecol*ology, 21: 141-144.
15. Paul S, Bezbarauh RL, Roy, MK, and Ghosh, AC (1997). Multiple antibiotic resistance (MAR) Index and its reversion in *Pseudomonas aeruginosa*. *Letters in Apllied Microbiology*. 24: 169-171.
16. Hooton TM, Scholees D, Stapleton AF (2000). A prospective study of asymptomatic bacteriuria in sexually active young women. *New Eng1and Journal of Medicine*; 343:992-7.
17. Cheesbrough M (2002). District Laboratory practice in Tropical countries. Part 2. Cambridge University press, U.K., pp. 391.
18. Cowan ST (1974). Cowan and Steel's manual for the identification of Medical bacteria (2nd edition). Cambridge University Press, Cambridge, pp. 110-118.
19. Collee J, and Miles RS (1989). Tests for identification of bacteria. In: College JR, Duguid JP, Fraser AG, Marmion BP (eds). Mackie and McCartney's Practical Medical Microbiology. 13th ed. Churchill Livingstone/Longman, London. Pp.141-160.
20. Bauer AW, Kirby WM, Sherris JC, Turch M (1996). Antibiotic susceptibility testing by a standardized single disc method. *American Journal of Clinical Pathology*. 45:493-497.
21. Wolf PL (1975). Practical Clinical Microbiology. Techniques and interpretations. John Wiley and Sons. Inc. New York. pp 186-188.
22. Clinical Laboratory Standards Institute (2006). M100-S16. Performance Standards for Antimicrobial Susceptibility Testing. Sixteenth Informational Supplement. 26 (3).
23. Olusanya O, Ogunledum A, Fakoya TA (1993). Asymptomatic bacteriuria among pregnant and non-pregnant women in Sagamu, Nigeria. *West African Journal of Medicine.* 12(1): 27-3
24. Durowaiye MT, Onaolapo JA, Oyi AR (2011). Preliminary study on asymptomatic bacteriuria in pregnant women attending antenatal clinics in three major hospitals, Kano, Nigeria. *Nigerian Journal of Pharmaceutical Sciences*. 10(2):15-21.
25. Krumperman PH (1983). Multiple Antibiotic Indexing *Escherichia coli* to identifying risk sources of feacal contamination of foods. *Applied and Environmental Microbiology*. 46: 165-170.