

URINARY TRACT INFECTIONS (UTIs) IN WOMEN: CAUSATIVE ORGANISMS AND ANTIMICROBIAL SENSITIVITY PATTERNS.

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SUMMARY

Context: "Blind" antibiotic therapies are often instituted for women with urinary tract infections (UTIs). There is therefore, a need to evaluate the current prevalence of pathogens of UTIs and their antimicrobial sensitivity patterns to highlight justifiable empirical antimicrobials in such a situation.

Objective: The aims of the study were to identify the pathogens of UTIs in pregnant and non-pregnant women, determine their antimicrobial sensitivity patterns as well as suggest appropriate empirical antimicrobial agents for them.

Study Design: The research was a prospective (cohort) study of the causative organisms of UTIs in women and their antimicrobial sensitivity patterns. The study was carried out at the Department of Obstetrics and Gynaecology, University of Ilorin Teaching Hospital, Ilorin, Nigeria. Urine samples of women with suspected UTIs were sent for microscopy, culture and sensitivity tests. Their results were analyzed and Chi Square was used to test the differences between the results of pregnant and non-pregnant patients.

Results: *Escherichia coli* predominated as a cause of UTIs. *Staphylococcus aureus* ($0.05 > p > 0.01$), *Proteus* species ($0.05 > p > 0.01$) and *Pseudomonas* ($0.05 > p > 0.01$) were more likely to be isolated in non-pregnant women. Good to very good effectiveness were found in Sultamicillin, Azithromycin, Nitrofurantoin, Nalidixic acid, Gentamycin and Cotrimoxazole. The more recent, expensive antibiotics like Ofloxacin, Ciprofloxacin, Ceftriaxone and Cefuroxime showed excellent effectiveness. Antibiotics were generally more effective in pregnancy with Gentamycin being statistically significantly better. ($0.05 > p > 0.001$).

Conclusion and Recommendations: The choice of empirical antibiotics for UTIs in this environment should be from among those with good to excellent activities as listed in the results. Consideration should be given to the severity of the infection, drug efficacy, safety in pregnancy and cost effectiveness.

Key Words: Urinary tract infections; women; causative organisms; antimicrobial sensitivity.

INTRODUCTION

Urinary tract infections (UTIs) are common in women, with the incidence ranging from 5 to 20%¹. This high incidence is as a result of the proximity of the vagina to the anus which makes it susceptible to colonization by enteric bacteria¹⁻⁵. The infections range from simple urethritis through cystitis, pyelitis to pyelonephritis. UTIs are more common in pregnancy, labour and the puerperium because of mechanical factors that obstruct urinary flow, causing stasis, thus promoting bacterial invasion of the urinary tract^{1,4}.

Recent reports have shown that frequent uses of broad-spectrum antibiotics have made the bowel commensals to

acquire resistance to many antimicrobial agents. These resistance properties are easily transferred between bacteria of different genera through plasmids^{7,9}. Other reports have shown that the bacteriology of UTIs has changed over time with an increasing presence of gram-positive cocci such as staphylococcus species. Also *Klebsiella* species a gram negative organism is becoming more frequently isolated even in community acquired UTIs apart from its usual association with hospital acquired cases¹⁰⁻¹².

Many times UTIs present acutely or present in places remote from reliable laboratories and blind antibiotic therapies are often instituted then. It is for this reason that the prevalence of the causative organisms and their antimicrobial sensitivity patterns need to be known, so

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that appropriate empirical antibiotics will be used. For this purpose 155 urinary isolates were analyzed at the Department of Obstetrics and Gynaecology, University of Ilorin Teaching Hospital, Ilorin, Nigeria.

MATERIALS AND METHODS

Mid-stream samples of clean catch (aseptic) urine specimen of selected patients were sent for bacteriological evaluation between January 1997 and December 1997. The patients were women presenting with symptoms suggestive of urinary tract infections UTIs at the Department of Obstetrics and Gynaecology, University of Ilorin Teaching Hospital, Ilorin Nigeria, either in the antenatal or Gynaecology clinics. All patients who were on antibiotics before or at the time of presentation were excluded from the study. Also excluded were patients who have had urinary tract infection six months before presentation.¹¹

Trained nurses supervised collection of specimen and samples were then sent immediately to the laboratory to prevent multiplication of organisms before examination.¹¹ A standard platinum loop was used to administer approximately 0.025ml of uncentrifuged urine onto cysteine lactose-electrolyte-deficient (CLED) media and macconkey agar plates. After overnight aerobic incubation at 37°C, samples were identified to species and their antimicrobial sensitivities tested using stokes disc diffusion technique.¹⁴

The laboratory results were analyzed separately for pregnant and non-pregnant women. Chi Square was used to test whether there was any significant difference in the prevalence and the antimicrobial sensitivity of the organisms isolated between the two groups of women.

RESULTS

Three hundred and eighteen (318) samples were sent for processing and subsequent analysis during the study period. One hundred and fifty five (155) samples showed significant growth, which amounted to 48.7%. Pregnant women accounted for 93 (60%), while non-pregnant women accounted for 62 (40%) of the isolates.

Table I shows the prevalence of the various organisms isolated. *Escherichia coli* was the commonest isolated organism accounting for 31.6% of cases. It was present equally among the pregnant and the non-pregnant women. Other organisms isolated in order of frequency were candida species (21.3%), *Streptococcus faecalis* (11.6%) *Klebsiella* (9.0%), *Staphylococcus aureus* (7.7%), *Proteus species* (7.1%), *Pseudomonas* (5.8%) and *Trichomonas vaginalis* (5.8%). It should be noted however that, the prevalence of staphylococcus aureus, proteus species and pseudomonas in non-pregnant patients was much higher than in pregnant patients. This difference was statistically significant ($0.05 > p > 0.01$). In the same vein the prevalence of candida species in pregnant women was higher than in non-pregnant women and this was also statistically significant ($0.01 > p > 0.001$). Similar finding existed for *trichomonas vaginalis* ($0.05 > p > 0.001$).

The antimicrobial susceptibility pattern of pregnant patients is shown in Table II. The isolates showed varying degrees of resistance to the antimicrobial agents tested. The common cheap antibiotics penicillin, Ampicillin, cloxacillin, Tetracycline and Chloramphenicol showed very low effectiveness of less than 20%. Some other relatively cheap drugs like Cotrimoxazole, Nalidixic acid, Nitrofurantoin and Gentamycin as well as Zithromax showed acceptable good to very good antimicrobial

TABLE I: Frequency of isolation of various pathogens in urine.

Organism	Pregnant patients		Non-pregnant patients		Total		P. value
	No	%	No	%	No	%	
E. Coli	28	31.1	21	33.9	49	31.6	
Strept Faecalis	11	12.2	7	11.3	18	11.6	
Klebsiella	9	10.0	5	8.1	14	9.0	
Staph aureus	4	4.4	8	12.9	12	7.7	$0.05 > p > 0.01$
Proteus sp	4	4.4	7	11.3	11	7.1	$0.05 > p > 0.01$
Pseudomonas	3	3.3	6	9.7	9	5.8	$0.05 > p > 0.01$
Candida sp	26	28.9	7	11.3	33	21.3	$0.05 > p > 0.01$
T. Vaginalis	8	8.9	1	1.6	9	5.8	$0.05 > p > 0.01$
Total	93	100	62	100	155	100	

$P < 0.05$ for difference between pregnant and non-pregnant women.

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activities. Excellent antimicrobial activities were however present in *Ofloxacin*, *Ciprofloxacin*, *cefuroxime* and *Ceftriaxone*.

Table III presents the antimicrobial sensitivity pattern

of the isolates from non-pregnant patients. The results were similar to the pattern found among pregnant patients, except that the organisms were generally slightly more resistant.

TABLE II: Susceptibility pattern of pregnant patients urinary isolates

Drug	E Coli			Strep F			Klebsiella			Staph aureus			Proteus Sp			Pseudomonas			Total		
	No Tested	No +Ve	% Sens	No Tested	No +Ve	% Sens	No Tested	No +Ve	% Sens	No Tested	No +Ve	% Sens	No Tested	No +Ve	% Sens	No Tested	No +Ve	% Sens	No Tested	No +Ve	% Sens
P	8	0	0	5	0	0	5	0	0	8	1	12.5	3	0	0	3	0	0	32	1	3.1
A	20	2	10	8	1	12.5	8	0	0	8	1	12.5	7	0	0	4	0	0	55	4	7.3
CX	19	3	15.8	8	2	15	7	1	14.3	6	3	50	8	0	0	6	0	0	54	9	16.7
SAM	22	11	50	6	4	66.7	8	2	25	5	3	60	5	2	40	4	1	25	50	23	46
E	13	2	15.4	7	3	42.8	5	1	20	5	3	60	5	0	0	3	0	0	38	9	23.7
AZM	13	10	61.5	6	5	66.7	3	1	33.3	3	3	100	3	1	33.3	2	1	0	30	21	70
T	6	0	2	3	0	0	2	0	0	3	1	33.3	3	0	0	2	0	0	19	3	15.8
C	11	3	18.2	4	1	25	3	0	0	8	2	25	3	0	0	3	0	0	32	6	18.8
S	6	2	33.3	2	0	0	3	1	33.3	3	2	66.7	5	1	20	2	0	0	21	6	28.7
G	20	15	75	8	5	62.5	5	3	60	4	3	75	5	3	60	4	2	50	46	31	67.4
OFX	22	20	81.8	8	6	75	6	4	50	5	4	60	4	3	50	3	2	66.7	48	39	81.2
CIP	19	17	84.2	7	7	100	6	5	50	5	5	100	5	4	80	4	3	50	46	41	89.1
CXM	19	19	100	8	8	100	6	6	100	5	4	80	6	5	83.3	4	4	100	48	40	95.8
CRO	18	17	94.4	9	9	100	7	6	85.7	5	5	100	6	5	83.3	4	4	100	49	46	93.9
COT	16	9	56.3	5	3	60.0	3	1	33.3	6	6	100	5	3	60	3	0	0	38	22	57.9
NIT	13	10	76.9	6	4	66.7	4	2	50	3	2	66.7	4	3	75	3	1	33.3	33	23	69.7
NAL	10	7	70	5	3	60	3	2	66.7	3	2	66.7	4	3	75	3	1	33.3	28	18	64.4

Key: P - Penicillin A - Ampicillin CX - Cloxacillin SAM - Sultamicillin
E - Erythromycin AZM - Azithromycin T - Tetracycline C - Chloramphenicol
S - Streptomycin G - Gentamycin OFX - Ofloxacin CIP - Ciprofloxacin
CXM - Cefuroxime CRO - Ceftriaxone COT - Cotrimoxazole NIT - Nitrofurantoin
NAL - Nalidixic acid.

TABLE IV: Comparison of efficacy of antimicrobial agents between pregnant and non-pregnant patients.

Antimicrobial agent	% Effectiveness		P-Value
	Pregnant patients	Non-pregnant patients	
Penicillin	3.1	3.6	
Ampicillin	7.3	5	
Cloxacillin	16.7	8.3	
Sulfamethoxazole	46	40	
Erythromycin	23.7	20	
Azithromycin	70.0	61.6	
Tetracycline	15.8	6.7	
Chloramphenicol	18.8	17.9	
Streptomycin	28.7	24	
Gentamycin	67.4	55	0.05 > p > 0.001
Ofloxacin	81.2	79.5	
Ciprofloxacin	89.2	85.4	
Cefuroxime	95.8	90.4	
Ceftriaxone	93.9	87.8	
Cotrimoxazole	57.9	50.0	
Nitrofurantoin	69.7	68.8	
Nalidixic acid	64.3	59.4	

P < 0.05 for difference between pregnant and non-pregnant women.

DISCUSSION

The 47% rate of significant bacteriuria reported in this study is far higher than rates reported in other studies^{1,2,3}. It may however be due to the fact that the rate obtained in this study was based on population with clinical suspicion of urinary tract infections UTIs, as against the other studies that were based on a large population of clinic attendance or hospital admissions. This is apart from the fact that significant (profuse) growth of *Candida albicans* and *trichomonas vaginalis* were included in the positive samples. The preponderance of positive pregnant patients samples is however in keeping with the predisposing

structural and functional changes in the urinary tract brought about by pregnancy itself^{2,3}.

The commonest organism isolated was *Escherichia coli*, accounting for 31.6%. This finding conforms to the generally observed trend the world over^{1,2,3,13}, but differ from some recent reports which tend to give *Klebsiella* predominance¹⁰⁻¹². The fact that *Klebsiella* ranked third among the bacterial pathogens isolated in this study as against fourth and fifth^{1,2} will support the fact that it is an emerging force in urinary tract infections. It was equally present in both the pregnant and the non-pregnant patients. The findings of significant difference in the presence of staph aureus, proteus species and *Pseudomonas* in non-pregnant patients confirms the aetiopathogenesis of urinary tract infections in them, which will include nosocomial infection, and not because they are women¹⁰⁻¹². This finding also confirms the fact that most isolates in pregnant women were hitherto the normal commensals of the vagina¹. Isolation of *Candida albicans* and *Trichomonas vaginalis* in both pregnant and non-pregnant patients is alarming, though expected¹, more significantly present in pregnant patients. This calls for a closer attention at the relationship between vulvovaginal candidiasis and trichomoniasis with urinary symptomatology. The plausible reason might be that vulvovaginal candidiasis/trichomoniasis causes irritation. Subsequent scratching by patients bruises the urethra with subsequent painful micturition or even colonization by pathogenic bacteria. It may also simply be a result of contamination. The high incidence of *Candida* and *Trichomonas* contaminants is in conformity with previous studies^{10,12}, and calls for improved specimen collection method to reduce the rate. This may be difficult since swabbing of the vulva with normal saline 3 times as recommended may not eradicate these organisms. The increasing presence of gram-positive organisms - *Streptococcus faecalis* and *Staph aureus*¹⁰, should be born in mind when choosing antimicrobials for UTIs in women. The two microbes have poor susceptibility to the common, cheap antibiotics except cotrimoxazole and to a limited extent cloxacillin for staph aureus. The prominent gram-negative organisms found in non-pregnant patients - *Pseudomonas* and *proteus* species were resistant to all easily available antibiotics except *Gentamycin*. This should also be born in mind in the choice of antibiotics for UTIs in non-pregnant women, though it is usually advised that, *Gentamycin* should be used with *Ampicillin* to reduce development of resistant strains⁸. *Nalidixic acid*, *Nitrofurantoin*, *Ofloxacin*, *Ciprofloxacin*, *Cefuroxime* and *Ceftriaxone* are also drugs of choice.^{3,10,17}

Generally speaking organisms isolated from pregnant patients were more susceptible to antimicrobial agents, even though this was only statistically significant in the

case of gentamycin. This however supports the likely theory that more drugs will be delivered to the urinary tract in pregnancy because of the increased renal blood flow in pregnancy. From the foregoing, the drugs of choice for empirical therapy in cases of urinary tract infections in women will include *Gentamycin*, *Sultamicillin*, *Cotrimoxazole*, *Nitrofurantoin*, *Nalidixic acid*, *Oxloxacillin*, *Ciprofloxacin*, *Cefuroxime* and *ceftriazone*. *Gentamycin*, *Cotrimoxazole*, *Nitrofurantoin*, *Nalidixic acid*, *Oxloxacillin* and *Ciprofloxacin* are contraindicated in or at some periods of pregnancy.¹⁸ However, *Cotrimoxazole* and *Nitrofurantoin* have enjoyed widespread use in pregnant patients especially in mid-trimester^{12,13,17}. *Gentamycin* too may be of choice in pregnancy if the usefulness outweighs the risks, especially in cases of resistance to other drugs or when drugs are not available. It is noted that certain organisms such as *Haemolyticus*, *Viruses*, *Chlamydia* and *Campylobacter* have been identified as possible causes of UTIs, though they are not common. The commonly available culture media, which was used in this study, cannot identify these organisms and their relative importance cannot be evaluated in this study.

In conclusion there is evidence that *Escherichia coli* is still the commonest aetiological organisms of UTIs in women in this environment, but that *Klebsiella* is also becoming prominent. Also that the notorious gram-negative organisms like *Pseudomonas* and *Proteus* species are likely to cause UTIs more in non-pregnant patients. In terms of drugs, *Gentamycin* has been shown to be useful especially in pregnant patients while the other more expensive drugs are useful but the choice must be balanced between safety, cost effectiveness and availability. Another all encompassing prospective study that will compare *in vitro* and *in vivo* effectiveness of the antimicrobials is desirable.

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outstanding and the most
desirable to all healthy and good
persons, is a Peaceful Life
With Honour!”*

- Marcus Tiellus Cicero