



Effects of Antibiotics on Urinary Tract Infections in Patients Attending General Hospital, Minna, Nigeria.

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ABSTRACT

The aim of this study is to determine the patterns of antibiotic susceptibility of bacteria isolated from urinary tract infections of patients attending General Hospital, Minna. One hundred (100) urine samples were collected from May to August, 2015. Bacteria isolates were identified by standard biochemical tests and antibiotic susceptibility test was carried out on some commonly used antibiotics. In this study, 60 out of 100 patients showed positive urine cultures, and the bacteria that were isolated from the urine samples include; *Escherichia coli* 31 (52%), *Staphylococcus aureus* 13 (22%), *Pseudomonas aeruginosa* 3(5%), *Streptococcus pneumonia* 3(5%) and *Klebsiella* sp 7 (12%) and *Proteus* sp 3(5%). *E. coli* isolates indicated susceptibility to Tarivid (67%) and Nalidixic acid (58%) and exhibited high resistance to Ampicillin (100%). *Klebsiella* sp indicated resistance to all the antibiotics, particularly Septrin (100%) and Ceporex (100%). *Pseudomonas aeruginosa* and *Proteus* sp isolates resisted all the antibiotics, but were susceptible to Streptomycin by 100% and 67% respectively. *S. aureus* isolates indicated susceptibility to Streptomycin (62%) and Rifampicin (54%) antibiotics only, and resisted other antibiotics. *S. pneumoniae* showed susceptibility to Levofloxacin (67%), strongly resisted all other antibiotics by 100%, except Gentamicin that it resisted by 33%. Statistical analysis using chi-square test of association revealed that the variables; age, gender, area of domicile and risk factors showed Statistical significance ($P < 0.05$).

Keywords: Antibiotics, Susceptibility, bacteria, Urinary, Infection

INTRODUCTION

Urinary tract infections are among the most common bacterial diseases worldwide and the commonest genitourinary tract infections in children. UTI can be asymptomatic or symptomatic, characterized by a wide spectrum of symptoms ranging from mild irritative voiding to bacteremia, sepsis or even death (Ranjbar *et al.*, 2009). Infection may occur at any part of the genitourinary tract, including urethra, bladder, ureter, renal pelvis or renal parenchyma (Feld and Matto, 2010). Most infections are caused by retrograde ascent of bacteria from fecal oral to bladder and kidney via urethra, especially in females where the urethra is shorter and wider. The other main factors which make females more prone to UTI are pregnancy and sexual activity (Bhat *et al.*, 2011). In pregnancy, the physiological increase in plasma volume and decrease in urine concentration develop glycosuria in up to 70% women which ultimately leads to bacterial growth in urine. Also in the non-pregnant state,

the uterus is situated over the bladder whereas in the pregnant state, the enlarged uterus affects the urinary tract (Hvidberg *et al.*, 2001)

It has been reported that the organisms that cause UTI in women colonize the vaginal introitus and the periurethral area before urinary infection results. Within the bladder, bacteria may multiply and then pass up to the ureters, especially if vesicoureteral reflux is present, to the renal pelvis and parenchyma. Sexual intercourse can force bacteria into the female bladder. Condom use may heighten the traumatic effects. Furthermore, just one catheterization of the bladder results in urinary tract infection in about 1% of ambulatory patients and infection develops within 3-4 days

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in essentially all patients with indwelling catheters with open drainage systems. Both the contraceptive diaphragm with nonoxynol-9 contraceptive jelly in women and the condom catheter in men have been shown to predispose to infection. Spermicides increase colonization of the vagina with uropathogens. Although, the dominant *Lactobacillus* vaginal flora is more sensitive to nonoxynol-9 than *E.coli* to vaginal epithelial cells. Estrogen deficiency is now recognized as a predisposing factor to recurrent UTI in post-menopausal women, because of consequent vaginal flora changes with loss of protective *Lactobacilli* which are replaced by coliforms and other uropathogens (Ranjbar *et al.*,2009)

The infection may involve only lower or both upper and lower parts of the urinary tract. The term “cystitis” has been used to describe a syndrome including dysuria, frequency and occasionally supra pubic tenderness. Acute pyelonephritis describes a clinical syndrome characterized by flank pain or tenderness, or both, and fever, often accompanied by dysuria, urgency and frequency (Mandell *et al.*, 2005). Majority of UTIs are not life threatening and do not cause any irreversible damage. However, when the kidneys are involved, there is a risk of irreparable tissue damage with an increased risk of bacteremia (Hvidberg *et al.*, 2001).

Bacteria are the major causative organisms and are responsible for more than 95% of UTI cases (Ramesh *et al.*, 2008). *Escherichia coli* are the most frequent infecting organism in acute infections (Ronald, 2002). Areas specific for monitoring studies aimed at understanding the types of pathogens responsible for UTIs and other susceptibility patterns may help clinicians to select proper empirical treatment (Hryniewicz *et al.*, 2001).

METHODOLOGY.

Sample Collection.

Clean-catch, midstream , One hundred (100) urine samples were collected in sterile disposable containers and transported immediately to the laboratory of Microbiology department, Faculty of Natural sciences, Ibrahim Badamasi Babangida University, Lapai, Niger State. Questionnaires were equally administered to the patients alongside sample collection to determine the possible risk factors associated with UTI. The risk factors that were

emphasized include: Use of catheters (catheterization) especially in young children Sexual activity, Use of diaphragm and Use of contraceptives.

Isolation of Bacteria from Urine

Urine specimens were cultured on CLED and MacConkey agar plates using wire loops for semi quantitative method and incubated for 24 hours at 37⁰C. Colonies that resulted from the first culture were further sub-cultured on the same media to get a pure culture of isolates and incubated for another 24 hours at 37⁰C. The pure colonies were then transferred into nutrient agar in slant bottles and incubated for 24 hours at 37⁰C (Cheesbrough, 2004)

Identification of Bacteria from Urine

The pure colonies that were obtained in the slant bottles were subjected to series of biochemical tests in order to identify the particular species and or strains of the bacteria isolates yielded (Cheesbrough, 2004). The tests that were carried out on the bacterial isolates includes, Gram stain, Catalase, Coagulase, Oxidase, Indole, Methyl-red, Voges- proskauer and Sugar fermentation.

Antibiotic Susceptibility Testing.

Antibiotic susceptibility testing was carried out on Mueller- Hinton agar using disc diffusion technique according to Clinical and Laboratory Standards Institute (CLSI) guidelines. Sterile Mueller- Hinton agar was prepared and standardized as instructed by the manufacturer. The medium was dispensed into petri dishes and allowed to solidify. The inocula were also prepared in test tubes in respect to 0.5 McFarland standards. The test isolates were inoculated on the Mueller- Hinton agar using sterile wire loops after which antibiotic discs were placed onto them using sterile forceps. The plates were incubated for 24 hours at 37⁰C. The plates were read after 24 hours, measuring the zones of inhibition to the nearest mm. The antibiotics used and their symbols are: Ciprofloxacin (CPX), Norfloxacin (NB), Gentamicin (CN), Amoxyl (AML), Streptomycin (S), Rifampicin (RD), Erythromycin (E), Chloramphenicol (CH), Ampiclox (APV), and Levofloxacin (LEV) , Augmentin (AU), Ceporex (CEP), Nalidixic acid (NA), Tarivid (OFX), Reflacine (PEF), Septrin (SXT) and Ampicillin (PN) (NCCLS,2002)

Statistical analysis

This was achieved using chi-square test of association between the socio-demographic factors and the occurrence of bacteria in the urine of patients.

RESULTS

E. coli was the most common bacteria isolated in all age groups and both sexes with a percentage of 52, while *Streptococcus pneumoniae*, *P. aeruginosa* and *Proteus* sp occurred least with a percentage of 5. The prevalence of the isolated bacteria and their percentages are as indicated in table 1.

Table 1: Percentage prevalence of bacteria in UTI

Organisms	No. of Isolates	Percentage (%)
<i>E.coli</i>	31	52
<i>S. aureus</i>	13	22
<i>Klebsiella</i> sp.	7	12
<i>S. pneumoniae</i>	3	5
<i>P. aeruginosa</i>	3	5
<i>Proteus</i> sp.	3	5
Total	60	100

Table 2: Percentage Susceptibility of the Gram negative Isolates to Antibiotics

Antibiotics	<i>E. coli</i> (n =31)	<i>Klebsiella</i> sp (n =7)	<i>P. aeruginosa</i> (n =3)	<i>Proteus</i> sp (n =3)
S	48(52)	29(71)	100(0)	67(33)
CN	29(71)	14(86)	33(67)	0(100)
CPX	32(68)	29(71)	33(67)	33(67)
OFX	67(33)	14(86)	33(67)	0(100)
NA	58(42)	14(86)	33(67)	0(100)
PEF	39(61)	43(57)	33(67)	33(67)
AU	16(84)	29(71)	0(100)	33(67)
SXT	10(90)	0(100)	0(100)	0(100)
PN	0(100)	14(86)	33(67)	33(67)
CEP	13(87)	0(100)	0(100)	33(67)

key:

Numbers outside bracket = Susceptible percentages

Numbers inside bracket = Resistance percentages

S- Streptomycin

NA- Nalidixic acid

SXT- Septrin

CN- Gentamicin

OFX- Tarivid

PN- Ampicillin

CPX- Ciprofloxacin

AU- Augmentin

CEP- Ceporex

PEF- Reflacine

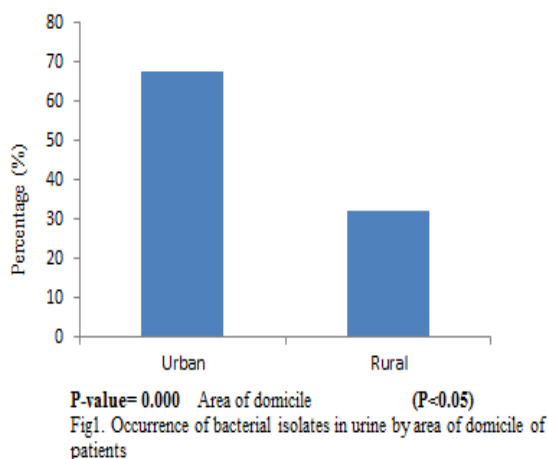
E.coli isolates showed susceptibility to Tarivid (67%) and Nalidixic acid (58%) and exhibited high resistance to Ampicillin (100%) and resisted other antibiotics used in this study. *Klebsiella* sp showed resistance to all the antibiotics, particularly Septrin (100%) and Ceporex (100%). *Pseudomonas aeruginosa* and *Proteus* sp isolates resisted all the antibiotics, but were susceptible to Streptomycin by 100% and 67% respectively.

S. aureus isolates showed susceptibility to Streptomycin (62%) and Rifampicin (54%) antibiotics only, and resisted other antibiotics. *S. pneumoniae* showed susceptibility to Levofloxacin (67%), strongly resisted all other antibiotics by 100%, except Gentamicin that it resisted by 33%.

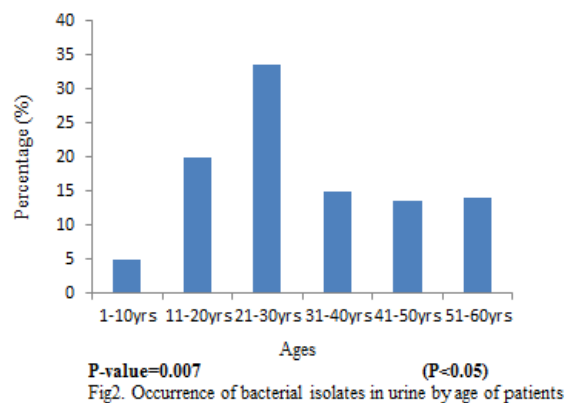
Table 3: Percentage Susceptibility of the Gram positive Isolates to Antibiotics.

Antibiotics	<i>S. aureus</i>	<i>S. pneumoniae</i>
	n = 13	n = 3
E	15(85)	0(100)
LEV	31(69)	67(33)
CN	15(85)	33(67)
RD	54(46)	0(100)
AML	15(85)	0(100)
S	62(38)	0(100)
NB	8(92)	0(100)
CH	0(100)	0(100)
CPX	0(100)	0(100)
APX	31(69)	0(100)

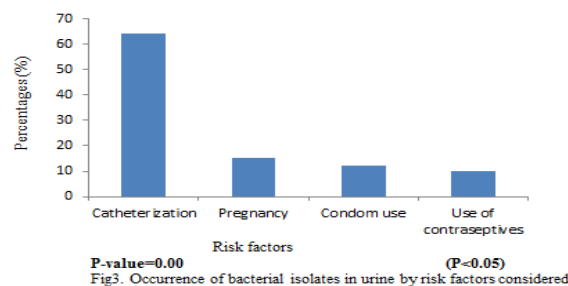
Key:
 Numbers outside bracket = Susceptible percentages
 Numbers inside bracket = Resistance percentages
 S- Streptomycin NA- Nalidixic acid
 SXT- Septrin
 CN- Gentamicin OFX- Tarivid
 PN- Ampicillin
 CPX- Ciprofloxacin AU- Augmentin
 CEP- Ceporex PEF- Reflacin



Test association to assess the association between different variables considered and the presence of bacteria in urine was carried out. The graph clearly showed statistical significance (P<0.05) in the distribution of area of domicile as in Figure 1 above. This translates to mean that there is association between Patient’s area of domicile and the presence of bacteria in their urine.



The graph above also showed statistical significance (P<0.05) in the distribution of ages of the patients, that is, there is association between age of the patients and the occurrence of Bacteria in their Urine.



There is also a significant difference (P<0.05) in the trend of distribution of the risk factors of the patients as shown in Fig. 3, this is a clear indication of association between the risk factors considered and the presence of Bacteria in their urine.

DISCUSSION

Sixty (60) out of 100 patients were positive for the following bacteria; *E. coli*, *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Streptococcus pneumoniae* and *Klebsiella* sp in the analyzed urine samples, while 31 of the samples were confirmed to be *E. coli*. This is in accordance with the findings of Salvatore *et al.* (2011), where urine samples were cultured and majority of the isolates were confirmed to be *E. coli* and other bacteria such as *Klebsiella* sp and *Staphylococcus* sp. were also isolated.

This study indicated that the commonest isolates in UTIs were *E. coli* (52%), *S. aureus* (22%), and *Klebsiella* sp. (12%). According to a related study by Nicolle (2008), *E. coli* is responsible for 53% of UTIs and *S. aureus* is responsible for

12% of the infection. In another study by Nicolle (2008), it was reported that *E. coli* is the cause of 80-85% of UTI, *S. aureus* being the cause of 5-10% and *Klebsiella* sp. being the cause of 8-9% of the infection, justifying their presence in the urine. Coincidentally, these bacteria were isolated in the present study in the same order.

Similarly, Danchaivijitr *et al.* (2005) found *E.coli* in his studies as the most common bacterial isolate in urinary tract infections and they also found the second most common bacterial isolate in UTIs as *S. aureus*, followed by *Klebsiella* sp. This is in support of the findings in the present study.

This study reveals that *E. coli* isolates were susceptible to Tarivid (68%) and Nalidixic acid (58%) but resistant to Amplicin (100%). The reason behind this high level of resistance of the bacteria may be due to indiscriminate or inappropriate use of the antibiotics, as well as steady and appropriate dosage not been used as administered to patients on the right time, while the susceptibility may be because those antibiotics are not frequently prescribed or are not readily available in pharmaceutical stores. Also, this high resistance pattern may have resulted from poorly guided antibiotic prophylaxis after catheterization and empiric therapy of catheter associated UTI.

The susceptibility and resistance pattern in this study is in contrast with the findings of Shaik *et al.* (2005), where it was reported that *E. coli* was more susceptible to Streptomycin, Levofloxacin, Erythromycin and Ciprofloxacin by 60%, but resistant to Penicillin and Norfloxacin by 100% and Nalidixic acid by 90%, which supports the findings in this study. *E. coli* displayed high percentage of resistance to test antibiotics and thus, multiple drug resistance was observed in the strains (Shaik *et al.*, 2005). In support of the results of this study is the report of Scholes *et al.* (2005), where it was reported that the susceptibility of *E. coli* towards Nalidixic acid was 50%.

Chi-square test of association revealed that there exist association between different variables considered and the presence of bacteria in the urine of patients ($P < 0.05$), suggesting that any of the variables could lead to the occurrence of urinary tract infection in the patients. This is evident in the distributions observed in the graphs of the variables considered in this study.

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