Urinary Tract Infections (UTIs) in a cohort of HIV and Non-HIV-infected females in Port Harcourt, Nigeria

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ABSTRACT: UTI is the most common problem found in all age group patients. UTI has more prevalence in HIV-infected patients because of decreased immune status compared to Non-HIV infected individuals. The aim of this study was to find the prevalence of UTI in a cohort of HIV and Non-HIV-infected females and planning its treatment strategy based on etiologic agent. Clean catch midstream urine samples were collected from 100 female subjects comprising 50 HIV-seropositive and 50 HIV-seronegative females in Port Harcourt, Nigeria. The HIV-positive females consisted of 20 highly active retroviral therapy (HAART) – naïve females and 30 subjects on HAART for three to six months. Most of the HIV-positive females had no signs or symptoms of UTI compared to HIV-negative females. Urine samples were analysed using standard methods. Microbial isolates were identified in urine and susceptibility tests were performed. The ages of the subjects ranged from 25-50 years. Of the 100 samples analysed, 37 had significant bacteriuria representing 37.0%. Among the 50 HIV seropositive females, 17(34.0%) had significant bacteriuria while among the HIV seronegative females (controls), 21 (42.0%) samples had significant bacteria growth. Bacterial uropathogens were significantly prevalent (42.0 vs. 34.0, $P<0.05$) among HIV seronegative females (controls) than HIV seropositive females. There was significant difference (40.0 vs. 25.0, $P<0.05$) in the prevalence of significant bacteriuria between HIV seropositive females on HAART and HAART naïve females. Generally, *Staphylococcus aureus* 10(26.3%) was most predominant in the urine samples. This was followed by *Klebsiella species* 7(18.4%), *Escherichia coli* 6(15.8%), *Pseudomonas aeruginosa* 5(13.2%), *Proteus species* 3(7.9%), *Streptococcus species* 3(7.9%), *Enterococcus faecalis* 2(5.3%) and *Staphylococcus epidermidis* 2(5.3%). Among the HIV seropositive females, *Escherichia coli* 5(29.4%) was the most predominant while among the HIV seronegative females, *Staphylococcus aureus* 6(28.6%) was the most predominant. However, *Staphylococcus epidermidis* was only present among the HIV seronegatives. Also, *Candida albicans* 10(71.4%) was most predominant fungi isolates. This was followed by *Aspergillus species* 2(14.3%) and *Penicillium species* 2(14.3%). However, *Aspergillus species* 2(33.3%) was only present among the HIV seronegatives. High sensitivity to ofloxacin (85.7%), ceprox (85.7%), ciprofloxacin (78.9%), peflacine (76.2%), gentamicin (60.5%), lincocin (58.8%), rifampicin (58.8%), streptomycin (55.3%), augmentin (52.4%) and ampiclox (52.4%) was recorded. High resistance to nalidixic acid (90.5%), septrin (80.9%), chloramphenicol (70.6%), floxapen (64.7%), nrobactin (64.7%), erythromycin (58.8%), ampicillin (57.1%), ampiclox (47.6%), augmentin (47.6%), and septromycin (44.7%) were observed. In conclusion, urinary tract infection is a significant co-morbidity in females with HIV. This study reveals a high prevalence of urinary tract infections in a cohort of HIV seropositive females in Port Harcourt, Nigeria. Thus, a high index of suspicion will lead to its prompt diagnosis and appropriate treatment. Of particular importance is the sensitivity patterns of the strains of bacteria isolated, in which ofloxacin, ceprox, ciprofloxacin, peflacine and gentamicin were the most effective. This calls for adequate planning for UTI treatment strategy based on etiologic agent. Prospective studies are advocated to clarify whether these antibiotics confers some benefit in protecting HIV seropositive individuals against UTI.
[Frank-Peterside N, Okerentugba PO, Ndukwu J, Okonko IO. **Urinary Tract Infections (UTIs) in a cohort of HIV and Non-HIV-infected females in Port Harcourt, Nigeria**] *Cancer Biology* 2013;3(3):1-10]. (ISSN: 2150-1041). http://www.cancerbio.net. 1

Keywords: Antibiograms, Coinfections, Gram-positive bacteria, Gram-negative bacteria, HIV, HAART

1. INTRODUCTION

Nigeria has the largest population in Africa with a population of over 150 million and HIV prevalence of 4.6% in 2008 (FMOH, 2008; Sanyaolu et al., 2013). It is estimated that 2.95 million individuals live with HIV/AIDS in Nigeria (WHO/UNAIDS/UNICEF, 2008) and integrated control efforts are immeasurably needed (Chukwujekwu et al., 2010; Merrigan et al., 2011; Sanyaolu et al., 2013).

The advent of HIV/AIDS has resulted in many microbial agents becoming opportunistic infections among individuals whose immune status has been suppressed by the infection (Bigwan and Wakjissa, 2013). Bacterial infections are a common cause of morbidity and mortality in HIV positive individuals (Evans et al., 1995). HIV-positive patients

are liable to acquire opportunistic infections including urinary tract infections (UTIs) (Schönwald et al., 1999). People living with HIV are likely to be more predisposed to urinary tract infection (UTI) due to the suppression of their immunity and women in this category tend to get them more often due to the nature of their anatomy (Bakke and Digranes, 1991; Kayima et al., 1996; Kumamoto et al., 2002; Bigwan and Wakjissa, 2013).

UTI is not only common nosocomial infection but an important source of morbidity in community as well (Acharya et al., 2011; Jai et al., 2012). It is the most frequent cause of illness in humans after respiratory tract infection (Jai et al., 2012). UTI is the most common problem found in all age group patients. UTI has more prevalence in HIV-infected patients because of decreased immune status compared to Non-HIV infected individuals. Recent reports suggest that the incidence of urinary tract infection (UTI) is increased in HIV positive patients (Omar de Rosa et al., 1990; Pinho et al., 1991; Evans et al., 1995). Furthermore, there is evidence that bacteriuria is more common as HIV disease progresses (Hoepelman et al., 1992; Bain et al., 1992; Evans et al., 1995).

Recent studies demonstrated a broad range of bacteria causing UTIs in HIV-infected patients, including the *Pseudomonas aeruginosa*, *Streptococcus faecalis*, and *Staphylococcus aureus* and unusual microorganisms including *Candida spp., Salmonella spp., Acinetobacter spp*., and Cytomegalovirus (Schonwald et al., 1999; Lee et al., 2001; Ochei and Kolhatkar, 2007; Bansil et al., 2007; Bigwan and Wakjissa, 2013). Co-trimoxazole is active against most common urinary pathogens and has been widely used as prophylaxis against Pneumocystis carinii pneumonia (PCP) in immunocompromised individuals (Evans et al., 1995).

The aim of this study was to find the prevalence of UTI in a cohort of HIV and Non-HIV-infected females and planning its treatment strategy based on etiologic agent. The study also assesses the susceptibility of isolated uropathogens to different antibiotics commonly used in Port Harcourt, Nigeria.

2. MATERIALS AND METHODS

2.1. Study Population

The study population focused on confirmed HIV positive female patients attending University of Port Harcourt Teaching Hospital (UPTH), Port Harcourt City, Nigeria. The study population comprised of 50 HIV seropositive and 50 apparently healthy HIV-seronegative females attending the health facility. The HIV-seropositive females consisted of 20 highly active retroviral therapy (HAART) – naïve females and 30 females on highly active antiretroviral therapy (HAART) for 3-6 months. Most of the HIV seropositive females had no signs or symptoms of UTI compared to HIV seronegative females. Exclusion criteria include antibiotic usage within one week and large fluid intake (in previous hour) before clinic attendance. The HAART, regimen for HIV patients on HAART consisted of zidovudine, stavudine and nevirapine. Informed consent was obtained from all subjects before specimen collection.

2.2. Sample collection and processing

Clean–catch midstream urine (MSU) was collected from each patient into a sterile screw–capped universal container. These urine samples were transported in a commercially available collection and transport system for urine specimens to the Medical Microbiology Laboratory, Department of Microbiology, University of Port Harcourt, Port Harcourt, Nigeria for analysis using standard laboratory procedures.

2.3. Microbiological analysis

Macroscopic examination was carried out on the samples. A loop-full (0.002 ml) of well mixed un-centrifuged urine was streaked onto the surface of blood agar and cystine lactose electrolyte deficient (CLED) medium. The plates were incubated aerobically at 37^0C for 24 hours and counts were expressed in colony forming units (CFU) per milliliter (ml). A count of up to 100,000CFU/mL was considered significant to indicate bacteriuria. Ten (10) mls of each well-mixed urine sample was centrifuged at 2000g for 5 minutes. The supernatant was discarded and a drop of the deposit was examined microscopically for urine deposits such as pus cells, red blood cells, epithelial cells, casts, crystals yeast-like cells and *Trichomonas vaginalis*. Pus cells $\geq$ 5 per high power field were considered significant to indicate infection. The isolates were identified based on gram reaction, morphology, and biochemical characteristics and antimicrobial susceptibility carried out via the disc diffusion technique using antibiotic discs in accordance to standard microbiological methods (Cheesbrough, 2000; Ochei and Kolhatkar, 2007).

2.4. Antibiotics sensitivity test

Antibiotic susceptibility test of antibiotics and their interpretation was carried out for bacterial isolates by Kirby-Baur technique as recommended by National Committee for Clinical Laboratory Standards (2000). Uropathogens were identified on the basis of Gram's reaction, colony morphology and standard biochemical tests. Antibiotic susceptibility

was tested by disc diffusion method for all 1st and 2nd line antibiotics. First line antibiotics tested were Ampicillin (30µg), Ampiclox (10µg), Augmentin (30µg), Chloramphenicol (30µg), Co-trimoxazole (Septrin, 30µg), Gentamicin (10µg), Lincocin (10µg), Nalidixic acid (30µg), Erythromycin (10µg), Rifampicin (10µg) and Streptomycin (30µg). Second line antibiotics tested were Ceporex (10µg), Ofloxacin (10µg), Peflacine (10µg), Floxapen (10µg), Nrobactin (10µg) and Ciprofloxacin (10µg).

2.5. Data Analysis

Data were analyzed using Chi-Square test. Values of $P < 0.05$ were considered statistically significant while values of $P > 0.05$ were non-significant.

3. RESULTS

3.1. Prevalence of significant bacteria in the HIV-seropositive and HIV seronegative females

One hundred (100) samples of urine collected from 50 HIV seropositive and 50 HIV seronegative females were evaluated to assess the prevalence of urinary tract infection in a cohort of HIV seropositive females and HIV seronegative females within age groups 25-50 years. Generally, of the 100 samples analysed, 37 had significant bacteriuria (i.e. $>10^5$ colony forming units (CFU)/ml) representing 37.0%. It also showed that 24(24.0%) samples had no significant bacteriuria (i.e. $<10^5$ colony forming units (CFU)/ml) and 39(39.0%) samples had no bacteriuria (Table 1).

Among the 50 HIV seropositive females, 17(34.0%) had significant bacteriuria, 14(28.0%) had no significant bacteria growth and 19 (38.0%) samples had no bacteriuria (Table 1) while among the HIV seronegative females (controls), 21 (42.0%) samples had significant bacteria growth, 10 (20.0%) had no significant bacteria growth and 19 (38.0%) samples had no bacteriuria (Table 1). There was significant difference (42.0 vs. 34.0, $P<0.05$) in the prevalence of bacterial uropathogens between HIV seropositive and HIV seronegative females. Bacterial uropathogens were more prevalent among HIV seronegative females (controls) than HIV seropositive females (Table 1).

3.2. Prevalence of significant bacteria in relation to highly active antiretroviral therapy (HAART)

There was significant difference (40.0 vs. 30.0, $P<0.05$) in the prevalence of significant bacteriuria between HIV seropositive females on HAART and HAART naïve females (Table 2).

Table 1: Prevalence of significant bacteriuria in HIV seropositive and HIV seronegative females

HIV Status	No. Tested (%)	No. Positive for UTI (%)	No significant bacteriuria (%)	No bacterial growth (%)
Seropositive	50(50.0)	17(34.0)	14(28.0)	19(38.0)
Seronegative (controls)	50(50.0)	21(42.0)	10(20.0)	19(38.0)
Total	**100(100.0)**	**38(38.0)**	**24(24.0)**	**38(38.0)**

Table 2: Prevalence of significant bacteriuria in relation to highly active antiretroviral therapy (HAART) stages among HIV-seropositive females

HIV Seropositives	No. Tested (%)	No. Positive for UTI (%)
On HAART	30(60.0)	9(30.0)
HAART naïve	20(40.0)	8(40.0)
Total	**50(100.0)**	**17(34.0)**

3.3. Frequency occurrence of bacteria isolates

Table 3 shows the frequency of occurrence of bacteria isolates. Generally, *Staphylococcus aureus* 10(26.3%) was the most predominant bacteria isolated from urine samples. This was followed by *Klebsiella species* 7(18.4%), *Escherichia coli* 6(15.8%), *Pseudomonas aeruginosa* 5(13.2%), *Proteus species* 3(7.9%), *Streptococcus species* 3(7.9%), *Enterococcus faecalis* 2(5.3%) and *Staphylococcus saprophyticus* 2(5.3%). Among the HIV seropositive females, *Escherichia coli* 5(29.4%) was the most predominant. This was followed by *Staphylococcus aureus* 4(23.5%), *Klebsiella species* 3(17.6%), *Pseudomonas aeruginosa* 2(11.8%) *Streptococcus species* 1(5.9%), *Enterococcus faecalis* 1(5.9%) and *Proteus mirabilis* 1(5.9%) while *Staphylococcus saprophyticus* 0(0.0%) was absent. Also among the HIV seronegative females, *Staphylococcus aureus* 6(28.6%) was the most predominant. This was followed by *Klebsiella species* 4(19.0%), *Pseudomonas aeruginosa* 3(14.3%), *Proteus mirabilis* 2(9.5%) and *Streptococcus species* 2(9.5%), *Staphylococcus saprophyticus* 2(9.5%) while *Enterococcus faecalis* 1(4.8%) and *Escherichia coli* 1(4.8%) were least predominant. However,

Staphylococcus saprophyticus was only present among the HIV seronegatives (Table 3).

Table 3: Frequency of occurrence of bacteria isolates

Bacteria isolates	No. (%)	HIV seropositives (%)	HIV negatives (%)
Staphylococcus aureus	10(26.3)	4(23.5)	6(28.6)
Staphylococcus saprophyticus	2(5.3)	0(0.0)	2(9.5)
Escherichia coli	6(15.8)	5(29.4)	1(4.8)
Pseudomonas aeruginosa	5(13.2)	2(11.8)	3(14.3)
Klebsiella species	7(18.4)	3(17.6)	4(19.0)
Proteus species	3(7.9)	1(5.9)	2(9.5)
Streptococcus species	3(7.9)	1(5.9)	2(9.5)
Enterococcus faecalis	2(5.3)	1(5.9)	1(4.8)
Total	**38(100.0)**	**17(44.7)**	**21(55.3)**

3.4. Frequency occurrence of fungi isolates

Table 4 shows the frequency of occurrence of fungi isolates. Generally, *Candida albicans* 10(71.4%) was most predominant. This was followed by *Aspergillus species* 2(14.3%) and *Penicillium species* 2(14.3%). *Candida albicans* was most predominant among HIV seropositive and HIV seronegative females. However, *Aspergillus species* 2(33.3%) was only present among the HIV seronegatives (Table 4).

Table 4: Frequency of occurrence of fungi isolates

Fungi isolates	Total No. (%)	HIV seropositives (%)	HIV negatives (%)
Aspergillus species	2(14.3)	0(0.0)	2(33.3)
Candida albicans	10(71.4)	7(87.5)	3(50.0)
Penicillium species	2(14.3)	1(12.5)	1(16.7)
Total	**14(100.0)**	**8(57.1)**	**6(42.9)**

3.5. Susceptibility and resistance of all bacteria isolated to different antibiotics

Table 5 shows the results of the percentage antibiotic sensitivity and resistance of uropathogens. High sensitivity to ofloxacin (85.7%), ceprox (85.7%), ciprofloxacin (78.9%), peflacine (76.2%), gentamicin (60.5%), lincocin (58.8%), rifampicin (58.8%), streptomycin (55.3%), augmentin (52.4%) and ampiclox (52.4%) was recorded. High resistance to nalidixic acid (90.5%), septrin (80.9%), chloramphenicol (70.6%), floxapen (64.7%), nrobactin (64.7%), erythromycin (58.8%), ampicillin (57.1%), ampiclox (47.6%), augmentin (47.6%), and septromycin (44.7%) were observed (Table 5).

Table 5. Susceptibility and resistance of all bacteria isolated to different antibiotics

Antibiotics	No. tested	Number of isolate sensitive (%)	Number of isolate resistant (%)
Ampicillin (30µg)	21	9(42.9)	12(57.1)
Ampiclox (10µg)	21	11(52.4)	10(47.6)
Augmentin (30µg)	21	11(52.4)	10(47.6)
Ceprox (10µg)	21	18(85.7)	3(14.3)
Ciprofloxacin (10µg)	38	30(78.9)	8(21.1)
Chloramphenicol (30µg)	17	5(29.4)	12(70.6)
Erythromycin (10µg)	17	7(41.2)	10(58.8)
Floxapen (10µg)	17	6(35.3)	11(64.7)
Gentamicin (10µg)	38	23(60.5)	15(39.5)
Lincocin (10µg)	17	10(58.8)	7(41.2)
Nalidixic acid (30µg)	21	2(9.5)	19(90.5)
Nrobactin (10µg)	17	6(35.3)	11(64.7)
Ofloxacin (10µg)	21	18(85.7)	3(14.3)
Peflacine (10µg)	21	16(76.2)	5(23.8)
Rifampicin (10µg)	17	10(58.8)	7(41.2)
Septrin (30µg)	21	4(19.1)	17(80.9)
Streptomycin (10µg)	38	21(55.3)	17(44.7)

4. DISCUSSION

The aim of this study was to find the prevalence of UTI in a cohort of HIV and Non-HIV-infected females so as to plan its treatment strategy based on etiologic agent. The study showed that overall prevalence of significant bacteriuria was 38.0%. The higher incidence found in these females may not be unconnected to the general increased risk of women to acquiring urinary tract infection (Samuel et al., 2012). This is due to the anatomical structure of the female genital tract that makes them susceptible to urinary tract infections compared to their male counterparts irrespective of their HIV sero status (Najar et al., 2009; Samuel et al., 2012). Close proximity of the female urethral meatus to the anus, shorter urethra, and sexual intercourse, incontinence, bad toilet habits have all been reported as factors that influence the higher prevalence in females (Orrett and Davis, 2005; Ochei and Kolhatkar , 2007; Aiyegoro et al., 2007; Bigwan and Wakjissa, 2013).

This figure (38.0%) reported in this study is lower than the 50.0% reported by Obiogbolu et al. (2009) and the 47.5% reported by Okonko et al. (2009a). However, it is higher than the 28.1% reported by Olowu and Oyetunji (2003) in Lagos, Nigeria, the 30.0% reported by Anochie et al. (2001) in a rural community in Enugu, Nigeria and the 26.0% overall prevalence reported by Samuel et al. (2012) in Irrua, Edo State, Nigeria. UTI prevalence of 38.0% reported in this present study is comparable to the 39.6% reported in our previous study in a cohort of HIV-positive and HIV-negative males in Port Harcourt, Nigeria. The higher prevalence found in females in this present study may not be unconnected to the general increased risk of women to acquiring urinary tract infection (Samuel et al., 2012). According to previous studies, this is largely due to the anatomical structure of the female genital tract that makes them susceptible to urinary tract infections compared to their male counterparts irrespective of their HIV serostatus (Najar et al., 2009; Samuel et al., 2012).

Although definitive diagnosis is based on culture results but looking at the significant bacteriuria in 38.0% of samples shows good clinical co-relation between clinical and microbiological diagnosis (Das et al., 2006; Jai et al., 2012; Frank-Peterside et al., 2013a,b). However in this present study, 24.0% of the samples had no significant bacteria growth (i.e. $< 10^5$ colony forming units (CFU)/ml) and 38.0% of the samples had no bacteria growth. In line with Jai et al. (2012) and Frank-Peterside et al. (2013a, b) presence of insignificant growth or sterile urine may be due to prior use of antibiotics or improper method of collecting samples.

The study also showed that of the 50 midstream urine samples from HIV seropositive females analyzed, 17(34.0%) had UTI while of the 50 urine samples of HIV seronegative females, 21(42.0%) had UTI. The study found significant differences (42.0 vs. 34.0, $P<0.05$) in prevalence of significant bacteriuria among HIV seropositive and HIV seronegative females (controls). This present finding agrees favourably with the fact that uropathogens causing UTIs are not higher in HIV seropositive individuals than HIV seronegative individuals as reported in our previous study (Frank-Peterside et al., 2013a). However, our present study disagrees with the fact that uropathogens causing UTIs are higher in HIV seropositive individuals (Bigwan and Wakjissa, 2013). The higher prevalence of the bacterial pathogens in all the HIV seronegative females (controls) may be attributed to their exposure to HIV/AIDS being the major predisposing risk factor and probably other risk factors such as pregnancy, diabetes, increased sexual activity and contamination from anus after defecation (Sheffield and Cunningham, 2005; Obiogbolu et al., 2009; Okonko et al., 2009a; Bigwan and Wakjissa, 2013; Frank-Peterside et al., 2013a).

The prevalence of significant bacteriuria among HIV seropositive females was 34.0%. This disagrees with similar studies reported previously in Nigeria and outside Nigeria. This figure is lower than the 78.0% reported in our previous study in Port Harcourt, Nigeria (Frank-Peterside et al., 2013b). It is also lower than the prevalence of 48.7% recorded by Iweriebor et al. (2012) in South Africa. It is higher than 23.9% reported in our previous study among HIV seropositive males (Frank-Peterside et al., 2013a). It is also higher than the 23.5% reported in Jos, Nigeria (Bigwan and Wakjissa, 2013) and the 29.1% reported in South Africa (Fabian et al., 2009). However, it is comparable to the 32.3% reported in Irrua, Edo State, Nigeria (Samuel et al., 2012).

According to most researchers, UTIs are an important health problem in HIV-infected persons, where the incidence is between 5% and 20 % (Foxman, 2002; Bigwan and Wakjissa, 2013). Studies have shown that the incidence of UTIs is greater among men and women infected with HIV than among men and women who are sero-negative for HIV (Schonwald et al., 1999; Foxman, 2002; Bigwan and Wakjissa, 2013). Our present study did not support this claim. Rather, our study showed significant differences (40.0 vs. 30.0, $P<0.05$) in the prevalence of significant bacteriuria between HIV seropositive females on HAART and HAART naïve females. The higher frequencies of occurrence among HIV-infected HAART naïve females may be due to several possibilities such as: advanced stage of HIV, increased sexual activity, bad toilet habits or sharing of bad public toilet facilities among these groups

(Bigwan and Wakjissa, 2013). This might have increased risk of bacteriuria which correlates with the degree of immunosuppression, as reflected by the CD4 count (Bigwan and Wakjissa, 2013).

The differences in the prevalence in these two groups may be linked to the immune status of the individuals, increased multiple sexual activities and other possible risks factors (Bigwan and Wakjissa, 2013). Most studies have demonstrated increased susceptibility to UTIs in HIV-infected patients with CD4 count of <200 lymphocytes/mm3 (Schonwald et al., 1999; Hochreiter and Bushman, 1999; Foxman, 2002; Bigwan and Wakjissa, 2013). Some studies have indicated that the risk of bacteriuria and UTI may be increased in HIV-infected patients and is inversely related to CD4+ lymphocyte counts (Hoepelman et al., 1992; Heyns and Fisher, 2005; Bigwan and Wakjissa, 2013).

Staphylococcus aureus which is the highest isolate has a high propensity for causing infections especially in young sexually actives (Mims et al., 2004; Bigwan and Wakjissa, 2013). In this study, *Staphylococcus aureus* accounted for the highest prevalence of bacteria isolates (26.3%), followed by *Escherichia coli* and *Klebsiella species* (18.4%). This is in agreement to what Omorogbe et al. (2009) found in Benin where *Staphylococcus aureus* (27.2%) was isolated more in the urine of their patients. In our previous studies, *Staphylococcus aureus* was reported to be most predominant over other bacteria uropathogens (Frank-Peterside et al., 2013a, b). This observation disagrees with previous studies on community acquired UTI (Cheesbrough, 2000; Allan, 2001; Fabian et al., 2009; Obiogbolu et al., 2009; Okonko et al., 2009a; Jai et al., 2012; Samuel et al., 2012; Bigwan and Wakjissa, 2013) where *Escherichia coli* was reported predominant over *Staphylococcus aureus*.

UTI due to *Escherichia coli* is a common finding (Obiogbolu et al., 2009; Fabian et al., 2009; Okonko et al., 2009a; Mwaka et al., 2011; Bigwan and Wakjissa, 2013). Among HIV seropositive females, *Escherichia coli* accounted for the highest bacteria isolates at 29.4% followed by *Staphylococcus aureus* being isolated in 23.5%. This agrees favourably with Samuel et al. (2012) who also reported *Escherichia coli* to be predominant over *Staphylococcus aureus* being isolated in 23.1%. This was also documented in Jos Nigeria (Jumbo et al., 2005), in Ibadan Nigeria among asymptomatic HIV positive pregnant women (Awolude et al., 2010), in Bamako Mali (Dao et al., 2007; Minta et al., 2007) where *Escherichia coli* was isolated in 46.7% and 28.57% of their studied cohort of patients respectively. However, this is also in contrast to what was reported by Omorogbe et al. (2009) who found *Staphylococcus aureus* (27.2%) more predominant in the urine of their patients in Benin and Frank-Peterside et al. (2013b) where *Staphylococcus aureus* (66.7%) more predominant in the urine of HIV seropositive patients in Port Harcourt, Nigeria.

Among HIV seronegative females, *Staphylococcus aureus* accounted for the highest bacteria isolates at 28.6%. This is also in contrast with our previous finding in a cohort of HIV seronegative males with *Escherichia coli* (29.6%) being predominant over other pathogens (Frank-Peterside et al., 2013a). It disagrees with our previous study among HIV seropositive (Frank-Peterside et al., 2013b). It also disagrees with previous studies on community acquired UTI (Cheesbrough, 2000; Allan, 2001; Fabian et al., 2009; Obiogbolu et al., 2009; Okonko et al., 2009; Samuel et al., 2012; Bigwan and Wakjissa, 2013). Furthermore, the spectrum of organisms causing UTI in our study are not similar to community acquired infections in the HIV negative population in a studies by Wilkie et al. (1992) and Evans et al., (1999), where nearly 90.0% of UTIs are due to *E. coli*, and where resistance to amoxycillin also occurred.

The presence of *Enterococcus faecalis* and *Streptococcus pyogenes* in this study agrees favourably with our previous study in Port Harcourt, Nigeria (Frank-Peterside et al., 2013b). Also, the presence of *Staphylococcus saprophyticus* in this study agrees favourably with previous study in Irrua, Edo State, Nigeria (Samuel et al., 2012).

Candidiasis is the most common opportunistic fungal infection (Hedayati and Shafiei, 2010; Donbraye-Emmanuel et al., 2010; Alli et al., 2011). In this study, *Candida albicans* 10(71.4%) was most predominant over other fungi isolates. This was followed by *Aspergillus species* 2(14.3%) and *Penicillium species* 2(14.3%). *Candida albicans* was also most predominant among HIV seropositive and HIV seronegative females. *Candida albican* and other *Candida species* had been isolated from several clinical specimens from different part of Nigeria (Donbraye-Emmanuel et al., 2010; Alli et al., 2011) and different parts of the world (Hedayati and Shafiei, 2010; Choudhry et al., 2010; Alli et al., 2011). McGee et al. (2009) also documented *Candida species* among immunocompromised patients with vaginitis and secondary to hematogenous spread. This figure reported for *Candida albicans* 10(71.4%) in this study is comparable to the 70.0% reported by Nwankwo et al. (2010) among females of reproductive age in Kano, Nigeria. It is lower than the 78.0% reported by Rizvi and Luby (2004) among Nepalese women; the 77.0% reported by Oyewole et al. (2010) among HIV-infected women in Sagamu, Ogun state, Nigeria and the 88.3 % prevalence reported by Nikolov et al. (2006).

This figure is also higher than the 40.0% reported by Oyewole et al. (2010) among non HIV-infected women in Sagamu, Ogun state, Nigeria; the 29.7% reported by Hedayati and Shafiei (2010) in their study; the 65.4% reported by Donbraye-Emmanuel et al. (2010) in their study; the 33.6% reported by Adeoye and Akande (2007) among women at LUTH and Military Hospital, Lagos; the 22.1% reported by Anorlu et al. (2004) among women in Lagos University Teaching Hospital, Lagos, Nigeria; and the 21.5% and 21.3% reported by Usanga et al. (2010) among pregnant women and non-pregnant women in Calabar, Nigeria. This was also higher than the findings published by some other workers (Nwokedi and Aniyam, 2003; Khan et al., 2009; Muvunyi and Hernandez, 2009) who reported a prevalence rate of 12, 28, and 52.5% respectively.

This 71.4% reported for *Candida albicans* in this study is also higher than the findings published by some other workers (Nwokedi and Aniyam, 2003; Donbraye-Emmanuel et al., 2010; Nwadioha et al., 2010; Alli et al. 2011) who reported a prevalence rate of 12, 28, and 52.5% respectively. It is higher than the 60.0% reported for *Candida albican* by Alli et al. (2011). It is also higher than what was reported by Choudhry et al. (2010), who reported *Candida* to be 2.0% in their study. It is also higher than the 26.0% reported for overall candida colonization and/or infection among pregnant women by Donbraye-Emmanuel et al. (2010). This agrees with the reports of Nwadioha et al. (2010) from Jos, Nigeria. Samuel et al. (2012) also reported the presence of *Candida albicans* in 7.7% of urine samples analysed.

This study also assessed the susceptibility of isolated uropathogens to different antibiotics commonly used in Port Harcourt, Nigeria. UTI in HIV-positive patients tends to recur, requiring longer treatment and it is suggested that treatment should be culture-specific (Heyns and Fisher, 2005; Bigwan and Wakjissa, 2013). However, our study revealed that ofloxacin, ceporex, ciprofloxacin, peflacine, lincocin, rifampicin, streptomycin, augmentin and ampiclox were the commonest antibiotics sensitive to the uropathogens. Our findings are however in agreement to that of several other workers. Samuel et al. (2012) reported the commonest antibiotic sensitive to the isolated organism to be ciprofloxacin, pefloxacin and ofloxacin. This also disagrees with the findings of Bigwan and Wakjissa (2013) who reported Gentamicin, Nitrofurantoin and Augmentin more effective against most of the urinary isolates. It also disagrees with the findings of Okonko et al. (2009b) who reported that Nitrofurantoin and Nalidixic acid remains the effective drug of choice against uropathogens. It is also in contrast to the findings of Omorogbe et al. (2009) in Benin Nigeria where Nitrofurantoin was found to be the most sensitive antibiotic to uropthogens.

The percentage sensitivity recorded for most isolates to some of the antibiotics used in this study is comparable to our previous findings (Frank-Peterside et al., 2013b). Dao et al. (2007) that found the fluoroquinolones sensitive to 90.9% of the isolates. Manfredi et al. (2001) also observed a similar sensitivity pattern among their cohort of patients. The observed contrast with the antibiotic sensitivity pattern with previous studies may not be unconnected with the different uropathogens isolated (Manfredi et al., 2001; Dao et al., 2007; Omorogbe et al., 2009; Samuel et al., 2012; Frank-Peterside et al., 2013b).

In this study, highest resistance to nalidixic acid (90.5%), septrin (80.9%), chloramphenicol (70.6%), floxapen (647%), nrobactin (64.7%), erythromycin (58.8%), ampicillin (57.1%), ampiclox (47.6%), augmentin (47.6%), and septromycin (44.7%) were observed. Resistance to ampicillin, amoxiclin, augmentin and penicillin was also reported in our previous study (Frank-Peterside et al., 2013a,b). This is also similar to what was observed by Jai et al. (2012) who reported 100.0% resistance of their *E. coli* isolates to ampicillin. Furthermore, in a study by Wilkie et al. (1992) and Evans et al. (1999) nearly 90.0% of UTIs were due to *E. coli* and were also resistance to amoxycillin.

Resistance to Cotrimoxazole [septrin] (80.9%) was reported in this study. This agrees with previous findings (Jai et al., 2012; Frank-Peterside et al., 2013b). Jai et al. (2012) reported 69.0% of their *E. coli* isolates were resistant cotrimoxazole. Frank-Peterside et al. (2013b) reported 52.9% resistance to Cotrimoxazole in our previous study. Most studies however found their isolates resistant to cotrimoxazole and penicillins perhaps due to the formers use prophylactically in the HIV clinic for the prophylactic treatment of several opportunistic bacterial and parasitic infections (Evans et al., 1995; van Dooyeweert et al., 1996; Maynart et al., 2001; Samuel et al., 2012), widespread and indiscriminate use in our environment (Jai et al., 2012; Frank-Peterside et al., 2013a,b), self-medication, use of fake, adulterated and substandard drugs and drug abuse (Bigwan and Wakjissa, 2013; Frank-Peterside et al., 2013a,b).

5. Conclusion

In conclusion, urinary tract infection is a significant co-morbidity in females with HIV. This study reveals a high prevalence of urinary tract infections in a cohort of HIV seropositive females in Port Harcourt, Nigeria. Thus, a high index of suspicion will lead to its prompt diagnosis and appropriate treatment. Of particular importance is the sensitivity patterns of the strains of bacteria isolated, in which

ofloxacin, ceprox, ciprofloxacin, peflacine and gentamicin were the most effective. Prospective studies are advocated to clarify whether these antibiotics confers some benefit in protecting HIV seropositive individuals against UTI.

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