



## Prevalence of urinary tract infection among HIV patients attending the infectious disease hospital in Benghazi, Libya

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### ABSTRACT

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People living with Human Immunodeficiency Virus (HIV) are prone to opportunistic infections including urinary tract infection (UTI). There is limited evidence in Libya regarding UTIs and HIV. This study was conducted to determine the prevalence of UTI among HIV patients attending the infectious disease hospital in Benghazi, Libya. Urine samples are collected and processed by macroscopic and microscopic examination for the identification of bacteria. Antibiotic susceptibility testing was performed using Kirby-Bauer's disc diffusion method. Urine samples were collected from 112 HIV seropositive patients, and 428 seronegative control group individuals. Out of 112 seropositive patients, 18(16%) had UTI. *Escherichia coli* was the most frequently occurring bacterial isolate 8(44%), followed by *Staphylococcus aureus* 4(21%), and *Klebsiella* species 3(17%). While the least common pathogens were *Salmonella* Species, *Micrococcus*, and *Sphingo-bacterium*; each had 1(6%). The age group 23-28 years recorded the highest prevalence of UTIs 11 (61%), while those aged 35-42 years had the least occurrence 2 (11%). On the other hand, out of 428 seronegative individuals' samples, 40(9%) yielded growth of bacteria. The distribution of uro-pathogens from urine specimens of seronegative patients revealed also *Escherichia coli* as the most prevalent uro-pathogens 18(45%), followed by *Klebsiella* species 8(20%) and then *Staphylococcus aureus* and *Enterobacter* species; each 5(12.5%). While the least common pathogens were *Pseudomonas* species and *Staphylococcus Saprophyticus* 2(5%). The age group 25-30 years recorded the highest prevalence of UTI; 11 (61%) in HIV-positive patients, while the age group. 41-70 years recorded the highest prevalence of UTI 18(45%) in HIV-negative patients. Female individuals showed the highest number of bacterial isolates; females had a prevalence of 14(78%) and males 4(22%) in seropositive patients, while in the seronegative patients, females had 35(87.5%) and males had 5(12.5). The study showed a high prevalence of UTIs among HIV patients which is an indication of the ineffectiveness of prophylaxis administered to HIV patients to prevent opportunistic.

### 1.0 Introduction

Urinary tract infection (UTI) is a condition where bacteria invade and grow in the urinary tract. Positive urine culture was defined as significant microbial

growth; a bacterial colony count of greater than or equal to 105 colony-forming units per ml of a typical urinary tract organism (Abderrazzack et al., 2015). UTIs are the most frequent community-acquired

infections in the world, and the most common pathogens are *E. coli* ((Abderrazzack et al., 2015, Aernan et al., 2016). Symptoms from a lower urinary tract include frequent and painful urination and feeling the need to urinate despite having an empty bladder (Ahmad et al., 2011). Symptoms of a kidney infection include fever and flank pain besides the symptoms of a lower UTI (Ali et al., 2018). Vulnerable populations for UTIs are women, especially during pregnancy, infants, and elderly patients (Abderrazzack et al., 2015, Almehdawi and Ismail, 2017, Angelescu et al., 2016). On the other hand, conditions that may increase susceptibility to infections are spinal cord injuries, urinary catheters, diabetes, multiple sclerosis, immunodeficiency, and underlying urologic abnormalities. Human immunodeficiency virus (HIV) positive patients are prone to urinary tract infections. The incidence of urinary tract infections in the HIV population is related to infection and immune function, determined by lymphocyte CD4+ cell count (Ankur et al., 2015, Emami et al., 2020). UTI is one of the significant illnesses that cause a burden. It is the most common nosocomial infection, as well as an important source of morbidity in the general population (Ben Ashur et al., 2021) and in HIV-positive individuals (Cheesbrough, 2006). HIV disease is associated with a variety of renal syndromes in patients with low CD4+ cell counts by causing neurologic complications, which lead to urinary stasis and ultimately infection (Emami et al., 2020 and Enayat et al., 2008). When CD4+ T cell count falls below 200 cells/mm<sup>3</sup>, the risk of a variety of opportunistic infections increases. The infectious organisms may include fungi, protozoa, viruses, and bacteria. (Farshad et al., 2010). Urinary tract infections account for a significant proportion of patients' daily hospital visits in HIV patients (Force et al., 2019). Symptoms of UTIs in HIV patients include dysuria, frequency, urgency, fever, and hematuria, but many patients are relatively asymptomatic. Neurological symptoms may also occur. Bladder areflexia or hyporeflexia is a common neurological complication, which leads to urinary stasis and ultimately UTI. The most common bacterial pathogens in HIV-infected patients are *Escherichia coli*, *Enterobacter* (Enterococci), *Pseudomonas*, Group D *Streptococcus*, *Proteus* spp., *Klebsiella*, *Acinetobacter*, and *Staphylococcus aureus* (Gohar et al., 2019). Although infection may be present, cultures are often negative. Most AIDS patients take prophylactic antimicrobials for

opportunistic infections causing pneumonia or diarrhea and this renders urine culture negative. Non-bacterial urinary tract infections (yeast, fungal, viral) are also common in this patient population, especially in patients with low CD4 counts, and negative cultures should alert the urologist to perform special cultures and stains (Jain et al., 2013).

The aim of the study is to determine the prevalence of the antimicrobial susceptibility pattern of bacteriuria of UTI, and investigate the variations, if any, in urinary bacterial pathogens in HIV-positive and HIV-negative individuals.

## 2.0 Materials and Methods

**Study design, period, and area.** A retrospective study was done after getting approval from the ethical committees. The study was done at Benghazi Center for Infection Disease & Immunity (BCIDI). The data were collected from November 2013 to November 2018. Collection of urine sample: All patients with available urine cultures were included and only the first urine culture was considered. Also, samples were taken from HIV-negative UTI patients and were treated as a control. **Bacterial culture and identification:** Urinalysis were performed on aliquots of MSU specimens using CombiUriscreen 10SL test strips. The presence of Pus cells ( $\geq 5$  per high-power field) was considered significant to indicate infection. UTI was diagnosed if the bacterial or pus cell count, or both, were significant in an individual. A urine culture was performed. A count of  $\geq 10^5$  cfu/mL was considered significant to indicate UTI. Mixed growths, in any count, of more than two organisms, were considered to be contaminated. Significant isolates were selected for identification. API 20E (Bio-Merieux) was used for identifying the Gram-negative bacilli, while the morphology on plates and biochemical reactions were used in identifying the gram-positive cocci. Categorical variables; frequency and percentage, were used

### 3.0 Results

#### A. Results of HIV Positive

A1. Sex distribution: Out of the 112 urine specimens examined, 18 (16%) were positive for UTI. Females had the highest occurrence of UTI; 14 (78%) compared to their male counterparts 4 (22%), figure 1.

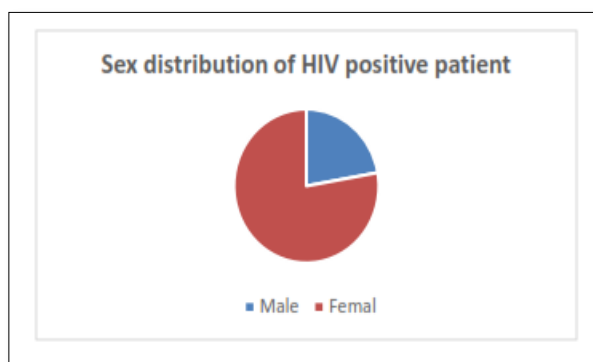


Figure 1: sex difference

A2. Age distribution: As can be seen in Table 1, The age group 25-30 years recorded the highest prevalence of UTI; 11 (61%). This was followed by the age group 31-35 years; 5(28%). The 36-40 years age group had the Least occurrence 2 (11%).

Table 1: Age distribution of HIV-positive patients with UTI

Age group	HIV- positive patients with UTI	Percentage
25-30	11	61%
31-35	5	28%
36-40	2	11%

A3. Distribution of uropathogens in HIV positive: the distribution from urine specimens of HIV-positive patients revealed Escherichia coli as the most prevalent uropathogens; 8 (44%), followed by Staphylococcus aureus; 4 (21%) and Klebsiella species; 3(17%), while the least occurring pathogens were Salmonella species, Micrococcus and Sphingobacterium spiritvorum; each had 1(6%). The last two bacteria rarely cause infection in humans (Figure 2).

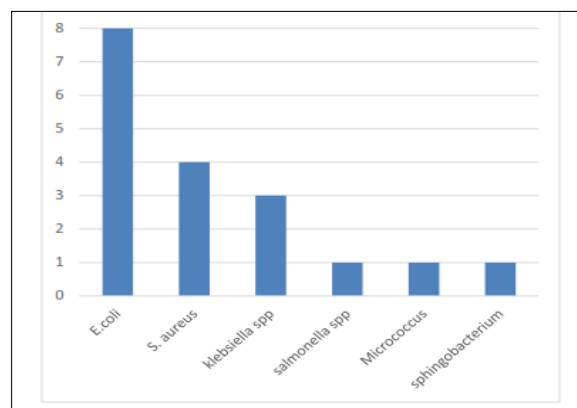


Figure 2: Distribution of bacteria isolate from specimen of HIV positive patients

Table 2. Results of antimicrobial susceptibility test.

No.	Antimicrobial agents	Conc. µg/disc	Antimicrobial class	Number of strains which were resistant to antibiotics
1	Ampicillin (AMP)	10 µg	Penicillins	8(44%)
2	Nalidixic acid (NA)	30 µg	Quinolones	9(50%)
3	Tetracycline (TE)	30 µg	Tetracyclines	6(13%)
4	Ciprofloxacin (CIP)	5 µg	Fluoroquinolones	7(38%)
5	Imipenem (IPM)	10 µg	Carbapenemes	0(0.0%)
6	Nitrofurantoin (F)	300 µg	Nitrofurantoin	6(13%)
7	Ceftazidime (CAZ)	30 µg	3 <sup>rd</sup> generation Cephalospori	11(61%)
8	Vancomycin (VA)	30 µg	Glycopeptide	6(13%)
9	Cefoxitin (FOX)	30 µg	2 <sup>nd</sup> generation Cephalosporin	8(44%)
10	Amoxicillin-clavulanic acid (AMC)	20/10 µg	Beta-lactam/beta-lactamase inhibitor	10(56%)

#### B. Results of HIV Negative

B1. Sex distribution: Out of the 428 urine specimens examined, 40 (9.34%) were positive for UTI. Females had the highest occurrence of UTI 35 (87.5%) compared to the male counterparts 5 (12.5%) as shown in Figure 3.

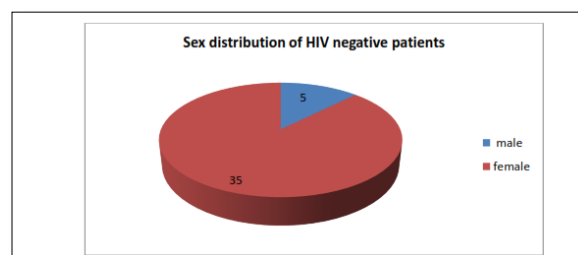


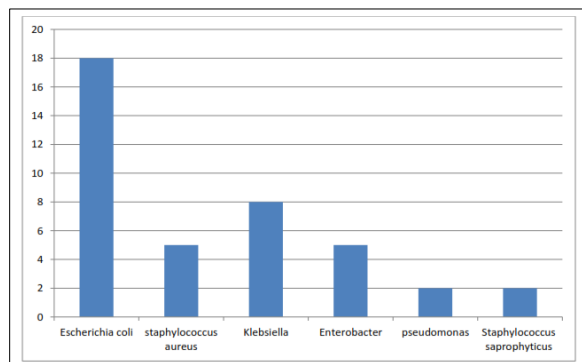
Figure 3: sex distribution of HIV-negative patients

**B2. Age distribution:** The age group 10-20 years recorded the least prevalence of UTI 2 (5%), followed by 21-30 years with 12(30%) and 31-40 years age group 8(20%), and 41-70 years age had the highest prevalence of UTI 18(45%).

**Table 3 Age distribution of HIV-negative patients with UTI**

Age group	HIV- negative patients with UTI	Percentage
10-20	2	5%
21-30	12	30%
31-40	8	20%
41-70	18	45%

**B3. Distribution of uropathogens in HIV negative** The distribution of uro-pathogens from urine specimens of HIV Negative patients revealed *Escherichia coli* as the most prevalent uropathogens 18(45%), followed by *Klebsiella* species 8(20%), *Staphylococcus aureus* and, *Enterobacter* species; each had 5(12.5), while the least occurring pathogens were *pseudomonas* species, and *Staphylococcus saprophyticus*; each had 2(5%) as shown in Figure 4.



**Figure 4: Distribution of bacteria isolate from specimen of HIV negative patients**

**B4. Antimicrobial susceptibility test in HIV negative patients: Antimicrobial susceptibility test:** Table,4 showed percentages of bacterial strains that were resistant to Ampicillin equal to 22 (55%) and that of Nalidixic acid 10 (25%), Tetracycline 9(22.5%), Nitrofurantoin 1 (2.5%),

Vancomycin 4 (10%), and Amoxicillin-clavulanic acid equal to 18 (45%). Also, the percentage of bacterial strains that were highly sensitive to Imipenem, Ciprofloxacin, and Cefoxitin is 40 (100%).

**Table 4: Results of Antimicrobial susceptibility test**

No.	Antimicrobial agents tested	Conc. µg/disc	Antimicrobial class	Number of strains resistant to antibiotics
1	Ampicillin (AMP)	10 µg	Penicillin	22(55%)
2	Nalidixic acid (NA)	30 µg	Quinolones	10(25%)
3	Tetracycline (TE)	30 µg	Tetracyclines	9(22.5%)
4	Ciprofloxacin (CIP)	10 µg	Fluoroquinolones	0(0.0%)
5	Imipenem (IPM)	30 µg	Carbapenems	0(0.0%)
6	Nitrofurantoin (F)	30 µg	Nitrofurans	1(2.5%)
7	Ceftazidime (CAZ)	30 µg	Third-Generation Cephalosporin	3(7.5%)
8	Vancomycin (VA)	30 µg	Glycopeptide	4(10%)
9	Cefoxitin (FOX)	30 µg	Second-Generation Cephalosporin	0(0.0%)
10	Amoxicillin-clavulanic-acid (AMC)	20/10 µg	Beta-lactam/beta-lactamase inhibitor	18(45%)

### 4.0 Discussion

In our study, we found that the prevalence of UTI among HIV- positive patients was high in comparison to that among HIV-negative patients (control group). The current study revealed a 16% prevalence of uropathogens in HIV-positive patients in tandem with results of a similar study obtained in Tanzania and India, in which the prevalence of UTIs was 21.4%, and 25.7% respectively (Jeremiah et al., 2017 and Asima et al, 2018). In contrast, in a study done by Zakkka et al (2018) in Nigeria, in which out of 225 HIV-positive patients, the prevalence rate of urinary tract infection among HIV/AIDS patients was low; 13 (5.8%). In our study, *Escherichia coli* was the most prevalent uropathogen in both HIV-positive and negative patients. The second most common organisms in HIV patients were *Staphylococcus aureus* (4; 21%), and *Klebsiella* species (3; 17%), while the least occurring agents were *Salmonella* and *Micrococcus*; each had (1; 6%), Besides, *Sponge* bacteria were frequently found. For this reason, these should be taken into consideration when treatment of a UTI with suspected bacteriemia in AIDS patients is initiated. On the other hand, out of 428 HIV- negative patients, (40; 9.34%) were positive for UTIs. *Pseudomonas* species and *Staphylococcus saprophyticus* were the least common organisms; each had a prevalence of (2; 5). Comparable to our findings, in a study performed in Iraq consisting of 300 HIV-positive patients, UTI was observed in 83 cases and *E. coli* was the most etiological agent of urinary tract infection (44; 53%). The other isolates

were *Proteus mirabilis*, *Klebsiella pneumoniae*, *Citrobacter diversus*, *Citrobacter freundii*, *Enterobacter aerogenes*, *Yersinia pestis*, *Pseudomonas aeruginosa*, *Klebsiella Oxytoca*, and *Hafnia alvei*. Their prevalence were as (18; 21.7%), (4; 4.8), (4; 4.8%), (3; 3.6%), (3; 3.6%), (3; 3.6%), (2; 2.4%), (1, 1.2%) and (1, 1.2%) respectively. (Salih et al., 2016) Another study conducted by Kemajou et al (2016) in Nigeria showed that a total of 165 bacteria were identified and grouped into four genera, out of which *Staphylococcus aureus* had the highest percentage of occurrence (49; 29.7%), followed by *Escherichia coli* (47; 28.5%), *Pseudomonas aeruginosa* (46; 27.9 %) and *Klebsiella* (23. 13.9%. Moreover, out of 111 bacteria isolates that exhibited multidrug resistance, HIV seropositive individuals had (103; 92.8%) and HIV seronegative individuals had (8; 7.2%). Overall, *Staphylococcus aureus* recorded the highest number of multidrug-resistant bacteria (36; 32.4%), followed by *Pseudomonas aeruginosa* (34; 30.6%).

This study also observed that the prevalence of UTI in females at 78% was higher compared to 22% in males. This follows the trend in normal healthy individuals where females are at higher risk of being infected with UTI due to their short straight urethra. In our study, we included outpatients who may have rather community-acquired pathogens and that is why *E. coli* was the most common isolated pathogen. Also, in the general population, urinary tract infections are mostly caused by *E. coli* (80-85% of cases). However, the higher prevalence of asymptomatic UTI is in contrast with the study done by Inyang Etoh et al (2009) and Spence et al (1996) reported a lower prevalence rate in females and agrees with earlier studies done by Omoregia and Eghafona (2009) in Benin City, Nigeria which had a similar result. The distribution of infection according to age in the present study of HIV-positive patients showed that the age group 25-30 had a prevalence of (11; 61% which was the highest frequent infection group, followed by the age group 31-35 years (5; 28%) and the least infected group were 36-40 (11%). This result agrees with the work of Kemajou et al (2016) in which the age group 24-30 years had the highest number of bacterial isolates (45; 32.9%), while those above 35 years

recorded the least (11; 7.8 %). In terms of the sensitivity pattern of bacterial strains in HIV- positive patients that were resistant to Ceftazidime, the prevalence rate was (11; 61%), and that of Amoxicillin-clavulanic acid was (10; 56%), Nalidixic

acid (9; 50%), Ciprofloxacin (7; 38%), Tetracycline (6; 14%), Vancomycin (6; 13%), and Nitrofurantoin (6; 13%). Likewise, in the percentages of bacterial strains that were highly sensitive to Imipenem, the prevalence rate was (18; 100%). This sensitivity pattern disagrees with Inyang et al (2009) who found that widespread sensitivity of isolates to antibiotics was observed with the Quinolones (Ciprofloxacin, Refloxacin, and Oxafloxacin) and Augmentin. In addition, the isolate of *E. coli* and *S. aureus* in the test and control subjects were highly sensitive (100%) to Ciprofloxacin and Refloxacin in their study.

Urinary tract infections (UTIs) are serious infections worldwide. The reasons for the enumerated resistance spread of antibiotics in the hospitals may be traced to the random and illogical use of these antibiotics by the temporary and permanent patients of the hospital. The active way to prevent the enumerated resistance of the drug by the pathogen is the logical use of antibiotics, in addition to being restricted to the specialized physician orders which supply the best benefit of antibiotics in addition to the financial expenditure. (Salih et al., 2016)

## 5.0 Conclusion

In our study, we found that the rate of infection of the urinary tract in patients infected with HIV was more than in non-infected HIV patients. The study also revealed that most patients with UTIs are women in both groups. *Escherichia coli* was the most frequently occurring bacterial isolate from the positive urine cultures in both groups. The 25-30 age group of patients with HIV had the highest incidence of urinary tract infections. Most of the bacteria were resistant to Ceftazidime (CAZ). Imipenem showed the highest activity against bacterial isolates tested. The resistance rate of Ceftazidime, Nalidixic acid Amoxicillin-Clavulanic in HIV patients was increased in comparison to isolates from urinary cultures of the HIV-negative population (control group) with UTI. This study draws attention to the high prevalence of UTIs among HIV patients therefore, there is a need for HIV patients to be examined for UTIs. HIV-positive individuals are at increased risk of opportunistic and common bacterial infections. The high prevalence of urinary tract infection recorded in the present study is an indication of the ineffectiveness of prophylaxis administered to HIV patients to prevent opportunistic infection

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