

# Urinary Tract Infection Among Prison Inmates in Afara Jail Umuahia

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## To cite this article:

Ezeagwula Divine, Nwachukwu Ndubuisi, Nwaugo Victor, Ulasi Amara. Urinary Tract Infection Among Prison Inmates in Afara Jail Umuahia. *International Journal of Clinical Urology*. Vol. 4, No. 1, 2020, pp. 25-29. doi: 10.11648/j.ijcu.20200401.16

Received: February 27, 2020; Accepted: March 10, 2020; Published: April 8, 2020

**Abstract:** Urinary tract infections are the most commonly encountered bacterial infections in clinical practice. It is yet to be fully explored in prisons. We determined the prevalence of urinary tract infection among prison inmates at Afara Jail Umuahia, Nigeria. A cross-sectional study was conducted among 218 prison inmates. Freshly-voided mid-stream urine from each inmate was cultured on MacConkey agar and 5% Blood agar and incubated at 37°C for 24h. Isolates were identified by standard microbiological techniques. Antimicrobial susceptibility testing was performed by Kirby-Bauer disc diffusion method. Data were analyzed using SPSS version 17 package and the Chi-square test. The prevalence of urinary tract infection was 22.0%. The commonly isolated bacteria were *Escherichia coli* (33.3%), *Klebsiella pneumoniae* (20.8%), and *Staphylococcus aureus* (18.8%). Exactly 72.9% of isolates were Gram negative bacilli and 27.1% Gram positive cocci ( $P < 0.05$ ). Gram negative isolates were more sensitive to Gentamicin (97.1%) followed by Zithromax (88.6%). Gram positive cocci showed maximum sensitivity to Ciprofloxacin (92.3%) and Gentamicin (92.3%). All Gram positive cocci were resistant to Tetracycline and Ampicillin. Females were more infected (56.6%) than males (17.9%) ( $P < 0.05$ ). The prevalence of urinary tract infection in Afara prison was 22.0%. *Escherichia coli* was the commonest isolate. Gentamicin and Ciprofloxacin were the most useful antibiotics and could be used as first line drugs for treatment of Urinary tract infection among prison inmates.

**Keywords:** Urinary Tract Infection, Prison Inmates, Antibiotic Susceptibility Testing, Afara Jail, Nigeria

## 1. Introduction

A prison is a facility used for the confinement of prisoners under the authority of the State. It is seen either as punishment for crimes committed or mode of rehabilitation [1, 2]. The normal life of inmates is restricted, freedom of movement is curtailed and private space is limited.

Prisoners in developing countries live in extremely poor conditions. Due to dilapidated facilities, the risk of acquiring, activation or aggravation of already existing infection usually increases in prisons [3]. Prisoners are more susceptible to disease owing to poor healthcare, overcrowding, high risk behaviors, poor nutrition, lack of potable water, poor personal and environmental hygiene and low level immunity due to stress [4, 5].

Urinary tract infections are commonly encountered by clinicians in developing countries, with an estimated annual global incidence of 250 million [6, 7]. Urinary tract infections have been studied extensively in diverse communities and among different age groups [8-10] but it is yet to be fully explored in prison inmates whose health are often neglected.

This study therefore, seeks to determine the prevalence of urinary tract infection among prison inmates of Afara Federal prisons Umuahia, Nigeria.

## 2. Materials and Methods

### 2.1. Study Area

This cross-sectional study was conducted among prison

inmates of Afara Federal Prisons, Umuahia, Abia State, Nigeria between July 2017 and October, 2018. Afara Federal Prisons Umuahia is a Minimum Prison located in the capital of Abia State and serves the South- eastern parts of Nigeria.

## 2.2. Study Participants

A total of 218 prisoners participated. Age of the subjects ranged from 21 years to 60 years.

## 2.3. Methods

The socio-demographic characteristics of the inmates were obtained using structured questionnaires. Urine samples were collected from each participant. Prior to urine collection, participants were instructed on how to aseptically collect a clean catch mid-stream urine into a sterile screw-cap universal container to avoid contamination.

## 2.4. Sample Processing

The bacterial counts in the urine samples were determined by semi-quantitative method using a calibrated inoculation loop of 4mm internal diameter. A loopful (0.001 ml) of mid-stream urine was inoculated unto the surface of well-dried MacConkey agar and 5% Blood agar plates. After overnight incubation at 37°C, culture plates that yielded bacterial counts of  $> 10^5$  CFU/ml were considered as significant [11]. Isolated organisms were characterized and identified using standard laboratory methods including colonial appearance, microscopy and biochemical techniques [11]. Corresponding ATCC strains were used as reference standard during biochemical identification of isolated uropathogenic bacteria.

## 2.5. Antibiotic Susceptibility Testing

Antibiotic susceptibility testing was performed by the Kirby-Bauer disc diffusion method [12]. Ten commercially available antibiotic discs were used at their respective concentrations and include Ciprofloxacin (10µg), Gentamicin (10mg), Norfloxacin (10µg), Amoxil (30µg), Tetracycline (30 µg), Erythromycin (30 µg), Nalidixic acid (30µg), Ampicillin (10µg), Streptomycin (30 µg) and Zithromax (10µg). After seeding respective test organism on Muller Hinton Agar plate and with the aid of a sterile forceps, each antibiotic disc was placed on the surface of the medium. The diameter of inhibition zone around the disc was recorded after incubation at 37°C for 24h. The reference standard was used for the inspection of isolate sensitivity/resistance pattern. The results of the antibiotic susceptibility tests were

interpreted following the National Committee for Clinical Laboratory Standards [13].

## 2.6. Data Analysis

The data were analyzed using SPSS version 17 package. Frequency tables were obtained for selected variables and statistical test of significance was performed using Chi-square test.  $P < 0.05$  was considered statistically significant.

## 2.7. Ethical Clearance

Ethical clearance was sought and obtained from the Chief Comptroller of Prisons. A support letter from Abia State University was also sent to the Chief Comptroller of Prisons. Inmates consented to participate in the study.

# 3. Results

A total of 218 prison inmates, whose age ranged from 21 years to 66 years enrolled in the study. Majority of the inmates were males (89.4%). Urinary tract infection affected more females (56.5%) than males (17.9%) ( $P < 0.05$ ). The age group most infected were 30-39 year old (25.0%) while the least infected were those 60 years and above (0%) ( $P < 0.05$ ). Illiterate prison inmates (25.0%) and the ones who completed primary school only (25.4%) had the highest prevalence of urinary tract infection. The length of time in prison is significantly associated with urinary tract infection. Inmates incarcerated for more than 10 years were most infected (29.4%) as presented in Table 1.

Out of the 218 urine samples examined, 48 (22.0%) yielded bacterial counts  $> 10^5$  CFU/ml, indicating significant growth of uropathogens. Exactly 72.9% of the isolates were Gram negative bacilli while 27.1% were Gram positive cocci (Table 2).

As presented in Table 3, *Escherichia coli* was the most common isolate (33.3%) followed by *Klebsiella pneumoniae* (20.8%), *Staphylococcus aureus* (18.8%) and the least frequent *Pseudomonas aeruginosa* (6.3%).

Antibiotic susceptibility testing of Gram negative bacilli revealed that Gentamicin (97.1%) was the most sensitive antibiotic. It was followed by Zithromax (88.6%) and the least sensitive antibiotic was Streptomycin (8.6%) (Table 4).

Results for the susceptibility pattern of Gram positive cocci showed that maximum sensitivity was seen in Ciprofloxacin (92.3%) and Gentamicin (92.3%). All the Gram positive cocci resisted Tetracycline and Amoxil (Table 5).

**Table 1.** Socio-demographic characteristics of inmates at Afara Prison, Umuahia.

Variable	No. examined (%)	No. UTI positive (%)
Gender		
Men	195 (89.4)	35 (17.9)
Women	23 (10.6)	13 (56.5)
Age group (yr)		
19-29	9 (4.1)	1 (11.1)
30-39	116 (53.2)	29 (25.0)
40-49	74 (34.0)	16 (21.6)
50-59	16 (7.3)	2 (12.5)

Variable	No. examined (%)	No. UTI positive (%)
60+	3 (1.4)	0 (0)
Education		
Illiterates	96 (44.0)	24 (25.0)
Completed primary school	67 (30.7)	17 (25.4)
Completed secondary school	41 (18.8)	6 (14.6)
Tertiary	14 (6.4)	1 (7.1)
Marital Status		
Single	129 (59.2)	26 (20.2)
Married	89 (40.1)	22 (24.7)
Time in Prison (Yr)		
< 1	52 (23.9)	10 (19.2)
1 – 5	132 (60.6)	28 (21.2)
> 10	34 (15.6)	10 (29.4)

Table 2. Prevalence of urinary tract infection among Afara prison inmates.

Total urine samples tested	No urine samples positive for UTI (%)	No. GNB Isolated (%)	No. GPC Isolated (%)	Total no. samples negative for UTI (%)
218	48 (22.0)	35 (72.9)	13 (27.1)	170 (78)

GNB: Gram Negative Bacilli; GPC: Gram positive cocci.

Table 3. Distribution of uropathogens among Afara prison inmates (n=48).

Bacteria	Frequency	%
<i>Escherichia coli</i>	16	33.3
<i>Klebsiella pneumoniae</i>	10	20.8
<i>Proteus</i> sp	6	12.5
<i>Pseudomonas aeruginosa</i>	3	6.3
Gram Positive Cocci		
<i>Staphylococcus aureus</i>	9	18.8
<i>Streptococcus fecalis</i>	4	8.3

Table 4. Antimicrobial susceptibility pattern of isolated Gram negative bacteria.

Antibiotics	<i>E. coli</i> (n=16)	<i>K. pneumonia</i> (n=3)	<i>P. aeruginosa</i> (n=3)	<i>Proteus</i> sp (n=6)	Total (%)
Gentamicin	15	10	6	3	34 (97.1)
Ciprofloxacin	12	8	5	2	27 (77.1)
Norfloxacin	11	4	1	1	17 (48.6)
Amoxil	0	0	5	0	5 (14.3)
Erythromycin	2	0	1	3	6 (17.1)
Nalidixic Acid	9	3	0	0	12 (34.3)
Ampicillin	0	0	0	0	0 (0)
Streptomycin	0	0	1	2	3 (8.6)
Zithromax	14	8	6	3	31 (88.6)

Table 5. Antimicrobial susceptibility pattern of isolated Gram positive cocci.

Antibiotics	<i>S. aureus</i> (n=9)	<i>S. fecalis</i> (n=4)	Total (%)
Gentamicin	9	3	12 (92.3)
Tetracycline	0	0	0 (0)
Ampicillin	0	0	0 (0)
Ciprofloxacin	9	3	12 (92.3)
Ceporex	6	4	10 (76.9)
Amoxil	3	2	5 (38.5)
Erythromycin	4	2	6 (46.2)
Streptomycin	1	1	2 (15.4)
Norfloxacin	8	3	11 (84.6)

## 4. Discussion

Urinary tract infections are recognized globally as the most prevalent bacterial infection in humans and a major public health concern [14]. Prisoners are generally more susceptible to diseases [5]. In our study, an overall prevalence of 22.0% was observed. This is similar to 21.4% obtained in an earlier

study in Jos Main Prison, Nigeria [3]. However, it contrasts with 9.9% recorded among prison inmates in central jail of Bhopal [5] and 0.67% in central jail of South India [2].

In this study, Gram negative bacilli constituted 72.9% of the total isolates while Gram positive cocci constituted 27.1%. This finding agrees with other reports that Gram negative bacilli are the commonest pathogens isolated from patients with urinary tract infection [5, 15]. This high

prevalence of Gram negative bacilli among prison inmates is also similar in other settings [16] and are due to the fact that the Enterobacteriaceae are primary agents causing urinary tract infection and has many factors responsible for their attachment to the uro-epithelium [16].

The most predominant organisms isolated from the inmates were *Escherichia coli* (33.3%), *Klebsiella pneumoniae* (20.8%) and *Staphylococcus aureus* (18.8%). This is consistent with the study conducted by others in Nigeria [3, 5, 17]; Ethiopia (18) and Saudi Arabia [19]. Globally, *Escherichia coli* is envisaged to cause 70-95% upper and lower urinary tract infection [7].

Urinary tract infection occurred more in female inmates than male inmates. Urinary tract infection is more frequent in females than males during adolescence and adulthood [15]. It is universally agreed that frequency of urinary tract infection is especially high among women due to their reproductive physiology [20, 21].

Prison inmates incarcerated for more than 10 years had the highest prevalence of urinary tract infection in our study. Similar observation had been documented [3]. Prolonged incarceration may lead to more exposure to stress and low standard of living and eventually reduced immunity and disease [17].

Antibiotic susceptibility pattern of isolated bacteria showed high sensitivity of Gram negative bacilli to Gentamicin and Zithromax. Similar findings had been previously reported [22, 23]. Maximum resistance was shown to Amoxil. The most useful antibiotics against Gram positive cocci were Ciprofloxacin and Gentamicin. Resistance shown to Tetracycline and Ampicillin could be due to over-use and above of these antibiotics. In conclusion, the prevalence of urinary tract infection in Afara Prison was 22.0%. *Escherichia coli* was the most implicated bacteria causing urinary tract infection and female prison inmates were mostly infected. Gentamicin and Ciprofloxacin were the most useful antibiotics for the treatment of urinary tract infection.

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