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Biochemical and Microbiological Profile of Community Acquired Urinary Tract Infection among Patients Attending University of Maiduguri Teaching Hospital, Borno State



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ABSTRACT

Background: Urinary tract infection (UTI) in the community hygiene practice poses a very serious problem. The knowledge of biochemical and microbiology profile of UTI caused by micro-organisms is vital for defining the empirical treatment. **Methodology:** A total of two hundred (200) subjects were recruited for this study by using Stratified sampling technique. One hundred (100) subjects were confirmed with UTI, while 100 apparently healthy subjects with no UTI were used as controls. Serum urea and Creatinine, urine analysis, urine microscopy and culture of both patients and control subjects were evaluated using standard methods. **Results:** The study subjects comprised of 40 males and 60 females confirmed with UTI. *Escherichia coli* (*E. coli*) was found to be the predominant causative agent isolated (57%), other bacteria uropathogens were present as follows; *Staphylococci* (19%), *Klebsiella* (13%), *Proteus* (9%) and *Candida* (2%). *E. coli* was isolated in 24 (60%) of males and 33 (55%) females. 60%, 20%, 16.7% of males isolated with *Klebsiella*, *proteus*, *Staphylococcus* respectively and 25%, 25%, and 18.2% of females isolated with *Klebsiella*, *proteus* and *E. coli* respectively have both serum urea and creatinine level elevated. Only 4.2% and 20% of males isolated with *E. coli* and *Klebsiella* respectively have proteinuria. Also, 8.3%, 20% of males isolated for *E. coli* and *Klebsiella* respectively and 3.0%, 7.7% and 25% of females isolated for *E. coli*, *Staphylococcus* and *Proteus* respectively have glucosuria. Only 20% of males isolated for *Klebsiella* have both proteinuria and glucosuria. **Conclusion:** This study shows elevated renal biochemical parameters among the subjects with Urinary tract infections (UTIs).

INTRODUCTION

Urinary tract infection (UTI) is an infection of any part of the urinary system. Most infections involve the lower urinary tract. They can affect the bladder (cystitis), urethra (urethritis) or kidney (pyelonephritis) [1,3]. UTI are caused by microbes such as bacteria most commonly *Escherichia coli*, *Klebsiella pneumonia*, *Proteus mirabilis*, *Enterococcus faecalis* and *Staphylococcus saprophyticus* [2]. These microbes cause the infection by overcoming the body's defenses in the urinary tract [1]. UTIs are one of the most common types of infection affecting about 150 million people each year worldwide and account for about 8.1 million visits to doctors each year [1]. It is second only to respiratory tract infection [2]. In United States, UTIs account for more than 10 million visits to medical offices and hospitals each year [2]. UTIs are more common in adults than in children and more common in females than in males and men younger than 50 years of age[2]- the reason for this is not well understood, but the anatomic differences between the genders (a shorter urethra in women) might be partially responsible [2]. They are significant cause of morbidity in infant boys, older men and female of all ages. Serious sequel includes frequent recurrences, pyelonephritis with sepsis, renal damage in young children, preterm birth and complications caused by frequent antimicrobial use, such as high- level antibiotic resistance and *Clostridium difficile* colitis[2].

The study is aimed at determining the effects of UTI on biochemical and microbiological profile in patients and find out whether there is a disparity with controls.

MATERIALS AND METHODS

A total of two hundred (200) subjects were recruited for this study by using Stratified sampling technique [4]. One hundred (100) subjects seen in general outpatient department of University of Maiduguri Teaching Hospital (UMTH) were confirmed with UTI, while 100 were apparently healthy individual as controls. The minimum sample size was determined from a standard formula for calculation of minimum sample size [5].

Morning Midstream clean catch urine samples (from both the study subjects and the control subjects) were collected in a sterile universal container. The study subjects were not on any antimicrobials within the previous fifteen (15) days. Five (5) ml of blood samples were drawn from each subject by vein-puncture into plain specimen tubes and allowed to stand for 30 minutes at room temperature to clot. The blood samples were then centrifuged at 4000 rpm

for 5 minutes and serum were collected into clean, well labeled cryovial container and stored frozen at 4°C until analysis.

The urine samples were cultured and bacterial uropathogens were isolated and identified. Urine microscopy was also done for presence of pus cells, crystals, cast and bacteria. Urinalysis was done using dipstick method. Serum urea and creatinine were estimated using Diacetyl monoxime and jaffe methods respectively.

STATISTICAL ANALYSIS

The data obtained was analyzed using the statistical package for social sciences (SPSS) version 20.0 for windows pc. Other descriptive statistic was also used for the analysis. Students t-test was used to test for the differences between the data obtained. The level of significance was set at 95% ($p < 0.05$) confidence interval.

RESULT

In this study, a total of two hundred (200) mid-stream clean catch urine samples and blood samples were collected. One hundred (100) UTI subjects and one hundred (100) control subjects. The study subjects comprised of 40 (40%) males and 60 (60%) females. The mean \pm S.D age of the study subjects was 32.17 \pm 10.29 years; (range 18 years to 60 years) and the mean \pm S.D age of the control group was 32.43 \pm 10.74. Table 1 shows the distribution of study subjects according to age and sex. 15 (37.5%) of males and 28 (46.7%) females were found between the age group of 18-28 years. 17 (42.5%) of the males and 22 (36.7%) females were between the age group of 29-39 years while 8 (20%) of males and 10 (16.6%) females were of the age of 40 - 60years.

Tables 2 shows mean serum biochemical parameters measured and percentages of uropathogens isolated from the study group according to sex. *Escherichia coli* (*E. coli*) was found to be the predominant causative agent isolated (57%), other bacteria uropathogens were present as follows; *Staphylococci* (19%), *Klebsiella* (13%), *Proteus* (9%) and *Candida* (2%). *E. coli* was isolated in 24 (60%) of males and 33 (55%) females. *Staphylococcus* was isolated in 6 (15%) males and 13 (21.7%) females. *Klebsiella* was isolated in 5 (12.5%) males and 8 (13.3%) females. *Proteus* was isolated in 5 (12.5%) males and 4 (6.7%) females while *candida* was isolated only in 2 (3.3%) females. Serum urea and creatinine concentration of both sex are statistically not different at $p \leq 0.005$.

Table 3 shows frequency of urine and mean serum biochemical parameters among the study subjects as compared to control subjects. The result showed that all (100) study subjects were positive due to bacteria culturing from UTI (40%, 60%) for male and female respectively and is significant ($p \leq 0.05$) when compared with the control subjects. Leukocyte was present in (96%) of the study subjects (39%, 57%) in male and female respectively and is significant ($p \leq 0.05$) when compared to the control subjects. Nitrite was present in 93% of the study subjects (37%, 56%) in male and female study subjects respectively and is significant ($p \leq 0.05$) compared to the control subjects. Pus cells, Casts and Crystals (79%, 47%, and 25%) respectively present in the study subjects all showed significant difference ($p \leq 0.05$) when compared to control subjects. Glucose was present in (7.5%, 5%) in male and female study subjects respectively and is significant ($P \leq 0.05$) when compared to control subjects. Blood was a constant value and there was no significant difference in urobilinogen, bilirubin, protein, ketones, pH and density of the study subjects when compared to control subjects. However, serum urea and creatinine concentration was significantly increased in the study subjects when compared to the control subjects.

Table 4 shows the frequency of elevated biochemical parameters among the study subjects according to sex. High percentage of males isolated with *Klebsiella*, *Proteus* and *Staphylococci* accordingly have elevated urea while females isolated with *Staphylococci*, *Candida* and *E. coli* accordingly have elevated urea. Also, higher percentage of males isolated with *Klebsiella* and *Proteus* accordingly has elevated Creatinine while high percentage of females isolated with *Klebsiella*, *E. coli* and *Proteus* accordingly have elevated Creatinine. Also, high percentages of males and females isolated with *Klebsiella* and *Proteus* accordingly have both elevated urea and Creatinine. Only those males isolated with *Klebsiella* and *E. coli* have proteinuria. Also only 1 (20%) and 2 (8.3%) of males isolated with *Klebsiella* and *E. coli* respectively and 1 (25%), 1 (7.7%) and 2 (8.3%) of males isolated with *Proteus*, *Staphylococcus* and *E. coli* respectively have glycosuria. Only 1 (20%) males isolated with *Klebsiella* have both proteinuria and glycosuria.

Table 1. Distribution of study subject according to age and sex

| Age group yrs | Male n= 40(%) | Female n=60(%) | Total N= 100(%) |
|---------------|---------------|----------------|-----------------|
| 18-28 | 15(37.5) | 28(46.7) | 43(43) |
| 29-39 | 17(42.5) | 22(36.7) | 39(39) |
| 40-60 | 8(20) | 10(16.6) | 18(18) |

Table 2. Mean serum biochemical parameters measured and percentages of uropathogens isolated from the study group according to sex.

| Parameters | Male n=40(%) | Female n=60(%) | Total N=100(%) | p-values |
|-------------------------|--------------|----------------|----------------|----------|
| <i>Escherichia coli</i> | 24(60) | 33(55) | 57(57) | |
| <i>Proteus</i> | 5(12.5) | 4(6.7) | 9(9) | |
| <i>Klebsiella</i> | 5(12.5) | 8(13.3) | 13(13) | |
| <i>Staphylococcus</i> | 6(15) | 13(21.7) | 19(19) | |
| Candida | 0(0) | 2(3.3) | 2(2) | |
| Mean urea | 6.17±3.76 | 6.26±3.52 | | 0.920* |
| Mean Creatinine | 128.38±81.22 | 119.42±92.69 | | 0.775* |

Key: * = Not Significant (P≤0.05)

Table 3. Frequency of urine and mean serum biochemical parameters among the study subjects as compared to control subjects.

| URINE AND SERUM BIOCHEMICAL PARAMETERS | STUDY SUBJECTS | | | | CONTROL SUBJECTS | | | | P-values | remark |
|--|----------------|------|-----------------|------|------------------|---|-----------------|-----|----------------|--------|
| | MALE n=40 (%) | | FEMALE n=60 (%) | | MALE n=40 (%) | | FEMALE n=60 (%) | | | |
| Blood | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Constant value | |
| Urobilinogen | 2 | 5 | 1 | 1.7 | 0 | 0 | 0 | 0 | 0.246 | NS |
| Bilirubin | 2 | 5 | 2 | 3.3 | 0 | 0 | 1 | 1.7 | 0.160 | NS |
| Protein | 2 | 5 | 1 | 1.7 | 0 | 0 | 0 | 0 | 0.246 | NS |
| Nitrite | 37 | 92.5 | 56 | 93.3 | 0 | 0 | 0 | 0 | 0.000 | NS |
| Ketone | 2 | 2 | 3 | 5 | 0 | 0 | 0 | 0 | 0.059 | NS |
| Glucose | 3 | 7.5 | 3 | 5 | 0 | 0 | 0 | 0 | 0.029 | S |
| pH | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.180 | NS |
| Density | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.845 | NS |
| Leucocyte | 39 | 97.5 | 56 | 93.3 | 0 | 0 | 0 | 0 | 0.000 | S |
| Pus cells | 29 | 72.5 | 57 | 95 | 0 | 0 | 0 | 0 | 0.000 | S |
| Casts | 24 | 60 | 23 | 38.3 | 0 | 0 | 0 | 0 | 0.000 | S |
| Crystals | 7 | 17.5 | 18 | 30 | 0 | 0 | 0 | 0 | 0.000 | S |
| bacteria | 40 | 100 | 60 | 100 | 0 | 0 | 0 | 0 | 0.000 | S |
| Mean Serum urea (mmol/L) | 6.22 ± 3.59 | | | | 4.44 ± 0.89 | | | | 0.000 | S |
| Serum creatinine (µmol/L) | 123.0 ± 87.97 | | | | 88.6 ± 34.78 | | | | 0.000 | S |

Key: S= Significant, NS = Not Significant P≤0.05

Table 4 Frequency of elevated biochemical parameters among the study subjects according to sex and isolates

| Biochemical parameters | Isolates in Male | | | | | Isolates in Females | | | | | Total | | | | |
|--------------------------|-----------------------|---------------------|--------------------------|-----------------------|-----------------------|-----------------------|----------------------|--------------------------|-----------------------|-----------------------|-----------------------|----------------------|---------------------------|-----------------------|-----------------------|
| | E.coli n=24 (%) | Staph n=6 (%) | Klebsiella n=5 (%) | Proteus n=5 (%) | Candida n=0 (%) | E.coli n=3 (3%) | Staph n=1 (3%) | Klebsiella n=8 (%) | Proteus n=4 (%) | Candida n=2 (%) | E.coli n=5 (7%) | Staph n=1 (9%) | Klebsiella n=13 (%) | Proteus n=9 (%) | Candida n=2 (%) |
| Urea >5.8mmol/l | 6 (25%) | 2 (33.3%) | 4 (80%) | 3 (60%) | 0 (0%) | 14 (42.4%) | 7 (53.8%) | 3 (37.5%) | 1 (25%) | 1 (50%) | 20 (35.1%) | 9 (47.4%) | 7 (53.8%) | 4 (44.4%) | 1 (50%) |
| Creatinine >132µmol/l | 5 (20%) | 1 (15.7%) | 3 (60%) | 2 (40%) | 0 (0%) | 9 (27.3%) | 2 (15.4%) | 3 (37.5%) | 1 (25%) | 0 (0%) | 14 (24.5%) | 3 (15.8%) | 6 (46.2%) | 3 (33.3%) | 0 (0%) |
| Both Urea & Creatinine | 2 (8.3%) | 1 (16.7%) | 3 (60%) | 1 (20%) | 0 (0%) | 6 (18.2%) | 1 (7.7%) | 2 (25%) | 1 (25%) | 0 (0%) | 8 (14%) | 2 (10.5%) | 5 (38.5%) | 2 (22.2%) | 0 (0%) |
| proteinuria | 1 (4.2%) | 0 (0%) | 1 (20%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 1 (1.8%) | 0 (0%) | 1 (7.7%) | 0 (0%) | 0 (0%) |
| Glucosuria | 2 (8.2%) | 0 (0%) | 1 (20%) | 0 (0%) | 0 (0%) | 1 (3.0%) | 1 (7.7%) | 0 (0%) | 1 (25%) | 0 (0%) | 3 (5.3%) | 1 (5.3%) | 1 (7.7%) | 1 (11.1%) | 0 (0%) |
| Proteinuria & Glucosuria | 0 (0%) | 0 (0%) | 1 (20%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 1 (7.7%) | 0 (0%) | 0 (0%) |

E.coli – Escherichia coli

Staph- Staphylococcus

DISCUSSION

Urinary tract infection (UTI) in the community hygiene practice poses a very serious problem. The knowledge of biochemical and microbiology profile of UTI caused by microorganisms is vital for defining the empirical treatment.

In this study, females are infected most (60%) than the males (40%). This finding is similar to study carried out by [6] (55.1% females and 34.6% males) and by [7] and [8]. Other studies by [9, 10] also reported similar findings. The differences in proportion of UTI between females and males as reported by various studies could be due to the anatomical differences in female genitals and that of males. It could also be as result of consequence of contraceptives commonly used by females. The genital environment in females which is in

most times wetter than that of the males could provide conducive environment for microbial growth than in the males [6].

In this study, *E. coli* was found to be the predominant (57%) cause of UTI followed by *Staphylococcus* (19%), *Klebsiella* (13%), *Proteus* (9%) and the least is *Candida* (2%). This finding is in agreement with studies of [8, 11, 12] where *E. coli* was responsible for most cases of UTI. The finding was also similar to report of [13] where *E. coli* was the predominant (45.2%) cause of UTI followed by *Klebsiella* (25%), *P. aeruginosa* (12.5%), *Proteus vulgaris* (7.7%) and *S. aureus* (3.8%). However, this finding was in contradiction with study reported by [6] where *Klebsiella* had the highest frequency followed by *E. coli*, *S. aureus*.

This study also showed that higher percentage of patients both female and males isolated with *E. coli*, *Klebsiella*, *proteus* and *staph* have both serum urea and creatinine levels elevated. This could possibly be due to effect of UTI on kidney as in pyelonephritis. However, this study also showed that 4.2% and 20% of males isolated with *E. coli* and *Klebsiella* respectively have proteinuria. This could also be due to consequence of the infection on the kidney and/ or the bladder.

CONCLUSION

This study shows elevated renal biochemical parameters among the subjects with UTI. UTIs are one of the most common types of infection and are a significant cause of morbidity in infant boys, older men and female of all ages. Serious sequel includes pyelonephritis with sepsis, renal damage as evidenced by this study.

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