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Bacterial Urinary Tract Infection in Renal Transplant Patients and their Susceptibility to Antibiotics in Ahmed Gasim Hospital Khartoum North

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Abstract: *This study aimed to determine the bacterial causative agent that cause urinary tract infection after renal transplantation and to determine the appropriate treatment for it, in prospective cross-sectional hospital based study which was conducted in Ahmed Gasim hospital, A total of 100 patients clinically suspected of having UTI after renal transplantation were included, They were made of 60 females and 40 males, Urine samples were collected and cultured to identify bacteria and antibiotic susceptibility was done. The result showed that out of the total collected samples sixty-five (65%) specimens gave growth while thirty-five (35%) specimens gave no growth. (66.6%) of female samples and (62.5%) of male samples showed positive growth. The majority of patients (41.5%) were over 60 years old. Escherichia coli was the most common isolate representing 35 (53.80%) followed by Enterococcus faecalis representing 10 (15.40%), Pseudomonas aeruginosa representing 9 (13.80%), Staphylococcus aureus representing 7 (10.80%), Klebsiella pneumoniae representing 2 (3.10%) and Proteus mirabilis representing 2 (3.10%). Isolated microorganism showed varied sensitivity to most used antibiotics.*

Keywords— urinary tract infection, renal transplantation, *Escherichia coli*

1. INTRODUCTION

A urinary tract infection (UTI) is an infection of one or more elements of the urinary system (kidneys, ureters, bladder, and urethra). UTIs are the most prevalent type of bacterial infection and can occur at any age. Bacteria that proliferate at the entrance of the urethra and move up to the bladder are responsible for over 95 percent of UTIs. Cystitis is a medical term for a bladder infection. The ailment "pyelonephritis" occurs when a bacterial infection spreads to the kidneys and ureters. Cystitis is a kind of urinary tract infection that occurs in the lower urinary tract. Pyelonephritis is a significantly more dangerous kind of upper urinary tract infection [1].

Urinary tract infections can cause the following symptoms:
-A strong desire to pee regularly, even after the bladder has been emptied

When urinating, there is a painful burning feeling.

-Anxiety, pressure, or bloating in the lower abdomen.

-Pain in the pelvis or back region.

-Urine that is cloudy or red, with a strong odour [2]

The number of patients with end-stage renal disease (ESRD) and the number of facilities offering therapy modalities such as haemodialysis, peritoneal dialysis, and kidney transplantation has increased dramatically in recent years [3].

Renal transplantation is the preferred therapy for people suffering from chronic renal insufficiency due to the majority of reasons [4]. Urinary tract infections (UTIs) are a common post-renal transplant complication, and they are the most prevalent infection among renal transplant recipients (RTRs) [5, 6]. During the first year following transplantation, more than 80% of RTRs have at least one incident of infection [7]. Furthermore, bacterial septicaemia caused by UTIs in the first month after transplantation is a significant source of morbidity and death [8], [9], [10].

Renal transplant recipients are often immunocompromised, putting them at increased risk of infection [11], [12].

Microbial infections are a major barrier to successful organ transplantation, causing significant morbidity and death in

transplant patients. Infections in kidney transplant recipients account for 26% of all inpatient days and 40% of all deaths [13].

Rational

Urinary tract infection (UTI) is the single most common bacterial infection among renal transplant recipients, and it continues to be a severe concern despite significant breakthroughs in renal transplant methods and procedures. Bacterial infection is the leading cause of kidney transplant failure in the early post-transplantation interval. Nosocomial septicaemia arises in renal transplantation patients as a result of UTIs. In addition, at least 10 patients every month undergo kidney transplants surgery at Ahmed Gasim Hospital. As a result, this study was carried out to identify the bacterial causative agents of urinary tract infection after kidney transplantation and the suitable antibiotic to be utilized.

2. MTHODOLOGY

The purpose of this paper was to investigate the bacteria that cause urinary tract infection in renal transplant patients, to isolate and identify the causative agents that cause urinary tract infection in renal transplant patients, and to determine the susceptibility of the causative agents to commonly used antibiotics in Ahmed Gasim Hospital.
It is a descriptive cross-sectional hospital-based research that was done in Sudan from February 2014 to June 2014 at Ahmed Gasim Hospital as a representative of Khartoum State.

2.1 Collection of specimens

The total samples collected were 100 urine samples from patients clinically suspected of having urinary tract infection after renal transplantation at Ahmed Gasim hospital were included. They were made of 60 females and 40 males.

2.3 Sampling & samples processing

Collection and processing of urine samples was carried out in Ahmed Gasim hospital. The identification & antibiotic susceptibility testing were done in the Microbiology Laboratory in University of Medical Sciences & Technology. These culture media: Blood agar, Cysteine lactose electrolyte deficiency (CLED) agar, MacConkey agar, Mannitol salt agar, Mueller Hinton agar, and Nutrient agar has been used for culturing of bacteria.
DNAse agar, Glucose phosphate, peptone water, Kligler iron agar (KIA), Peptone water contain tryptophan, Simmon's citrate agar contains Bromothymol blue (as indicator) and Urea agar contain phenol red (as indicator) has been used for biochemical tests [14].
The disc diffusion method (Kirby-technique) Bauer's was used to perform antibiotic sensitivity testing on commercially available discs (HiMedia, India), and the findings were documented in accordance with the manufacturer's instructions. According to the medicine of choice for urinary tract infections, these test disks comprised the following: Amoxyclav, Cefotaxime, nitrofurantoin, Ciprofloxacin, Doxycycline Hydrochloride, Gentamicin, Imipenem, and Norfloxacin.

2.4 Inclusion criteria

Samples were collected from hospitalized patients that clinically suspected having urinary tract infection.

2.5 Exclusion criteria

-Urine samples of non-hospitalized patients.
-Any urine samples collected after antibiotic treatment.

3. Results

A total of 100 urine samples were collected from renal transplant patients of both genders and age group from 30 to over 60 years. Out of the total collected samples 65 (65%) specimens gave growth while 35 (35%) specimens gave no growth (table 3-1, figure 3-1).

Table (3-1): Frequency of specimens gave growth from the total collected samples

	Growth	NO Growth
Percentage	65%	**35%**
Sample No.	65	**35**

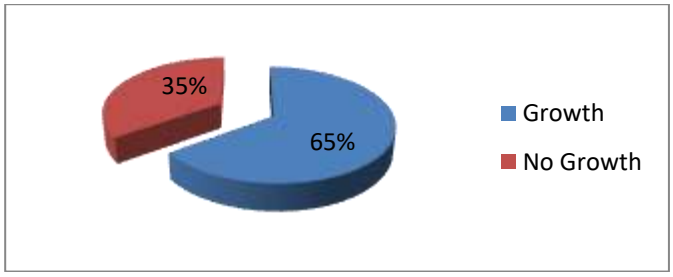

Fig (3-1): Frequency of specimens gave growth from the total collected samples

Out of 60 female samples they were 40 (66.6%) samples showed positive growth, were 20 (33.4%) samples showed no growth (Table 3-2, Figure 3-2).

Table (3-2): Frequency of specimens gave growth from the collected female samples

	Growth	NO Growth
Percentage	**66.6%**	**33.4%**
Sample No.	**40**	**20**

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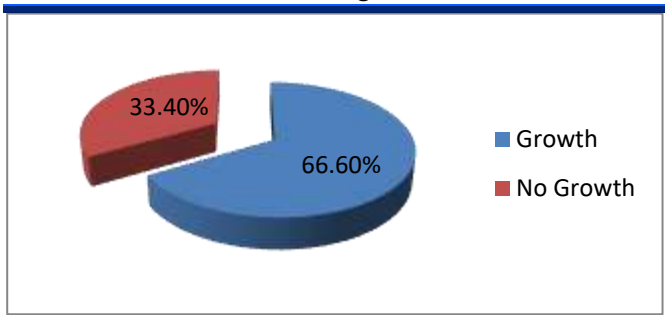

Figure (3-2): Frequency of specimens gave growth from the collected female samples

Out of 40 male samples they were 25 (62.5%) samples showed positive growth, were 15 (37.5%) showed no growth (Table 3-3, Figure 3-3).

Table 3-3: Frequency of specimens gave growth from the collected male samples

	Growth	NO Growth
Percentage	**62.5%**	**37.5%**
Sample No.	**25**	**15**

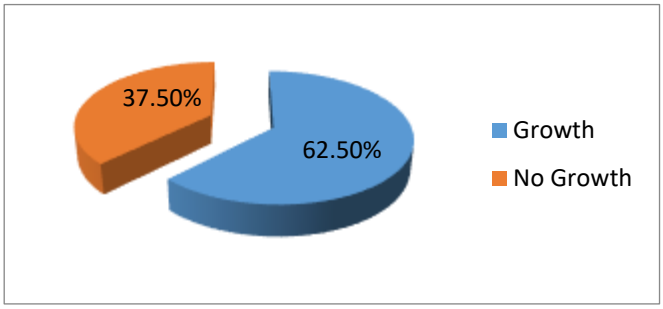

Figure (3-3): Frequency of specimens gave growth from the collected male samples

Patients who showed a positive growth were distributed into 4 groups according to their ages. 9 patients who comprise (13.8%) fall in the age group between 30 to 40 years old, 12 (18.8%) fall in the age group between 40 to 50 years old, 17 (26.1%) fall in the age group between 50 to 60 years, while the majority (41.5%) were over the 60 years old as shown in table (3-4).

Table (3-4): distribution of age groups among patients with positive growth

Age	No. of patients	Percentage
30-40	**9**	**13.8%**
41-50	**12**	**18.8%**
51-60	**17**	**26.1%**
Over 60	**27**	**41.5%**

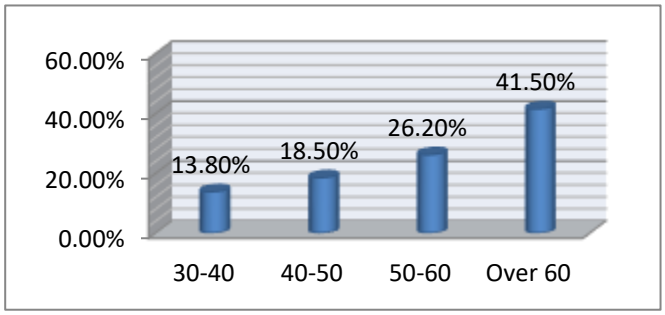

Fig (3-4): distribution of age groups among patients with positive growth

The biochemical tests were carried out to identify the positive growth samples and 6 organisms were identified: *Escherichia coli* was the most common isolate representing 35 (53.80%) followed by *Enterococcus faecalis* 10 (15.40%), *Pseudomonas aeroginosa* 9 (13.80%), *Staphylococcus aureus* 7 (10.80%), *Klebsiella pneumonia* 2 (3.10%) and *Proteus mirabilis* (3.10%) as shown in figure (3-5)

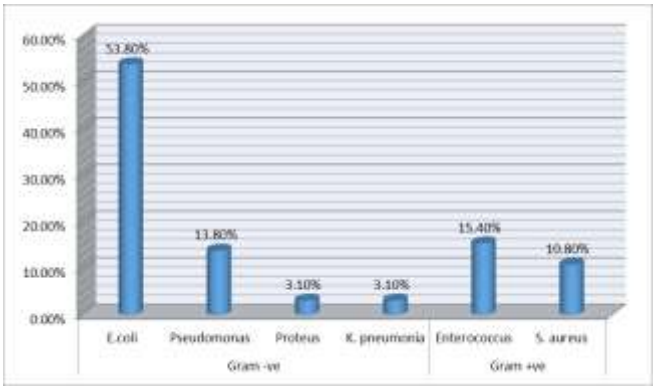

Fig (3-5): Frequency of the isolated microorganisms among study samples

The sensitivity and resistance of the isolated bacteria to different antibiotics were assessed in this study and the results showed in table (3-5) and it revealed that 44.4% of isolated *Pseudomonas*, 71.4 % of isolated *S. aureus*, 94.2% of isolated *E. coli*, and all isolated *Proteus*, *K. pneumonia* and *Enterococcus. Fecalis* were sensitive to Amoxyclav while the rest were resistant.

Cefotaxime showed that 57.2% of isolated *E. coli*, 77.8% of isolated *Pseudomonas*, 50.0 % of isolated *Proteus*, 30.0% of isolated *Entero. Fecalis*, 57.1 % of *S. aureus* and none of isolated *K. pneumonia* were resistant to cefotaxime, while the rest showed to be sensitive.

Ciprofloxacin showed that 34.3% of isolated *E. coli*, 66.7% of isolated *Pseudomonas*, none of isolated *Proteus* and *K. pneumonia*, 40.0 % of isolated Entero. *Fecalis* and 42.9 % of isolated *S. aureus* were resistant while the rest isolates were sensitive.

Doxycycline hydrochloride showed that 74.3% of isolated *E. coli*, all the isolated *Pseudomonas*, none of isolated *Proteus* and *K. pneumonia*, 30.0 % of isolated Entero. *Fecalis* and 14.3 % of isolated *S. aureus* were resistant while the rest isolates were sensitive.

Gentamicin showed that 14.3% of isolated *E. coli*, 66.7%b of the isolated *Pseudomonas*, none of isolated *Proteus*, 50% of *K. pneumonia*, 20.0 % of isolated Entero. *Fecalis* and 14.3 % of isolated *S. aureus* were resistant while the rest isolates were sensitive.

Iminpenem showed that none of the isolated *E. coli*, 11.1% of the isolated *Pseudomonas*, none of isolated *Proteus, K. pneumonia*, Entero. *Fecalis* and the isolated *S. aureus* were resistant while the rest isolates were sensitive.

Nitrofurantion showed that 14.3% of isolated *E.coli*, 22.2 % of *Pseudomonas*, 50.0 % of *Proteus*, *K. pneumonia*, and Entero. *Fecalis*, and 28.6 % of the isolated S. *aureus* were resistant while the rest were sensitive to this antibiotic.

Antibiotic discs		***E.coli*** **N=35**	***Pseudomonas*** **N=9**	***Proteus*** **N=2**	***K.pneumonia*N=2**	***Entero. Fecalis*** **N=10**	***S. aureus*** **N=7**
Amoxyclav (30 mcg)	S	**33 (94.2%)**	**4 (44.4%)**	**2 (100%)**	**2 (100%)**	**10 (100%)**	**5 (71.4 %)**
	R	**2 (5.8%)**	**5 (55.6%)**	**0 (0.0%)**	**0 (0.0%)**	**0 (0.0%)**	**2 (28.6 %)**
Cefotaxime (30 mcg)	S	**15 (42.8%)**	**2 (22.2%)**	**1 (50.0%)**	**2 (100%)**	**7 (70.0 %)**	**3 (42.6 %)**
	R	**20 (57.2%)**	**7 (77.8%)**	**1 (50.0 %)**	**0 (0.0 %)**	**3 (30.0 %)**	**4 (57.1 %)**
Ciprofloxacin (5 mcg)	S	**23 (65.7%)**	**3 (33.3%)**	**2 (100%)**	**2 (100%)**	**6 (60.0 %)**	**4 (57.1 %)**
	R	**12 (34.3%)**	**6 (66.7%)**	**0 (0.0%)**	**0 (0.0%)**	**4 (40.0 %)**	**3 (42.9 %)**
Doxycycline Hydrochloride (30 mcg)	S	**9 (25.7%)**	**0 (0.0%)**	**2 (100%)**	**2 (100%)**	**7 (70.0 %)**	**6 (85.7 %)**
	R	**26 (74.3%)**	**9 (100%)**	**0 (0.0%)**	**0 (0.0%)**	**3 (30.0 %)**	**1 (14.3 %)**
Gentamicin (10 mcg)	S	**30 (85.7%)**	**3 (33.3%)**	**2 (100%)**	**1 (50.0 %)**	**8 (80.0 %)**	**6 (85.7 %)**
	R	**5 (14.3%)**	**6 (66.7%)**	**0 (0.0%)**	**1 (50.0 %)**	**2 (20 %)**	**1 (14.3 %)**
Imipenem (10 mcg)	S	**35 (100%)**	**8 (88.9 %)**	**2 (100%)**	**2 (100%)**	**10 (100%)**	**7 (100%)**
	R	**0 (0.0%)**	**1 (11.1 %)**	**0 (0.0%)**	**0 (0.0%)**	**0 (0.0%)**	**0 (0.0%)**
Nitrofurantoin (300 mcg)	S	**30 (85.7%)**	**7 (77.8 %)**	**1 (50.0 %)**	**1 (50.0 %)**	**5 (50.0 %)**	**5 (71.4 %)**
	R	**5 (14.3%)**	**2 (22.2 %)**	**1 (50.0 %)**	**1 (50.0 %)**	**5 (50.0 %)**	**2 (28.6 %)**
Norfloxacin (10 mcg)	S	**16 (45.7%)**	**3 (33.3 %)**	**1 (50.0 %)**	**1 (50.0 %)**	**5 (50.0 %)**	**4 (57.1 %)**
	R	**19 (54.3%)**	**6 (66.7 %)**	**1 (50.0 %)**	**1 (50.0 %)**	**5 (50.0 %)**	**3 (42.9 %)**

Finally, Norfloxacin showed that 54.3% of *E. coli*, 66.7 % of *Pseudomonas*, 50 % of *Proteus, K. pneumonia*, and *Entero. Fecalis*, and almost 43 % of isolated *S. aureus* were resistant to Norfloxacin while the rest isolates were sensitive.

4. Discussion

Urinary tract infection (UTI) is the most common bacterial infection among renal transplant recipients, and it continues to be a serious concern despite significant breakthroughs in renal transplant methodology and practice, the main reason for the failure of kidney transplantation in the early post transplantation period is bacterial infection, Specifically, Nosocomial septicemia occurs in renal transplantation patients due to UTIs. Therefore, this research was carried out to determine the bacterial causative agent's that cause urinary tract infection after renal transplantation and to determine the appropriate treatment for it.

The current study showed that almost two thirds of collected specimens gave growth which indicates the high prevalence of UTI among kidney transplanted patients.

Many variables influence the occurrence of UTIs, including age, female gender, kidney function, co-morbidity, type and quantity of immunosuppression, urological instrumentation, and/or the follow-up time (short or long term) following kidney donation. UTI might have a negative impact on transplant and patient survival. A considerable proportion of kidney transplant recipients who get UTIs may develop acute pyelonephritis (APN), which is an independent risk factor for graft function decline. Because of immunosuppression, renal transplant patients with UTIs are frequently clinically asymptomatic. UTI, on the other hand, can lead to APN (especially in the early post-transplant period), bacteraemia, and the full-blown image of urosepsis [15].

Our results showed that 66.6% of female samples and 62.5% showed a positive growth which indicated that no differences between different genders in acquiring UTI.

Our findings disagreed with a study done by Roberto Rivera-Sanchez et al, who stated that Female patients were more susceptible than male ($p < 0.042$) [16].

Another study conducted in Iran 2013 by Pourmand R. M. *et al* stated that the majority of diagnosed UTIs were in female patients (73.3% vs. 26.7%; *p*-value = 0.003) [17].

Also our findings somehow disagreed with Barbouch S. and his colleagues who stated that when patients with UTIs were compared with those without UTIs, female gender was the only independent risk factor ($P = 0.007$) [18].

Our study demonstrated that the majority of UTI patients (41.5%) were more than 60 years old followed by the age group between 50 and 60 years old. These findings suggest that UTI more frequently observed among elder patients and this can be due to decrease the efficacy of the immune system.

Our findings corresponded with those of Alkatheri M., who did a study in Saudi Arabia in 2013 and found that the problem of UTIs in RTRs is serious, and that gender and old age are potential risk factors. The participants had an average age of 41.316.22 years. Gender (69.2% of female RTRs developed UTI against 30.8 % of men) and age (66.7 % of RTRs? 50 years experienced UTI) appeared to be risk factors for post-renal transplant UTIs [19].

This study revealed that the most frequent microorganisms isolated from transplanted patients were *Escherichia coli*, followed by *Enterococcus faecalis, Pseudomonas aeruginosa, Staphylococcus aureus, Klebsiella pneumonia*, and the minority was *Proteus mirabilis.*

These findings agreed with a study conducted in Iran in 2008, stated that *E.coli* was the most common isolate, followed by *K.pneumoniea*, *Pseudomonas aeruginosa*, *Proteus mirabilis*, *Citrobacter freundii* and *Staphlococcus aureus* [20].

Another study conducted in Pakistan; stated that *E. coli* was found in 51% of patients and *Pseudomonas* in 18% [21].

Our findings corresponded with those of Alkatheri M., who did a study in Saudi Arabia in 2013 and found that the problem of UTIs in RTRs is serious, and that gender and old age are potential risk factors. The participants had an average age of 41.316.22 years. Gender (69.2% of female RTRs developed UTI against 30.8 % of men) and age (66.7 % of RTRs? 50 years experienced UTI) appeared to be risk factors for post-renal transplant UTIs [19].

The current study aimed to test antibiotic susceptibility patterns of isolated microorganism and it revealed that most of isolated E. coli was sensitive to Amoxyclav, Cefotaxime, ciprofloxacin, Gentamicin, Imipene, and Nitrofurantoin, and resistant to Cefotaxime, Doxycycline Hydrochloride, and Norfloxacin. Also the current study showed that majority of isolated Pseudomonas was resistant to all antibiotics except Imipenem and Nitrofurantoin. Most of isolated Enterococcus fecalis showed to be sensitive to all types of antibiotics and most of isolated Staphylococcus aureus showed to be resistant to Cefotaxime. Majority of Proteus and K. pneumonia for some extent showed to be sensitive to most types of used antibiotics.

The multidrug resistance microorganisms can be the most cause of UTI among RTR.

Shirazi M. H. and colleagues discovered that all Proteus spp, Pseudomonas spp, Klebsiella spp, and Enterococcus spp were resistant to the majority of antibiotics tested, suggesting that these multiresistant bacteria are the leading cause of UTI in renal transplant recipients. [23]

According to another study, ciprofloxacin resistance was 22% and ampicillin resistance was 33%. Aztreonam, trimethoprim-sulfamethoxazole, netilmicin, and fosfomycin were the available therapeutic choices. A vancomycin-sensitive multiresistant Enterococcus was isolated. The research was carried out in Mexico in 2010 [22].

Another investigation discovered that the isolates were resistant to TMP/SMX and piperacillin, but sensitive to imipenem. [17]

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