

# Frequency of urinary tract bacterial infection and their susceptibility patterns among hemodialysis patients in Zliten hospital

## Abstract

Urinary tract infection (UTI) caused by microorganisms such as bacteria, virus, fungus, and parasites that affects upper or lower urinary tract. Renal failure or renal insufficiency is a medical condition in which the kidney fails to adequately filter waste product from the blood.

In a study of 103 patients, the target group was dialysis patients who attended regularly to kidney dialysis unit, at Zliten Teaching Hospital in Libya. During the period of study from March to June 2015 were representing the study population. The results showed that the highest rate of UTI among the hemodialysis was observed among the age group 56-65(52.4%). Result showed also UTI was highest in dialysis patients how have diabetes (53.8%). The susceptibility pattern of isolated showed that the Gram negative isolates were most sensitive to meropenem (100%), followed by amikacin (91.7%) and imipenem (91.7%). However, in the Gram positive isolates showed high sensitivity to (100%) to nitrofurantoin, deptomycin, and linezolid followed by teicoplanin (90.5%). The result also showed resistance marker among isolated bacteria was BALCT (42.4 %), MRS (36.4 %), STAIML (11.6%), ALTER (6.1%), HLGR (3.0%), ESBL (3.0%).

**Keywords:** urinary tract infection, frequency, bacterial infection, susceptibility patterns, hemodialysis patients, Zliten hospital

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## Introduction

Urinary tract infection (UTI) is the microbial invasion of any of the tissues of the urinary tract extending from the renal cortex to the urethral meatus. Urinary tract includes the organs that collect and store urine and release it from the body and these organs include the kidneys, ureters, bladder, urethra and accessory structures. Urine formed in the kidney is a sterile fluid that serves as a good culture medium for the proliferation of bacteria.<sup>1</sup>

Lower urinary tract known as a simple cystitis (a bladder infection) and when it affects the upper urinary tract, it is known as pyelonephritis (a kidney infection).<sup>2</sup>

There are several factors that affect the clinical manifestation of UTIs e.g., it depends on the severity of the infection, part of the urinary tract affected, the etiologic organism and patient's ability to mount a strong immune response. Common symptoms are fever, urinary urgency, chills, dysuria and cloudy urine, UTIs in children are more severe because they are more likely to damage the kidneys. Among children, poor urine control and bed-wetting during the day are common signs.<sup>3</sup>

Urinary tract infection may involve only the lower urinary tract or both the upper and the lower tracts. The term cystitis has been used to describe the syndrome involving dysuria, frequency, and occasionally suprapubic tenderness.

Acute pyelonephritis describes the clinical syndrome characterized by flank pain or tenderness, or both, and fever, often associated with dysuria, urgency.<sup>4</sup> UTI more common in pregnant than in the non-pregnant women. This was because, during pregnancy, there is a change in urine chemical composition with an increase in glucose and amino acids and physiologic changes associated with pregnancy and

the shorter urethra in women that allows bacteria quicker access to reach the bladder, which facilitate bacterial growth in urine.<sup>5</sup> UTI is a common infection observed in diabetic patients. Diabetes mellitus (DM) alters the genitourinary system where UTI can be a cause of severe complications ranging from dysuria (pain or burning sensation during Urination) organ damage and sometimes even death due to complicated UTI (pyelonephritis). UTI is more widespread in women with DM than in non-diabetic women as a consequence of a debilitated immune system.<sup>6</sup>

Bacteria are considered as the most common cause of lower and upper urinary tract infections. *Escherichia coli* the bacteria infecting half of the patients regardless of sex. *Escherichia coli* is the most infective bacteria in UTI patients.<sup>7</sup> *Klebsiella*, *Staphylococci*, *Enterobacter*, *Proteus*, *Pseudomonas*, and *Enterococci* species are more often isolated from inpatients. *Corynebacterium urealyticum* has been recognized as an important nosocomial pathogen. Anaerobic organisms are rarely pathogens in the urinary tract Coagulase negative *Staphylococci* are a common cause of urinary tract infection *Staphylococci saprophyticus* tends to cause infection in young women of a sexually active age.<sup>4</sup>

In this study, we found that *Escherichia coli* was the bacteria infecting half of the patients regardless of sex. Since *Escherichia coli* is the most infective bacteria in UTI patients.

## Materials and methods

### Study population

The dialysis patients who attended regularly to kidney dialysis unit, at Zliten Teaching Hospital during the study period from March to June 2015 were representing the study population.

### Inclusion criteria

Dialysis patients suspected having urinary tract infection.

### Exclusion criteria

Dialysis patients who do not suspected urinary tract infection.

### Data collection

Information related to study such as age, gender, frequency of dialysis per week, were collected using unstructured questioner.

### Sample size

One hundred and three dialysis patients were agreed to participate in this study.

### Collection of specimens

As pathogens accumulate in the patient's bladder overnight, the first mid-stream morning voided urine samples were collected or first morning in sterile container.

### Examination of bacterial growth

The primary culture which showed significant growth was subjected for identification and susceptibility test. The culture growth was interpreted as significant when  $\geq 10^4$  CFU/ml was present. Culture with less than  $\geq 10^4$  CFU/ml considered contamination; culture with no growth considered negative.

## Results

The present study aimed to detect the frequency of UTI and susceptibility patterns of bacterial isolates among dialysis patients who were attending Zliten dialysis center during the study period, 103 out of 145 patients registered in this center are agree to participate in this study.

Results in Table 1 show that the frequency of demographic factors among study population; the male to female ratio was almost similar 1.00:1.02, most of the patient 25(24.3%) and 21(20.4%) belong to age group (36-45), (56-65) and (26-35) years, respectively, 101(98%) and 2(2.0%) of the patients had three times and two times dialysis per week respectively whereas no patient had once dialysis per week. The present study showed that all the study group 103(100%) had chronic infections; the most dominant cause was hypertension 71(69.0%) followed by diabetes mellitus 13(12.6%) and other chronic disease 19(18.4%) such as glomerular disease, poly cystic disease, a hereditary disease.

The frequency of UTI among dialysis patients was 33 (32.3%); eight different bacterial species were isolated, the most dominant causative agent of UTI was *Staphylococcus haemolyticus* 8(24.2%) and *E. coli* 8(24.2%) followed by *Enterococcus faecalis* 6(18.2%) and *Staphylococcus epidermis* 5(15.2%) Table 2.

The present study showed that the UTI among male 20(39.2%) was higher than the UTI among female 13(25%) Table 3, the highest rate of UTI was observed among the age group 56-65 followed by age group >65 and 46-55 years, it was 11(52.4%), 5(41.7%) and 5(35.7%) respectively.

Most patients in this study were dialysis 3 times a week. Diabetic Patients show more UTI 53.8% than hypertension patient 29.6% Table 3.

**Table 1** Risk factor of UTI among hemodialysis patient

Factor	Frequency	Percentage	
Sex	Male	51	49.5
	Female	52	50.5
	Total	103	100
Age group	15-25 Years	10	9.7
	26-35 Years	21	20.4
	36-45 Years	25	24.3
	46-55 Years	14	13.6
	56-65 Years	21	20.4
	>65 Years	12	11.6
Total	103	100	
Frequency of dialysis	Twice	2	2
	Three time	101	98
	Total	103	100
Cause of R.F	Other Chronic Disease	19	18.4
	Hypertension	71	69
	Diabetes Mellitus	13	12.6
	Total	103	100

**Table 2** Type and frequency of isolated bacterial from hemodialysis patients

Isolated bacteria	Frequency	%
<i>Staphylococcus haemolyticus</i>	8	24.2
<i>Escherichia coli</i>	8	24.2
<i>Enterococcus faecalis</i>	6	18.2
<i>Staphylococcus epidermidis</i>	5	15.2
<i>Klebsiella pneumonia</i>	3	9
<i>Staphylococcus aureus</i>	1	3
<i>Streptococcus agalactiae</i>	1	3
<i>Proteus vulgaris</i>	1	3
<b>Total</b>	<b>33</b>	<b>100</b>

The study showed that the Gram negative isolates were most sensitive to meropenem 12/12(100%), followed by amikacin, imipenem, piperacillin tazobactam where they showed 11/12(91.7%), 11/12(91.7%), 8/12(83.3%), 8/12(83.3%) respectively, the Gram negative isolates showed low response to ampicillin 2/12(16.7%), and cefuroxime, azetronam, trimethoprim-sulfamethoxazole, ertapenem and ceftazidime they showed 5/12(41.7%), 5/12(41.7%), 5/12(41.7%), 5/12(41.7%), (66.7%) and (66.7%) respectively and intermediate response to the rest of used antibiotics (Table 3). The study showed that the Gram positive isolates showed highly sensitive 21/21(100%) to nitrofurantoin, debrinone, and linezolid followed by teicoplanin 19/21(90.5%) and showed low response to ceftazidime 2/21(9.5%), the cefotaxime, imipenem and oxacillin showed 3/21(14.3%), erythromycin and ampicillin showed 6/21(28.6%) and amoxicillin-clavulanae 7/21 (33.3%) and penicillin G 8/21 (38.0%).

**Table 3** Frequency of UTI and resistance markers among hemodialysis patients based type of chronic disease

Characteristics	Frequency	Results of culture				Resistance Markers				
		Growth		Non- growth		FOUND		NON		
		Frequency	%	Frequency	%	Frequency	%	Frequency	%	
Cause of R.F	Other Chronic Disease	19	5	26.3	14	73.7	2	40	3	60
	Hypertension	71	21	29.6	50	70.4	12	57.1	9	42.9
	Diabetes Mellitus	13	7	53.8	6	46.2	4	57.1	3	42.9
	<b>Total</b>	<b>103</b>	<b>33</b>	<b>32</b>	<b>70</b>	<b>68</b>	<b>18</b>	<b>54.5</b>	<b>15</b>	<b>45.5</b>

In the present study six different types of resistant markers were detected among the isolated uro-pathogens and repeated 33 times; BALCT 14(42.4%), MRS 12(36.4%), STAIML 3(9.0%), ALERT1 2(6.0%) HLGR 1(3.0%) and ESBL 1(3.0%); the *Staphylococcus spp.* showed high degree of resistance, the resistant markers detected 29(87.9%) time among *Staphylococcus spp.*; *Staphylococcus haemolyticus* 16(48.5%), *Staphylococcus epidermidis* 11(33.3%) and *Staphylococcus aureus* 2(6.0%) Table 4.

Table 5 showed the statistical analysis and correlation between demographic factors and UTI among hemodialysis patients, the analysis indicated that there were no association between the UTI and sex, frequency of dialysis per week and chronic disease as P value was  $\geq 0.05$ . Statistically significant relation was observed between age group 26–35, 56–65 Years and UTI hemodialysis patients as the P value showed 0.010 and 0.026 respectively.

**Table 4** Frequency of resistance markers among bacteria isolated from urine of hemodialysis patients

Isolated bacteria	Resistance Markers							Frequency	%
	BALCT	MRS	STAIML	ALERT	HLGR	ESBL			
<i>Staphylococcus haemolyticus</i>	8	7	1	0	0	0	16	48.5	
<i>Escherichia coli</i>	0	0	0	0	0	1	1	3	
<i>Enterococcus faecalis</i>	0	0	0	0	1	0	1	3	
<i>Staphylococcus epidermidis</i>	5	5	1	0	0	0	11	33.3	
<i>Klebsiella pneumonia</i>	0	0	0	2	0	0	2	6.1	
<i>Staphylococcus aureus</i>	1	0	1	0	0	0	2	6.1	
<i>Streptococcus agalactiae</i>	0	0	0	0	0	0	0	0	
<i>Proteus vulgaris</i>	0	0	0	0	0	0	0	0	
Total	14	12	3	2	1	1	33		
Percentage %	42.4	36.4	9.1	6.1	3	3	100		

**Table 5** Statistical relationship between the demographic factors and UTI among hemodialysis patient using chi square

Factors	Frequency and Percentage	P-Value
<b>Sex</b>	Male	51(39.2%)
	Female	52( 25% )
<b>Age of group</b>	15-25 Years	10(30%)
	26-35 Years	21(9.5%)
	36-45 Years	25(28%)
	46-55 Years	14(35.7%)
	56-65 Years	21(52.4%)
	>65 Years	12(41.7%)
	Twice	02(50%)
<b>Frequency of dialysis /Week</b>	Three time	101(31.7%)
	Other Chronic Disease	19(26.3%)
	Hypertension	71(29.6%)
<b>Chronic disease</b>	Diabetes Mellitus	13(53.8%)
		0.072

## Discussion

UTIs are considered to be the most common bacterial infection; there are specific subpopulations that are at increased risk of UTI, including infants, pregnant women, the elderly, patients with spinal cord injuries and/ or catheters, patients with diabetes, multiple sclerosis, AIDS/ HIV and patients with underlying urologic abnormalities.<sup>8</sup>

Patients with renal impairment are at high risk of developing infection due to low immunity, severe clinical condition and need of vascular accesses for renal replacement therapy. There are few studies of patients with CKD and UTI particularly in Libya there is no authentic data showing the frequency of UTI among the hemodialysis patients, therefore the present study undertaking to follow the frequency of urinary tract bacterial infection and their susceptibility pattern among hemodialysis patients in Zliten hospital, considering that Zliten is one of the biggest city in Libya.

The study showed that all the study groups 103(100%) had chronic infections; the most dominant disease was hypertension 71(69.0%) followed by diabetes mellitus 13(12.6%), this finding in agreement with Hsiao et al.,<sup>9</sup> who stated that the hemodialysis patients may have some medical problems that cause CKD, such as diabetes mellitus (DM), uncontrolled high blood pressure and contrary to Manhal et al.,<sup>10</sup> study who stated diabetes mellitus in 51.1% and hypertension in 20% of patients on long term hemodialysis.

UTI among dialysis patients was 33 (32.3%); this result show similarity to.<sup>10</sup> Result who stated 37% as the frequency of UTI among hemodialysis patients Jaiswal et al.,<sup>11</sup> and less than Otajewo<sup>1</sup> and D'Agata et al.,<sup>12</sup> who reported 39% and 47%. This study showed that the most dominant causative agent of UTI was *Staphylococcus haemolyticus* 8(24.2%) and *E. coli* 8(24.2%) followed by *Enterococcus faecalis* 6(18.2%) and *Staphylococcus epidermidis* 5(15.2%). These results were in agreement with Shirazi et al.<sup>8</sup> and Jaiswal et al.<sup>11</sup> who concluded that the most common cause of UTI is *E. coli*; other common causes species are *Klebsiella*, *Proteus*, *Enterobacter*, *Pseudomonas*, and *Enterococcus* as well as *Staphylococcus saprophyticus*, *Staphylococcus epidermidis*, and *Candida albicans*.

The study showed that the UTI among male 20(39.2%) was higher than the UTI among female 13(25%). However, male and female show the same CKD in contrast to other study that show male is a common problem among males compared to females due to stress, alcoholism, hypertension and diabetes mellitus, also urinary stagnation, alkalization of urine and absence of flushing action, the presence of urinary tract infection (UTI) in CKD of males is higher compared to normal males,<sup>1</sup> several other studies showed the same result.<sup>13</sup>

This study revealed that the highest rate of UTI among the hemodialysis was observed among the age group 56-65 followed by age group >65 and 46-55 years, it was 11(52.4%), 5(41.7%) and 5(35.7%) respectively this finding indicated that the UTI was age dependent and it occurs often in older patients, contrary to this result Otajewo<sup>1</sup> reported inconsistency manner of UTI.

The study showed that the patients had two time dialysis per week had highest incidence of UTI 1(50%) followed by three time dialysis per week 32(31.7%), this result indicated that the UTI among the dialysis patients were increased according to the frequency of dialysis per week, this finding may owing to the status of CDK where more dialysis per week indicated low immunity and therefore increased

susceptibility to get infection or due to the nature of study group itself where most of the patients 101(98.1%) had three time dialysis per week versus 2(1.9%) had two time dialysis per week. Due to prolonged hemodialysis that may compromise their immune system, they are vulnerable to infection, including UTI's.<sup>14</sup>

The present study showed that the UTI was highest in dialysis patients who had diabetes (53.8%) than the patients with other chronic disease. These results may be attributed to the enhance the risk for UTI in diabetics that include age, metabolic control, and long term complications, primarily diabetic nephropathy and cystopathy. The general factor showed that the patient with renal impairment are at high risk of developing infection due to prolonged hemodialysis which may compromise their immune system. Then they are more susceptible to infection, including UTIs.<sup>15</sup>

## Conclusion

This research showed that all the hemodialysis patients had a chronic disease such as hypertension and diabetes mellitus which may point out the relation between the kidney problem and these diseases. The frequency of UTI among hemodialysis patients at Zliten hemodialysis center was 33(32.3%), the commonest causative agent was *E. coli* and *Staphylococcus haemolyticus*, UTI was higher among male compared to female. The present study revealed high degree of resistance to antimicrobial agents, the resistance of bacteria causing urinary tract infection (UTI) has emerged even to more potent antimicrobial agents.

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None.

## Conflicts of interest

The authors declare there are no conflicts of interest.

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