Original Research Paper

Prevalence of Urinary Tract Infections and Associated Risk Factors Among Patients Attending Medical City Hospital in Baghdad City, Iraq

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Abstract: Urinary Tract Infections (UTIs) are the most common bacterial infection in humans and a major cause of morbidity and they are the most common cause of hospital visits worldwide. Proper knowledge in identifying factors associated with urinary tract infection may allow the intervention to easily control of the disease in a timely manner. Therefore, the purpose of the study is determining the prevalence of UTI, diagnosis of causative bacterial agents and identifying the factors associated to the urinary tract infection among patients attending Medical City Hospital in Baghdad, Iraq. A total of 237, morning mid-stream urine samples were collected aseptically and the samples were diagnosed according to the standard methods. Information about the factors related to UTI were obtained by using questionnaire. Prevalence of UTI patients attending medical city hospital in Baghdad was 63/237 (26.58%). The most prevalent bacterial uropathogen was *Escherichia coli* with 21/63 (33.33%), followed by *Klebsiella pneumoniae* 13/63 (20.63%), *Staphylococcus aureus* 10/63 (15.87%), *Enterococcus faecalis* 8/63(12.70%), *Enterobacter cloacae* 4/63(6.35%), *Pseudomonas aeruginosa* 3/63 (4.763.5%), *Proteus mirabilis* 3/63 (4.763.5%), finally 1/63 (1.59%) for Proteus vulgaris. The results showed significant relationships (P <0.05) between hospital (department), sex, age and lower abdominal or back pain with urinary tract infection. Prevalence of bacterial causing UTIs were higher in the age group 30-39 with 16/63 (25.40%) and there was a significant association between hospital (department), sex, age and lower abdominal or back pain with UTI.

Keywords: Urinary Tract Infection, Urinalysis, Bacteriuria, Risk Factors

Introduction

Urinary Tract Infection (UTI) is one of the most prevalent diseases in human beings with diverse etiological agents annually affecting 250 million people worldwide (Prakash and Saxena, 2013). They are associated with a significant morbidity and mortality in general population and impose substantial financial burden to the society. About 150 million people worldwide are affected by UTIs every year, spending about 6 billion US dollars (Djordjevic *et al.*, 2016). Infections of the urinary tract are the most frequently reported bacterial infections in the community coming second to respiratory tract infections in humans (Thass *et al.*, 2019) and occur in all ages in both men and women. However; infection is more common in women (Karki *et al.*, 2004).

Urinary tract infections may be nosocomial or community acquired. It is believed that most urinary tract infections develop and are acquired from the community. It is unclear how primary community-acquired infections occur or how they are spread, although most cases have been thought to arise sporadically (Djordjevic *et al.*, 2016). UTIs are also commonly acquired in the hospital, often due to contaminated urinary catheters. Hospital-acquired infections (known as nosocomial infections) tend to be more serious because the bacteria that cause them are often resistant to drug treatment and patients are often in poor general health (Lacovelli *et al.*, 2014). UTIs may

occur either symptomatic or asymptomatic and the symptoms are either acute or chronic and may be uncomplicated or complicated. The clinical manifestation of urinary tract infections depends on; causative agent, severity of the bacterial infection and the ability to immune response (Olowe *et al*., 2015). Clinical symptoms of UTIs include; fever, burn during urinating, suprapubic pain and formation of blisters and ulcers in the genital area. Appearance of these symptoms depend on the age and infected location in the urinary tract (Amali *et al*., 2009).

Albeit great diversity of etiological agents is attributed to UTIs, bacteria are the major causative organisms which are responsible for more than 95% of UTIs (Bonadio *et al*., 2001). Both gram negative and gram-positive bacteria is associated with UTIs. *E. coli* is the most frequent causative agent of UTIs. Other organisms reported include members of the family *Enterobacteriaceae* (i.e., *Klebsiella*, *Proteus*, *Citrobacter* and *Enterobacter* spp.), *Enterococcus species*, *Pseudomonas species*, *streptococci* and *staphylococci* (Mahato *et al*., 2018).

The relative frequencies of the pathogens vary with age, sex, catheterization and hospitalization (Getenet and Wondewosen, 2011). Although it is not always possible to trace the mode of entry of bacteria into the urinary tract, four possible routes of entry have been suggested; ascending infection; haematogenous spread; lymphogenous spread and sexual intercourse (Tibyangye *et al*., 2015).

Predisposing factors to Asymptomatic Bacteriuria (ASB) are low socioeconomic status, increasing age, multiparty, sexual behavior, urinary tract anomalies, previous treatment for UTI, other medical conditions like diabetes, sickle cell disease and immune compromised states like AIDS, spinal cord injuries and women in menopause age (Fareid, 2012). Patients with asymptomatic urinary tract bacteriuria, 25%, will develop symptomatic urinary tract infection (cystitis, pyelonephritis) than those without (Nabbugodi *et al*., 2015). Many factors such as sex, age, race, circumcision (Dias *et al*., 2010), urogenital tract abnormalities, urinary catheter (Mladenovic *et al*., 2015), infants, elderly, pregnancy and hospital (department) (Nelson and Good, 2015), are believed to increase the risk of recurrent UTIs. In recent years, there has been increased appreciation that other factors, such as Bladder and Bowel Dysfunction (BBD) and defects in innate immunity, may also be important contributors to the recurrence of UTI (Keren *et al*., 2015).

Therefore, this study was aimed to determine the prevalence of UTI, diagnosis of causative bacterial agents and identifying the factors associated to the urinary tract infection among patients attending Medical City Hospital in Baghdad, Iraq.

Methodology

Study Design and Area

A cross sectional and experimental study was carried out in medical city in Baghdad, Iraq, from DES 2018 to APR 2019.

Inclusion and Exclusion Criteria

The study included patients attending clinics, who were confirmed to have UTI signs and symptoms by the attending Clinician. All the patients with no history of antimicrobial drug administration for UTIs in the last two weeks and had consented to participate in the study.

The study excluded female patients who were in their menstruation period, patients with history of antimicrobial drug administration in the last two weeks and patients who had not consented to participate.

Sample Size and Sampling Procedure

Sample number (n) was calculated as 237 samples using the standard formula according to (Dawson and Trapp, 2004) and prevalence rate of urinary tract infection (17.8%) for the study conducted in Gonder, Ethiopia according to (Yismaw *et al*., 2012):

$$\text{Sample number (n)} = Z^2 (p)*(1-p)/d^2$$
$$= (1.96)^2 *0.178 *(1-0.178) / (0.05)^2$$
$$= 224.8$$

Considering 5% non-response rate, the final sample size was.

$$=237$$

Where:
n = Sample number
Z = Level of significance (1.96) for confidence interval of 95%
P = Prevalence
d = Margin of error of setting a significance level of 0.05 (i.e., 5%)

Data Collection and Processing

In order to identify the risk factors, interviews of all the suspected cases of UTI was performed using a structured questionnaire.

The Self-administered questionnaire and interview guide were carried out to capture demographic data, predicting factors for UTIs and counseling for specimen collection. The study subject was then sent for specimen collection and the results were kept confidential.

Collection of Samples

Two hundred and thirty-seven (237) morning mid-stream urine samples were collected from patients from

patients who attended to hospital of medical city in Baghdad in sterile bottles. Collected urine was examination within 3 h in the bacteriology laboratory of medical city hospital for diagnosis of the uropathogens and the result of the examination was added to the questionnaire. All the collected data were entered and analyzed using SPSS 20.0 version.

Isolation and Identification of Uropathogens

Diagnosis of the bacterial uropathogens was done at microbiology laboratory of medical city hospital. Each sample of midstream urine was inoculated CLED agar (Cystine Lactose Electrolyte Deficient) and incubated at 37°C for 24 h (Cheesbrough, 2009). After incubation, cultures were sub-cultured on blood agar and macConkey agar media, positive UTI was recorded upon the appearance of 100,000 Colony Forming Units (CFU) permilliliter on blood, macConkey agar (Harding *et al.*, 2002). Identification of bacteria was established based on their gram staining and cultural morphological as well as biochemical characteristics as described in the book of Cheesbrough (2009).

Data Analysis

Data were statistically analyzed using SPSS version 20 to obtain the prevalence rate of urinary tract infection, frequency of causative agents and the mean of age. UTI results were divided into presence or absence of the disease and tested against suspected factors associated with UTI to assess for associations. Where the chi-square (χ^2) and probability value (p) were calculated for the test of significance. The p-value of ≤0.05 was considered statistically significant. In addition, Odd's Ratio (OR), Confidence Interval (CI) were added to estimate the risk factors of contracting UTI.

Ethical Consideration

Consents was taken from all participants and they were informed that participation is voluntary and that they can refuse or withdrawal from the study without stating any reason.

Results

Two hundred and thirty-seven (237) urine samples were collected from all patients attending to hospital of medical city in Baghdad who suffering from UTIs. The age of the patients ranged from 2 years to 85 years and the mean of the study participants was 41.4±18.3 years. The majority of the participants in the study were females 149/237(62.86%). Most of the participation out of were married 163/237(68.77%) and rest were unmarried (Table 1).

Table 1: Associated of UTI with demographic characteristics of patients attending medical city hospital (n = 237)

Variables	Categories	Frequency	Percentage (%)	χ^2	P
Department	Inpatients	11	4.64	4.6	0.03
	Outpatients	226	95.36		
Six	Female	149	62.87	8.2	0.004
	Male	88	37.13		
Age	Mean ±*SD	41.4±18.3			
	≤ 19	31	13.08	14.1	0.003
	20-39	81	34.18		
	40-59	82	34.60		
	≥ 60	43	18.14		
Marital	Single	74	31.22	3.2	0.07
	Married	163	68.78		
Residence	Rural	41	17.30	0.3	0.8
	Suburban	82	34.60		
	Urban	114	48.10		
Level of education	Illiterate	83	35.02	3.1	0.2
	Primary education	84	35.44		
	Secondary education	70	29.54		
Occupational status	Child	5	2.11	10.9	0.05
	Employs	28	11.81		
	Farmer	31	13.08		
	Student	41	17.30		
	House sitting	53	22.36		
	Laborer	79	33.33		

* χ^2= Chi square - *p* = probability value - SD = standard deviation

Sixty-three samples 63/237(26.58%) had significant bacteriuria. Prevalence of bacterial UTIs were higher in the age group 30-39 with 16/63 (25.40%), compared to the group of more than 80 years that had the lowest value 1/63 (1.59%). (Table 2). The prevalence of UTIs were higher in females with 49/63(77.78%) compared to 14/63(22.22%) in men. Urinary Tract Infections (UTIs) are mainly caused by bacteria and the findings in this study showed that eight bacterial uropathogens were isolated from 63 midstream urine samples of which *Escherichia coli* was the most prevalent isolate 21/63 (33.33%), followed by *Klebsiella pneumoniae* 13/63

(20.63%), *Staphylococcus aureus* 10/63 (15.87%), *Enterococcus faecalis* 8/63(12.70%), *Enterobacter cloacae* 4/63(6.35%), *Pseudomonas aeruginosa* 3/63 (4.76%), *Proteus mirabilis* 3/63 (4.76%) and *Proteus vulgaris* 1/63 (1.59%) (Table 3).

The various symptoms of urinary tract infection experienced by the participants were very high in symptoms of lower abdominal or back pain (91.14%) followed by Burning micturition (81.43%) and frequency of micturition (71.31%), while they were low in symptoms of UTI previously (31.64) followed by Un-controlling of micturition (19.41%) and Presence of blood in urine (13.50%) (Fig. 1), (Table 4).

Table 2: Prevalence of urinary tract infections according to age of patients attending medical city hospital (n = 237)

Age	Positive UTI (%)		Negative UTI (%)		
	Female n,(%)	Male n,(%)	Female n,(%)	Male n,(%)	Total (%)
≤ 9	3 (4.76%)	2 (3.17%)	1 (0.57%)	2 (1.15%)	8 (3.37%)
10-19	3 (4.76%)	1 (1.59%)	12 (6.90%)	6 (3.45%)	22 (9.28%)
20-29	10 (15.87%)	1 (1.59%)	8 (4.60%)	12 (6.90%)	31 (13.08%)
30-39	15 (23.81%)	1 (1.59%)	20 (11.50%)	15 (8.62%)	51 (21.52%)
40-49	5 (7.94%)	2 (3.17%)	18 (10.34%)	13 (7.47%)	38 (16.03%)
50-59	4 (6.35%)	4 (6.35%)	19 (10.92%)	17 (9.77%)	44 (18.57%)
60-69	5 (7.94%)	1 (1.59%)	11 (6.32%)	4 (2.30%)	21 (8.86%)
70-79	4 (6.35%)	1 (1.59%)	10 (5.75%)	4 (2.30%)	19 (8.02%)
≥ 80	0 (0.00%)	1 (1.59%)	1 (0.57%)	1 (0.57%)	3 (1.27%)
Total	49 (77.78%)	14 (22.22%)	100 (57.47%)	74 (42.53%)	237 (100%)
	63 (26.58%)		174 (73.42%)		

Table 3: Prevalence of bacterial uropathogen isolates from patients attending medical city hospital (n = 237)

N0.	Uropathogens	Female (n,%)	Male (n,%)	Total (n,%)
1	*Escherichia coli*	17 (34.69%)	4 (28.57%)	21 (33.33%)
2	*Klebsiella pneumoniae*	11 (22.45%)	2 (14.29%)	13 (20.63%)
3	*Staphylococcus aureus*	5 (10.21%)	5 (35.71%)	10 (15.87%)
4	*Enterococcus faecalis*	6 (12.25%)	2 (14.29%)	8 (12.70%)
5	*Enterobacter cloacae*	4 (8.16%)	0 (0%)	4 (6.35%)
6	*Pseudomonas aeruginosa*	2 (4.08%)	1 (7.14%)	3 (4.76%)
7	*Proteus mirabilis*	3 (6.12%)	0 (0%)	3 (4.76%)
8	*Proteus vulgaris*	1 (2.04%)	0 (0%)	1 (1.59%)
Total		49 (77.78%)	14 (22.22%)	63 (100%)

Table 4: Associated of UTI with clinical characteristics of patients

Variables	Categories	Frequency	UTI (+)	UTI (-)	OR	CI	χ^2	P
Frequency of micturition	Yes	169	43	126	0.8	0.4-1.5	0.4	0.5
	No	68	20	48				
Un-controlling of micturition	Yes	46	12	34	0.9	0.5-2.01	0.007	0.9
	No	191	51	140				
Presence of blood in urine	Yes	32	7	25	0.7	0.3-1.8	0.4	0.5
	No	205	56	149				
Lower abdominal or back pain	Yes	216	53	163	0.4	0.1-0.9	5.2	0.02
	No	21	10	11				
Burning micturition	Yes	193	55	138	1.8	0.8-4.1	1.9	0.2
	No	44	8	36				
Previously of UTI	Yes	75	21	54	1.1	0.6-2.1	0.1	0.7
	No	162	42	120				
Total		237	63	174				

X^2 = Chi square – OR = Odd Ratio - *p* = probability value – CI = Confidence Interval
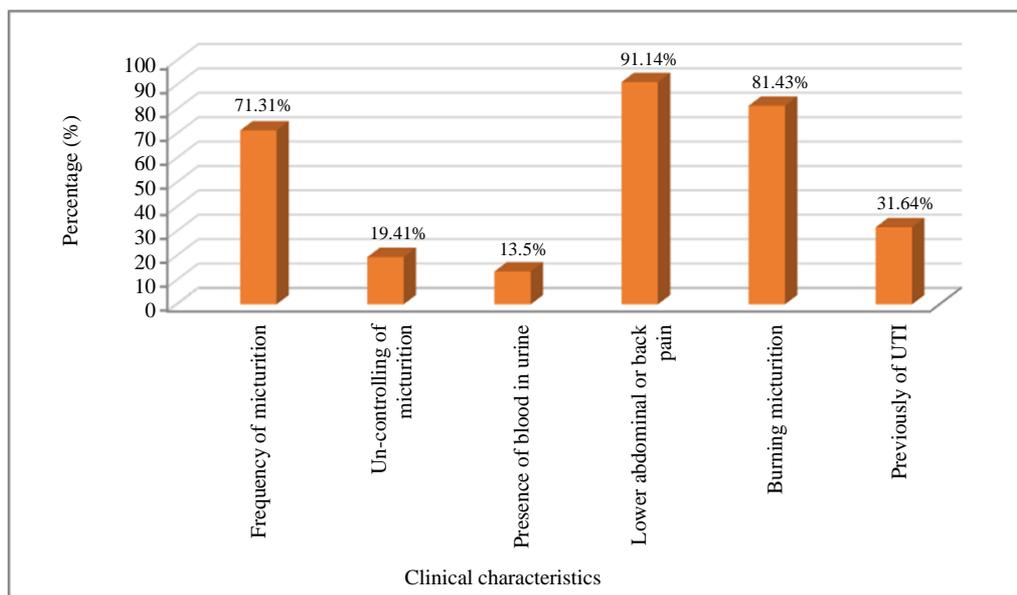
Fig. 1: Frequency of urologic symptoms among the study population

According to bivariate statistically analysis based on demographic characteristics of UTI patients, they had the following values: Hospital (department), sex and age were found to be statistically significant (p<0.05). However; Marital, Residence, Level of education and Occupational status were not statistically significantly associated with occurrence of UTI (Table 1).

While statistical analysis according to health conditions, there was only a significant association between Lower abdominal or back pain [OR-0.4, CI-(0.1-0.9), P < 0,05] with occurrence of urinary tract infection. Whereas; Burning micturition, Frequency of micturition, Un-controlling of micturition, Presence of blood in urine and Previously of UTI were not significantly associated with occurrence of UTI (Table 4).

Discussion

This study conducted to determine the prevalence rate, causative agent and factors associated with urinary tract infections in patients who attended to Medical City Hospital in Baghdad. Our analysis showed the prevalence rate of bacterial urinary tract infection was 63/237(26.58%). Similar findings have been reported in previous study conducted in Erbil city was 110/500(22%) by (Alsamarai *et al.*, 2016); in Chittagong- Bangladesh was 507/1957 (25.91%) by (Chowdhury and Parial, 2015); and in Oman 155/559(27.73%) by (Hassali *et al.*, 2018). In this study, the prevalence of UTIs was found to be higher than that previously studies occured in Saudi Arabia, 763/7154(10.67%) by (Akbar, 2001); in Ethiopia, 21/228(9.2%) by (Beyene and Tsegaye, 2011); and in Iran 553/7056(7.8%) by (Amin *et al.*, 2009).

While it was lower than a previous study; in Al-Karkh Surgery Hospital in Baghdad city, 125/311(40.19%) by (Kareem and Rasheed, 2011); and in Mulago hospital, 54/139(38.8%) according to study done by (Kabugo *et al.*, 2016). The difference in our results with other studies may be due to either a variation occured in the sample size, region, or community customs and traditions, personal hygiene level, or education level.

The highest prevalence of UTI in females was 49/63(77.78%) as compared to 14/63(22.22%) in men, the highest rate among females in the reproductive age group was 30-39(23.81%) and 20-29(15.87%). The reason behind of the high prevalence of urinary tract infection in females is the close proximity of the urethral with anus, wider and shorter urethra, sexual behavior, incontinence and less acidic pH of vaginal surface and poor hygienic conditions (Khan *et al.*, 2015). The highest rate among males was recorded in the age group 50-59(6.35%). The increased frequency of prostate diseases and diabetes in males may have a role in occurrence of urinary tract infection at this age of patients (Mahesh *et al.*, 2010). Higher prevalence of urinary tract infection in married patients 43/63(68.25%) than unmarried 20/63(31.75%). In 1990, Betsy Foxman found an association between sexual behavior and UTI (Foxman and Chi, 1990).

UTIs are caused by a variety of microorganisms, including both gram positive and gram negative ones. The Enterobacteriaceae family were the most common microorganism isolated of Urinary tract infection in present study accounting 50/63(79.37%) of total isolated bacteria and amongst them *E. coli* was the most predominant bacteria with 21/63(33.33%) followed by *Klebsiella pneumoniae* 13/63(20.63%). There are earlier

studies in agreement to present finding (Hussein *et al*., 2017; Odoki *et al*., 2019). *E. coli* can bind to the glycoconjugate receptor (Gal α 1-4 Gal) of the uroepithelial cells of human urinary tract with its unique virulence determinant, the p pilus (Gal-Gal receptor) so as to initiate the infection (Awasthi *et al*., 2015). Enterobacteriaceae possess several factors for their adhesion to uroepithelium. Such bacteria colonize the uroepithelial mucosa, with pilli, fimbriae and adhesion (Jacobsen *et al*., 2008). The highest proportion of *E. coli* in UTI in females may be due to the variety of virulence characteristics that facilitate their intestinal carriage, persistence in the vagina and then ascent and invasion of the anatomically normal urinary tract (Mahato *et al*., 2018).

The third most isolated bacterial uropathogen was *Staphylococcus aureus* with 10/63(15.87%). Studies in Southern- Ethiopia 2017 and Erbil-Iraq 2016 reported the same rates of *S. aureus* of 6/33(18.2%) and 17/112(15.17%), respectively (Nigussie and Amsalu, 2017). However, the higher rate of staphylococcus was observed in another previous study compared to our study (Awasthi *et al*., 2015). These disparities in etiologic agents could be because of the different bacterial ecology in different regions, different lifestyle, hygienic conditions, availability of education, inadequate water availability and sample size (Al-Gosha'ah *et al*., 2014). The other common isolate was *Enterococcus faecalis* 8/63(12.70%). This is also in agreement with previous study conducted in Ethiopia (Yismaw *et al*., 2012). While a low occurrence was seen with bacteria like *Enterobacter cloacae* 4/63(6.35%), *Pseudomonas aeruginosa* 3/63(4.76%), *Proteus mirabilis* 3/63(4.76%) and *Proteus vulgaris* 1/63(1.59%). Also, this result is in agreement with studies had done in France about the UTI in community, which showed that the lowest recovered pathogens were *Enterobacter spp*, *Pseudomonas aeruginosa* and *Proteus mirabilis* (Beyene and Tsegaye, 2011; Alsamarai *et al*., 2016).

Similar study done by Paudel *et al*. (2018) showed the commonest urological symptoms to be lower abdominal pain (58.46%) followed by frequency of micturition (35%) and haematuria (1.5%) was the least common symptoms. The study done by Wamalwa *et al*. (3013) showed the commonest urological symptoms to be urgency (43.1%) and least common symptoms hematuria (4.2%).

Also study done by Khatri *et al*. (2012) showed burning sensation during micturition (62.40%) as the most common symptoms and nocturnal incontinence (4.1%) the least common symptoms. This variation in the presenting symptoms could be due to environmental and socio-economic condition, age group and other underlying health conditions.

This study showed that hospital (department), sex (gender) and age bear statistically significant relationship with urinary tract infections. Similar previous study showed that age and sex were statistically significant with urinary tract infection by (Kabugo *et al*., 2016). Similar reports also indicated that age, gender (Ally *et al*., 2016), hospital (department) (Adukauskiene *et al*., 2006) found to be statistically significant relationship with UTIs. Marital status, Residence, Level of education and Occupational status were the common risk factors but were not statistically significant. Similar study done by Haider *et al*. (2010) found that the illiteracy, sexual activity, low socio-economic level and past history of UTI as risk factors for UTI. Periodic health examination and awareness programs can help to improve the health status as well as quality of life. Similarly, there is need to raise awareness of UTI and to expand services for prevention of UTI by maintaining hygienic conditions, changing behavior and regular health examination.

Conclusion

The prevalence result for urinary tract infections was 63/237(26.58%). Escherichia coli was the major cause of urinary tract infections with 21(33.33%). This study has demonstrated that hospital (department), sex and age were important factors related to urinary tract infections. Appropriate measures may help reduce urinary tract infection by knowing the factors associated with this infection. Therefore, we recommend a routine screening for patients, these routine checks can achieve prevention of urinary tract infection at a lower cost.

Acknowledgment

Author's Contributions

Fadhl A.S. Al-Gasha'a: Researched and collected the data, reviewed the tables and write the manuscript.

Shayma M. Al-Baker: Contributed to the writing of the manuscript.

Jamil M. Obiad: Design the research plan and organized the study.

Fadhil A. Alrobiai: Contributed in facilitated the collection of data from Medical City laboratories.

Ethics

The author does not see any ethical issues that may arise after the publication of this manuscript.

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