Original Article

Correlation Study between Urinary Tract Bacterial Infection and Some Acute Inflammatory Responses

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Abstract

Background: There is no population in the world clear from urinary tract infection (UTI), especially among women. Urinary tract disease is a general term alluding to the bacterial infection anyplace in the urinary tract. It is commonly acknowledged that contamination of the upper urinary tract puts the patient in danger for kidney damage. The aim of the study was to identify the type of bacteria that cause UTI beside elevates the correlation between UTI and some inflammatory markers such as erythrocyte sedimentation rate, white blood cell, C-reactive protein (CRP), and hemoglobin for the UTI among patients in various sex and age groups. **Methods:** The study was carried in Baghdad Teaching Hospital during July 7, 2017–October 15, 2017. A sum of 45 UTI patients and 20 control group was collected. **Results:** The study showed that UTI increased in female than in male with 62.2% and 37.8%, respectively, and high risk at age 30–49 years with 42.2%. The microorganisms identified in this study were *Escherichia coli* (42.2%), followed by *Enterobacter* (8.9%), *Pseudomonas* and *Klebsiella* (6.7% for each), *Proteus* spp and *Serratia* spp (4.4% for each), and mixed culture (*E. coli* + *Proteus* and *E. coli* + *Pseudomonas* with 2.2% for each one). **Conclusion:** This study showed highly significant correlation between CRP and bacterial isolation.

Keywords: Bacterial infection, erythrocyte sedimentation rate, inflammatory parameters, urinary tract infection

Introduction

Every year, about 150 million individuals are infected by urinary tract infection (UTI) that was considered the most common bacterial infection worldwide.[1] About 50% of female will be infected by bacterial UTI during their life span although both male and female may be infected.[2] UTI can be seen most commonly in infants, persons with abnormality in the urinary tract, women, and individuals with urethral catheterization for long time as persons who have injury in the spinal cord. Antimicrobial resistance, pyelonephritis, kidney damage in young children, sepsis, preterm birth, and frequent recurrent infection are considered serious complications of UTI.[3]

The clinical symptoms of UTI incorporate infection-induced inflammation of the urethra (urethritis), urinary bladder (cystitis), and kidneys (pyelonephritis) and are diagnosed by the presence of high amount of bacteria in the urine (bacteriuria) with concomitant symptoms. Symptoms of cystitis include frequent urination, burning sensation and pain during urination (dysuria), suprapubic pain and/or lower abdominal inconvenience, and cloudy, foul-smelling urine. Symptoms of pyelonephritis include the presence of bacteriuria and pyuria (white blood cells [WBCs] in the urine) that is accompanied by flank pain and fever yet could conceivably incorporate different symptoms of cystitis.

To activate the inflammation of urinary tract mucosa, the pathogens used molecular mechanisms with high diversity. Inflammatory mediators released from epithelial cells when they are triggered by some bacteria in the mucosa, but some other bacteria have the ability to activate dendritic cell and macrophages. Many symptoms and signs of infection are caused by the releasing of these inflammatory mediators.[4]

Access this article online

Quick Response Code:

Website: www.bmbtrj.org

DOI: 10.4103/bbrj.bbrj_122_19

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How to cite this article: AL-Khikani FH, Auda Ga, Ayit AS. Correlation study between urinary tract bacterial infection and some acute inflammatory responses. Biomed Biotechnol Res J 2019;3:236-9.

Received: 18.08.2019; **Revision:** 28.08.2019; **Accepted:** 09.10.2019; **Published:** 03.12.2019

Old and prepubertal kids are highly susceptible to chronically recurrent UTI that leads to the increasing use of antibiotics and adversely influencing the personal quality of life.[2] The yearly cost of community-acquired UTI is estimated to be about 1.6 billion dollars.[2]

Methods

The study protocol was approved by the Ethical Committee in the Baghdad Health Directorate on April 3, 2017. In addition, verbal approval was obtained from the patients and/or their parents before taking the sample. Health measures and safety were taken during sampling.

A total number of 40 patients (subjects) were enrolled in this study; apparently, 20 healthy individuals who have no history or clinical evidence of abnormalities were selected as a healthy normal control group. During July 7, 2017–October 15, 2017, these patients have attended the Urology Department in Baghdad Hospital for teaching, every patient suffering from clear symptoms of UTI. Five ml blood stream was collected from each patient and was distributed into the ethylenediaminetetraacetic acid tube for hematological parameters and test tube for immunological parameters.

Questionnaire survey has been taken from patients. An absolute number of 40 patients (subjects) were tested during this study, each patient suffering from a complaint of frequent urge to urinate and painful; apparently, 20 healthy individuals who have no history or clinical evidence of abnormalities were selected as a healthy normal control group.

Laboratory investigations were done as hematological investigation, WBC, erythrocyte sedimentation rate (ESR), hemoglobin (Hb), and immunological investigation (C-reactive protein [CRP]). Urine sample for direct examination and basic bacterial-cultured methods have been done.

Statistical analysis

The Statistical Package for the Social Sciences (International Business Machines Corporation SPSS, Armonk, New York, USA) version 20 was used for the statistical analysis of the data and Excel application for Windows.

This study was approved by the Ethics Committee of the Ministry of Health and was performed in accordance with all national regulations.

Results

Microorganism frequency distribution in this study showed *E. coli* with high percentage (42.2%), followed by *Enterobacter* spp. (8.9%), *Pseudomonas* and *Klebsiella* (6.7% for each), *Proteus* and *serratia* (4.4% for each), and mixed culture (*E. coli* + *Proteus* and *E. coli* + *Pseudomonas* with 2.2% for each) [Figure 1].

Distribution of samples according to gender showed a high frequency of UTI with female than male with 62.2% and 37.8%, respectively [Figure 2].

Distribution of samples according to age showed a high frequency of UTI in age 30–49 years with high percentage (42.2%), followed by 50–69, 10–29, and 70–89 years with 26.7%, 24.4% and 6.7%, respectively.

Distribution according to parameters

the study showed the ESR with a high percentage at >40 mg/dl at 73.3%. The CRP test showed the positive result more than the negative result with 82.2% and 17.8%, respectively, but WBC is present at 4–11 × 10^3 with 55.6% more than <4 and >11 with 13.3 and 31.1%, respectively, whereas Hb appeared <12 with 77.8% more than >12 at 22.2% [Table 1].

Correlation between gender and parameters

This result showed highly significant differences with CRP at *P* 0.000, but other parameters were not significant [Table 2].

Table 3 shows the correlation between age and other parameters. The result of this study showed no significant

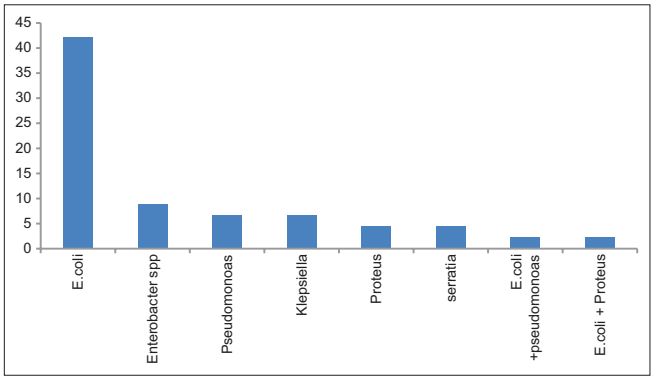

Figure 1: Uromicrobial distribution

Table 1: Distribution of samples according to studies parameters

Parameters	*n* (%)
ESR	
<20	4 (8.9)
20-40	8 (17.8)
>40	33 (73.3)
Total	45 (100)
CRP	
Positive	37 (82.2)
Negative	8 (17.8)
Total	45 (100)
WBC	
<4	6 (13.3)
4-11	25 (55.6)
>11	14 (31.1)
Total	45 (100)
Hb	
<12	35 (77.8)
>12	10 (22.2)
Total	45 (100)

CRP: C-reactive protein, WBC: White blood cell, Hb: Hemoglobin, ESR: Erythrocyte sedimentation rate

Table 2: Correlation between gender and other parameters

Parameters	Male	Female	*P*
ESR			
<20	2	2	0.8
20-40	2	6	
>40	13	20	
Total	17	28	
CRP			
Positive	14	23	0.000
Negative	3	5	
Total	37	8	
WBC			
<4	2	4	0.23
4-11	9	16	
>11	6	8	
Total	17	28	
Hb			
<12	12	23	0.81
>12	5	5	
Total	17	28	

CRP: C-reactive protein, WBC: White blood cell, Hb: Hemoglobin, ESR: Erythrocyte sedimentation rate

Table 3: Association between age and others (C-reactive protein, white blood cell, hemoglobin, and erythrocyte sedimentation rate)

Parameters	10-29	30-49	50-69	70-89	*P*
ESR					
<20	1	2	1	0	1.34
20-40	2	4	2	0	
>40	8	13	9	3	
Total	11	19	12	3	
CRP					
Positive	8	16	10	3	1.38
Negative	3	3	2	0	
Total	11	19	12	3	
WBC					
<4	3	3	0	0	16.24
4-11	2	12	9	2	
>11	6	4	3	1	
Total	11	19	12	3	
Hb					
<12	9	16	9	1	4.6
>12	2	3	3	2	
Total	11	19	12	3	

CRP: C-reactive protein, WBC: White blood cell, Hb: Hemoglobin, ESR: Erythrocyte sedimentation rate

differences between age and other parameters (CRP, WBC, Hb, and ESR).

Distribution of microorganism and its relation with age showed bacterial isolation related with age. The result showed *Escherichia coli* with high percentage (19, 42.2%) with age (50–69) at number 7, followed by *Enterobacter* with 4 (8.9%), the age 10–29 years and 30–49 years have the same number 2 [Table 4].

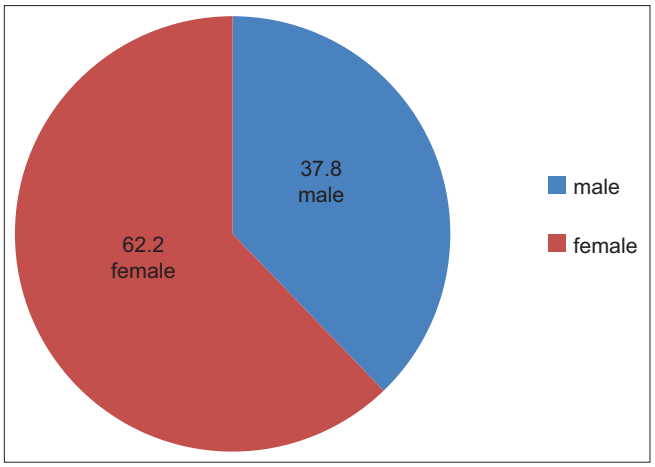

Figure 2: Samples and gender distribution

Discussion

Determination or isolation one or more urinary tract pathogen from culture is considered as definitive diagnosis.[5] Urine, which should be gutted before antimicrobial therapy beginning, can be collected by various methods. This study showed that women are more prone to UTIs than men because women tend to have UTI more often than man due to the short and wider female urethra and its travelling from the anus to the urethra.[6] Furthermore, women lack the bacteriostatic properties of prostatic secretions that have bactericidal activity against bacteria.[7] In this study high frequency of UTI observed in age 30–49 years due to sexual activity. In elderly UTI distribution is equal in female and male may because an enlarged prostate in men that causes urethra obstructs and increased of urinary retention due to prostate gland swelling.[8]

Gram-negative *Bacilli* with lactose fermenting was prevalent in most UTI in all cases with no prominent sex difference. The most frequent causative agents of UTIs in this study were found to be *E. coli* (19, 42.2%), followed by *Enterococcus* (4, 8.9%), *Pseudomonas* and *Klebsiella (*3, 6.7%), and *Serratia* spp. and *Proteus* (2, 4.4%), while mixed culture was found to be 1 (2.2%) for each. This result agrees with[9] that found, *E. coli* is the most common prevalent bacteria in uncomplicated UTIs. Another study[10] revealed that *Klebsiella*, *Pseudomonas* species, *Proteus, Enterococcus* and *Staphylococcus saprophyticus* seen in smaller numbers and cause 5%–15%.[11,12] Sample size and hygienic conditions of the patients are attributed in several populations, although the prevalence of different pathogens is involved in UTIs. Along these lines, stable example in such manner cannot conjecture, and this is the reason that varying information is seen when diverse investigations are considered. Numerous investigations of UTI create the impression that most regular secluded pathogen is *E. coli*. UTIs review examination uncovered that 90.12% of isolated organisms were *E. coli* and *Klebsiella* (7.72%) trailed by *Staphylococcus* (1.24%).[13]

Table 4: Frequency distribution of microorganism and its relation with age

Bacteria	*n* (%)	10-29	30-49	59-69	70-89
E. coli	19 (42.2)	4	6	7	2
E. coli + *Proteus*	1 (2.2)	0	1	0	0
Enterobacter	4 (8.9)	2	2	0	0
Proteus spp	2 (4.4)	0	2	0	0
Pseudomonas + *E. coli*	1 (2.2)	1	0	0	0
Pseudomonas	3 (6.7)	0	2	1	0
Chlamydia	2 (4.4)	0	0	2	0
Klabsilla	3 (6.7)	1	2	0	0
No growth	10 (22.2)	3	4	2	1
Total	45 (100)	11	19	12	3

E. coli: *Escherichia coli*

E. coli was found to be the most possible isolated pathogen during 1996–2001, amid an examination on catheter-related UTIs in a UK Emergency Clinic. These investigations uncovered that *Enterococcus* was the second successive pathogen.[14] Furthermore, among the 45 collected urine samples, 11 samples were identified with positive *E. coli* in girl patients with UTI under 5 year olds.[15]

The consequences of this investigation are as per the greater part of the studies done by others referenced above, with *Klebsiella* and *E. coli* being the principle etiologic agents in UTIs. The explanation behind the expanded recurrence of *Klebsiella* in UTIs might be the aftereffect of nosocomial infection. While in complicated UTIs, the most widely recognized pathogens are *E. coli, Enterococci*, *Klebsiella*, *Proteus*, and *Pseudomonas aeruginosa* by general examination of urine microscopy, scanning for the finding of red blood cell, WBC, and uropathogen in pee (bacteriuria).[8]

This investigation demonstrates factual contrasts between bacterial isolation and CRP. This study practically in accordance with the study of Chuang *et al*.[16] that found the relationship of raised serum CRP with lower urinary tract symptoms proposes a conceivable role of inflammation. The estimation of urine CRP levels can supplement the shortfall in the particularity of serum CRP levels as potential biomarkers of lower UTI. On the other hand, raised serum dimensions of CRP have been found consistently in young girls with intense clinical pyelonephritis yet just inconsistently in those with clinical cystitis. In light of this information, the recommendation has been made that elevated serum CRP fixations might be valuable in distinguishing patients with upper UTI.[17]

Conclusion

This study showed a highly significant correlation between CRP and urinary tract bacterial isolation. UTI increased in female than male with 62.2% and 37.8%, respectively, and high risk at age 30–49 years with 42.2%. The most predominant microorganism identified in this study was *E. coli* (42.2%).

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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