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COMPARE URINE CULTURE AND URINANALYSIS TEST (MICROSCOPIC, NITRITE AND LEUKOCYTE ESTERASE DIPSTICK TEST) IN THE DIAGNOSIS OF URINARY TRACT INFECTION

Shahram Bagheri[1], Leila Asadzadeh*[2] and Maryam Asadzadeh[3]

[1]Professor Assistant of Department of General Pathology, Jundishapur University of Medical Science, Ahwaz, Iran.

[2]Resident of Pathology of Jondishapsr University of Medical Science, Ahwaz, Iran.

[3]Professor Assistant of Department of oral and Maxilla Fascial Pathology, Booshehr University of Medical Science, Booshehr, Iran.

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***Corresponding Author**
Dr. Leila Asadzadeh
Resident of Pathology of Jondishapsr University of Medical Science, Ahwaz, Iran.

ABSTRACT

Introduction: Urinary tract infection is one of the most common bacterial infectious diseases and its early detection plays a key role in the prevention of secondary complications. Standard method in diagnosis of urinary tract infection is urine culture, but credit of urinalysis test as a screening test is the topic of discussion. Thus, the aim of this study was to determine the accuracy of urine analysis tests for diagnosis of urinary tract infection. The results: Of 288 patients studied, 98/57% female and 01/42 percent male had average ages of 35/20 ± 14/31 and 97/24 ± 09/34 years respectively. E. coli was the cause of producing 21/52% of urinary infections. After E. coli, Enterobacter (70/31 percent), Streptococcus (75/9%) and Pseudomonas (31.7 percent) held the next places in terms of prevalence. Sensitivity, specificity, positive predictive value and negative predictive value of nitrite test in the diagnosis of UTI were as follows: 17/73, 100, 100 and 73/95 percent. Sensitivity, specificity, positive predictive value and negative predictive value of leukocyte esterase test for the diagnosis of UTI were as follows: 46/41, 100, 100 and 14/91 percent. Sensitivity, specificity, positive predictive value and negative predictive value of urinary culture test in diagnosis of urinary tract infection were as follows: 100, 13/78, 15/43 and 100%. Discussion and conclusion: urine culture test is expensive and should not be used routinely unless nitrite and leukocyte esterase dipstick test results are positive.

KEYWORDS: urinary tract infection, urine culture, nitrite and leukocyte esterase test.

INTRODUCTION

Urinary tract clean waste from the blood and evicts them with extra water along with urine. It also regulates the concentration of body fluids and acid-base balance in body.[1] Urine consists of the materials which have been created in nephrons due to blood purification.[2] More than 90% of urinary tract infections are caused by certain types of bacterial species that form a part of the normal flora of the gastrointestinal tract. E. coli is considered as the most outstanding bacterial factor of urinary tract infection. A variety of gram-positive coccis such as enterococci and staphylococci also play an important role in the incidence of urinary tract infection.

Delays in the treatment of critically ill patients for 48 until preparation of urine culture is not recommended. It is proposed that urinalysis and leukocyte esterase tape can be used to screen patients' in terms of urinary infection and the practical treatment can be started after identification of culture test. Leukocyte esterase is observed in urine in 80 to 90 percent of marked urinary tract infections, but presence of leucocytes in urine is not specific and is observed during febrile maladies, infection with vaginal discharge (abundant Mucus) and Trichomonas infection. In cases that urine culture is positive, nitrite test is positive in 44% of cases, but hematuria and proteinuria in the diagnosis of urinary tract infection are not of worth. The absence of leukocytes and nitrites in urine denies possible urinary tract infection but positive leukocytes nitrite and leukocyte esterase tape, is not an accurate finding for the diagnosis of urinary tract infection. There are conflicting reports on replacing drug analysis test with urine culture. Studies about pediatric population have shown that in the absence of urine culture, urine analysis test can be used in the diagnosis and treatment of urinary tract infection and other studies have shown that urine culture cannot be accurately predicted by urine analysis test. Sharif et al. studied 375 children with suspected urinary tract infection and reported that negative leukocyte and nitrite in a leukocyte esterase tape rebuts urinary tract infection but their positivity has not diagnostic value and must not replace urine culture. Idleman et al. also reported that tape and urinalysis tests, as diagnostic tests in urinary infection, have not appropriate sensitivity. Armengol et al. introduced Dipstick as a method with properties of 98% but insensitive. Zaman et al. also concluded that bacteriuria in the urine has 40% false positives effect, therefore, dipstick is not convenient method for screening. Otukesh also stated that sensitivity and accuracy of leukocyte esterase test is more

than nitrite.[20] According to available records, comparing urine culture and urinalysis test in the diagnosis of urinary tract infection has been done less. Thus, the aim of this study was to investigate and compare urine culture and urinalysis test (microscopic, nitrite and leukocyte esterase dipstick test) in the diagnosis of urinary tract infection.

MATERIALS AND METHODS

In this cross - sectional study, in the first six months of 1394, 288 patients with suspected UTI referring to the laboratory centers under supervision of Ahvaz University of Medical Sciences were examined. The morning urine samples of participants for urinalysis and urine culture were investigated simultaneously. During the project, each patient's urine sample was investigated only once. Medical records and patients' information remained confidential and any use of such information, except in the direction of the project, was prevented.

In the beginning of standard sample project, in order to train appropriate sample taking, patients' urine samples were prepared. The morning urine sample, remaining in the bladder at least for 4 hours, was selected for urinalysis and urine culture. The patients washed their external genital with soap and water and urinary middle part (at least 10 to 30 ml) was taken in a specific container for tests. Three days before the test, patients had not received antibiotics unless prescribed by doctor. For urinalysis, Dipstick of 11 parameters was prepared with both nitrite esterase test and leukocyte esterase. Dipstick was immersed in non-centrifuged urine and measured parameters were read False-positive results (due to poor maintenance or collection of samples or medicines changing the color of urine) and false-negative results (due to large quantities of ascorbic acid, urobilinogen or PH less than 6) were also investigated and registered. Colonies growth in blood agar and eosin methylene blue was a sign of Gram-negative bacteria, but if it had grew only in blood agar, it would have been considered as gram-positive signs of infection and according to diagnosis for segregation catalase or oxidase tests were used. Due to urine contamination with vaginal fluid and large number of squamous epithelial cells, trichomonas and eosinophils, false-positive results may be created. For measuring leukocyte esterase, dipstick was immersed in urine, egressed immediately and read after 60 seconds; purple color is the sign of positive test result.

Data analysis

The collected data was in the form of laboratory information for whose analysis SPSS-21 software was used. For data description mean, standard deviation, amplitude, frequency and

percentage were used and the charts and tables were drawn. Quantitative variables were expressed as Mean (SD) and qualitative variables as number and percentage.

RESULTS

The results of comparing urine culture and urinalysis (microscopic, nitrite and leukocyte esterase dipstick test) in the diagnosis of urinary tract infections in shown in Figure 1 and Tables 1 to 8.

The gender distribution of patients in Figure 1. As is seen 167 patients (98/57%) women and 121 ones (01/42 percent) were men.

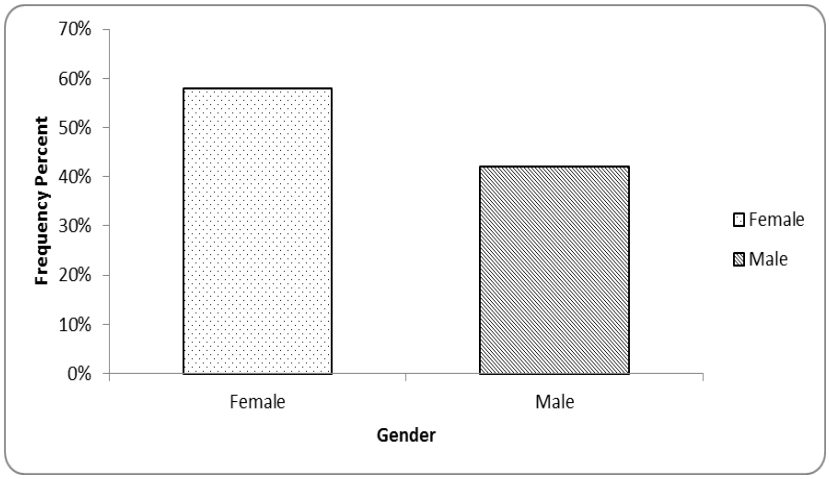

Figure 1. The gender distribution of patients

The mean age of patients was 32/38 with a standard deviation of at least 20 days and a maximum age was 89 years. Meanwhile, the mean age of women and men, respectively, were as follows: 35/20 ± 14/31 and 97/24 ± 09/34 years (Table 1).

Table 1. Patients' age information

maximum (year)	minimum (day)	standard deviation (year)	Mean (year)	
75	20	20/35	31/14	زن
89	22	24/97	34/09	مرد
89	20	22/41	32/38	کل بیماران

As is seen in Table 2, Escherichia coli had the most frequency among bacteria cultures which were obtained from cultures (21/51 percent), thereafter the highest frequencies were as follows: Enterobacter (31/70%), Staphylococcus (9/75%) and Pseudomonas (7/31%).

Table 2. The frequency of bacteria obtained from positive cultures

percent	Number	
51/21	21	**Ecoli**
31/70	13	**Enterobacter**
9/75	4	**Staphylococcus**
7/31	3	**Pseudomonas**
100	41	**Total**

The results of average red blood cell (RBC) and white blood cell (WBC) are shown in positive and negative cultures in Table 3. The mean RBC range in positive cultures was between at least 63/2 up to 56/5; this amount for negative cultures was at least 66/0 to 96/1 (Table 4-4). WBC range also in positive cultures was an average of at minimum 95/12 to 97/14 maximum, but in a negative cultures, as expected, the mean range was between the minimum 02/1 to maximum 3.

Table 3. The mean RBC and WBC in positive and negative cultures

maximum mean	Minimum mean	
5/56	2/63	**RBC+**
1/96	0/66	**RBC-**
14/97	12/95	**WBC+**
3	1/02	**WBC-**
WBC: white blood cell, RBC: red blood cell		

Colony frequency of bacteria in positive and negative urine culture is shown in Tables 4 and 5 below. In positive urine culture, the colony frequency of bacteria colonies was almost in the category related to many (85/65 percent), but in negative urine cultures, the category related to medium had most frequently.

Table 4. Frequency of bacteria in positive cultures

percent	Number	
65/85	27	High
19/51	8	medium
14/63	6	low

Table 5. Frequency of bacteria in negative cultures

percent	Number	
90/74	5	medium
9/25	49	low

The results of this study (Table 6) sensitivity, specificity, positive predictive value and negative predictive value of nitrite test in the diagnosis of urinary tract infection, were 17/73, 100, 100 and 73/95, respectively.

Table 6: Frequency of positive and negative test results of nitrite and leukocyte esterase in bacteria positive cultures

Number	Leukocyte esterase	Nitrite
9	+	+
21	-	+
8	+	-
3	-	-

Sensitivity, specificity, positive predictive value and negative predictive value leukocyte esterase test in the diagnosis of urinary tract infection, were 46/41, 100, 100 and 14/91%, respectively. (Table 7).

Table 7. Leukocyte esterase test

diagnosis of infection by urinalysis	Indiscrimination of infection by urinalysis	
true-positive 17	false negative 24	Culture results (+)
zero false-positive	false negative 247	Culture results (-)

In this study sensitivity, specificity, positive predictive value and negative predictive value of urine cultures in diagnosis of urinary tract infection were 100, 13/78, 15/43 and 100% respectively (Table 8).

Table 8. Urine culture

diagnosis of infection by urinalysis	Indiscrimination of infection by urinalysis	
true-positive 41	zero false negative	Culture results (+)
false-positive 54	true negative 193	Culture results (-)

DISCUSSION AND CONCLUSION

Urinary tract infection is the most common bacterial infection in human societies and it annually effects about 150 million people worldwide (23). In this cross-sectional study investigates 288 patients with suspected urinary tract infection in the first six months of 1394 referred to laboratory centers under the supervision of Ahvaz University of Medical Sciences. Of the total 288 patients, 98/57% were men and 01/42% were men with an average age of 35/20 ± 14/31 and 97/24 ± 09/34 years.

The prevalence of this infection varies by age and gender and due to anatomical differences is more prevalent among women than men. The infection is observed among infants less than one year, about 2.7% of boys and only 7.0% of girls, but among children 2 to 5 years bacteriuria increases by 4.5% among girls while among the boys, the rate is 5.0 percent and

the prevalence remain constant until about age of 15. Consequently up to the age of 35 the prevalence has been stable among men but in women increases by 20 percent and consequently it continues in relation to age in each sex so that in the ages higher than 65 is reported 40% for men and 35% for men. Tajvidi et al (1392), Kheirabadi et al (1391) and mansuri et al (1392) obtained results similar to those of the present studies. The urinary tract infection was more common among women.[23, 25, 26] In the present study 57/98 % were men and 42/01% women which shows higher prevalence of this infection among women, similar to results of other studies.

E. coli from Enterobacteriaceae family, at least in 80% of cases, is the main factor for UTI which could be due to the presence of the bacteria in feces and probably infection of urinary tract through it.[27] Among the less common pathogens Klebsiella, Proteus, Enterobacter, etc. can be mentioned. In this study, E. coli was the main factor for 52/21% of urinary tract infections. In conducted studies, this microorganism is known as the most common cause of UTI. The prevalence of the bacteria was investigated by Madani et al, on 10,492 samples in Kermanshah was reported 45/4%[28], in the study by Kader et al, on the 11659 samples in Saudi Arabia 58%, in the study by Ekram et al on 920 samples in India, 60%[29] and in the study by Rostamzadeh et al, on 803 samples in urumia 58/78%. Another study in 2002 in America the role of E. coli and Klebsiella in urinary infections of patients suffering from spinal cord injuries decreased comparing with Pseudomonas and Proteus, but Escherichia coli was still the most common organism isolated from patients. A study in 2006 in France reported that E. coli, Klebsiella and Pseudomonas, respectively, are the most common organisms of urinary infection factor in patients suffering from urinary infection. Similar results were achieved in Turkey (2007) in a study on the organisms isolated from urinary tract infections.[32] In the present research, after Escherichia coli, Enterobacter (70/31 percent), Streptococcus (75/9%) and Pseudomonas (31.7 percent), respectively, held the next ranks in terms of prevalence.

The mean range of RBC in positive urine culture was 2/63-5/56, and in negative cultures was 0/66-1/96 (normal range is less than 3). The mean range of WBC in positive urine cultures was 12/95-14/97 and in negative cultures was 1/02-3 (normal range of WBC in urine culture for men is hpf 1-2 and at most hpf 5 for women). According to the results of this study, sensitivity, specificity, positive predictive value and negative predictive value of nitrite test in the diagnosis of urinary tract infection were 17/73, 100, 100 and 73/95% respectively.

Sensitivity, specificity, positive predictive value and negative predictive value of the urine culture in diagnosis of urinary infection were 100, 13/78, 15/43 and 100% respectively.

Ayyazi et al also compared the urine culture and urinalysis for the diagnosis of urinary tract infection on the pediatric population and reported that althogh nitrite and leukocyte esterase test can prevent lots of the expenses being spent on urinary tract infection, screening methods such as nitrite and leukocyte esterase should not replace urine culture in children with urinary tract symptoms. Sharif et al. noted that negative nitrites and leukocyte in a leukocyte esterase tape rejects urinary infection, but their positivity has not diagnostic value and should not replace urine culture. Idleman et al. noted that dipstick and urinalysis test as a diagnostic tests in urinary tract infection, have not appropriate sensitivity. Armangole et al. introduced dipstick as a method with the specifity of 98%, but insensitive. The result of the study[20] conducted by otukesh showed that the sensitivity of leukocyte esterase test is more than that of nitrite.[20] Adlek et al[21] also concluded that leukocyte esterase test is sensitive enough in detection of urinary tract infections and in addition to short time of the test, requires little training for relevant personnel.[21] Bovzayan et al.[14] reported that positive cultures cannot accurately be predicted by microscopic analysis or only nitrite test.

Overall, the results of this study, nitrite and leukocyte test in the diagnosis of urinary tract infection had of paramount specificity of 100%, however, urine culture with the sensitivity of 100% was not able to detect UTI. Sensitivity of nitrite test (17/73 percent) and leukocyte esterase (46/41 percent) in the diagnosis of urinary tract infections was less than UTI (100%), meanwhile nitrite test sensitivity was more than that of leukocytes. Specificity of urine culture (78/13) was less than that of nitrite test (100%) and leukocytes (100%). Urine culture is a golden standard for diagnosis, but in the place where there is no access to the center of urine culture urine analysis can be used to diagnose and treat urinary tract infections. Ramadan et al. suggest that both microscopy and dipstick test can be used for rapid diagnosis and urine culture which is an expensive test should not be used routinely unless results of nitrite, leukocyte esterase, WBC and RBC and white blood cells, erythrocytes and bacteria in microscopic investigation is read positive.

According to the results of this study it can be concluded that although nitrite and leukocyte esterase dipstick can prevent the bulk of the costs spent on urine culture, urine culture cannot be exactly predicted by urinalysis.

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