

Original Article

A comparison of urine microscopy and urine culture results of patients considered to have urinary tract infection

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Abstract. Urinary tract infections are the diseases of the urogenital system caused by various microorganisms. Currently, the most used descriptive tests are urine strips, microscopic analysis of urine and spot bacteruria tests. The aim of this study was to present the consistency of culture results with leukocyte count determined cytometrically in the urine of patients considered to have a urinary tract infection and thereby facilitate treatment approaches. A retrospective examination was performed with the urine samples of patients sent to central laboratory of the Dicle University Hospital in January 2012- December 2013. Both microscopic urine analysis and urine culture were performed for each patient on the same day. The study comprised a total of 839 patients; 222 males and 617 females. Urine culture results and urine microscopy findings of patients with positive urine strip tests were compared. With the comparison of urine culture results, positive urine microscopy findings were found to have 92% sensitivity, 26% specificity, 52% positive predictive value (PPV) and 78% negative predictive value (NPV) ($p < 0.001$). Compared to the culture results, the urine microscopy findings of patients with positive urine strip tests were found to have high sensitivity and low specificity ($p < 0.001$). As a result empirical antimicrobial therapy can be considered for patients with positive urine microscopy findings without waiting for culture results, and patients with negative results are recommended to have urine culture results.

Keywords: Urinary tract infection, leukocyte count, sensitivity, specificity, microscopy

Introduction

Urinary tract infections (UTI) are defined as a group of diseases of the urogenital system from the renal cortex extending as far as the urethra caused by various microorganisms [1]. UTI is seen very often in the general population. Just as these infections may be asymptomatic, there may also be severe clinical situations which can progress to death [2]. The gold standard test for diagnosis is urine culture and the other tests used are only descriptive tests. Compared to urine culture, descriptive tests offer the possibility of having earlier results and therefore are useful in the early diagnosis of UTI. Frequently used descriptive tests are urine strips which are able to detect nitrite and leukocyte esterase (LE), the microscopic analysis of urine and spot bacteriuria test based on bacterial staining technique and evaluations oriented to the determination of bacteria with gram staining in urine sediment [3].

The aim of this study is to compare the urine culture results and the leukocyte count determined by cytometry in the urine of patients with positive urine strip LE test and thereby facilitate treatment approaches.

Materials and Methods

This study was conducted with a retrospective examination of the data obtained from urine samples sent from polyclinics to Dicle University Hospital Central Laboratory between January 2012 and December 2013. Approval for the study was granted by the Ethics Committee of Dicle University Medical Faculty (Decision No: 358/24.09.2013).

A total of 839 patients were included in the study. These comprised 222 (26.5%) males and 617 (73.5%) females from whom urine microscopic analysis and urine culture had been applied on the same day.

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For the urine LE biochemical analyses, the Aution Max AX 4280 (Iris Diagnostics, Chatsworth, California, USA) device was used. LE was measured with urine strips (Aution sticks-10EA, Arkray Inc., Kyoto, Japan). In the study, a leukocyte count of $<25/\mu\text{L}$ was evaluated as normal.

The Iris iQ@200 Elite (Aution Max-4280, Arkray, Kyoto, Japan) autoanalyzer was used for microscopic analysis of urine. In both males and females, ≤ 4 leukocyte in each area at $\times 100$ magnification was evaluated as normal.

For the urine culture, single-use plasma calibrated to 1 μL as standard from the samples were quantitatively embedded in eosin methylene blue (EMB) agar medium

TABLE 1
COMPARISON OF URINE CULTURE RESULTS WITH URINE MICROSCOPY FINDINGS IN PATIENTS WITH POSITIVE URINE STRIP LE TESTS

Urine microscopy	Urine culture		
	No. Positive (%)	No. Negative (%)	Total No. (%)
Positive	358 (42.7%)	334 (39.8%)	692 (82.4%)
Negative	32 (3.8%)	115 (13.7%)	147 (17.6%)
Total	390 (46.5%)	449 (53.5%)	839 (100%)

TABLE 2
THE SENSITIVITY, SPECIFICITY, PPV AND NPV VALUES OF URINE MICROSCOPY COMPARED TO THE URINE CULTURE RESULTS OF PATIENTS WITH POSITIVE URINE STRIP LE TESTS IN PREVIOUS STUDIES IN LITERATURE

Variable	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)
Steinmetz et al (2004)	81	85	70	91
Kim et al (2007)	68	80	60	86
Lunn et al (2010)	94	58	45	96
Falbo et al (2012)	98	59	34	99
Current study	92	26	52	78

and 5% sheep blood agar and left for 18-24 hours of incubation at 37°C . After incubation, the urine cultures determined with ≥ 100.000 CFU/mL bacteria reproduction on the medium surface were evaluated as positive.

Statistical analysis of the data was made by using SPSS version 15.0 statistics software program (SPSS Inc. Chicago, IL, USA). In the comparison of data, the Chi-square test was used. A value of $p < 0.05$ was accepted as statistically significant.

Results

The mean age and standard deviation (SD) of the patients included in the study was 34.8 ± 22.1 years for males and 25.1 ± 21.5 years for females. The urine culture results were compared with the urine microscopy findings of the patients with positive LE urine strip test (Table 1). The urine microscopy findings of the patients with positive LE urine strip tests were have 92% sensitivity, 26% specificity, 52% positive predictive value (PPV), 78% negative predictive value (NPV) as compared to the urine

culture results ($p < 0.001$). Urine culture results were determined as positive in 390/839 (46.5%) patients with positive LE urine strip test. The microscopic analysis was positive in 358/390 (91.8%) patients. On the other hand urine culture results were determined as negative in 449/839 (53.5%) patients with negative LE urine strip test. In culture negative group, microscopic analysis was positive in 334/449 patients (Table 1).

Discussion

UTIs are the second most frequently infections in the general population after upper respiratory tract infections. The infections show differences in respect of prevalence and course in different populations [4]. To reduce costs and prevent antimicrobial resistance, rational treatment approaches should be applied. In a study by Lunn et al [5], positive urine culture result was found in 18/66 (27.3%) patients with positive LE urine strip tests. Ducharme et al [6] determined positive urine culture in 23/67 (34%) patients with positive LE urine strip tests. In the current study, positive urine culture was determined in 390/839 (46.5%) patients with positive LE urine strip tests. Thus, the results of the current study are seen to be not consistent with those of Lunn and Ducharme [5,6]. This inconsistency can be considered to be associated with the number of samples in the study. The obtained data can be considered to be consistent with results from a sufficient number of studies to represent the system. According to the urine strip LE test results only, starting medical treatment with unnecessary medication may cause the development of antimicrobial resistance. Therefore, urine culture should be applied to patients with positive urine strip LE tests.

In our study we found 92% sensitivity, 26% specificity, 52% PPV and 78% NPV according to the urine microscopy findings of the 839 patients with positive LE urine strip tests compared to the results of urine culture. In previous studies the sensitivity, specificity, PPV and NPV were reported as 68-98%, 58-85%, 34-70% and 86-99% respectively (Table 2) [5,7-9]. Compared to the urine culture results, the sensitivity of urine microscopic analysis was found to be extremely high and the specificity was lower.

When the current study is compared with previous studies in literature, apart from the lowness of specificity, similar results are seen [10]. In the lowness of urine density, while differences may occur in urine microscopy results associated with leukocyte destruction as a result of urine remaining in the bladder for a long time or a change in the urine pH, as the urine strip LE level is measured enzymatically, a difference in the results is not expected as there is no enzyme change in cell destruction. Therefore, the urine strip LE results are seen as more definitive than the findings of urine microscopy.

In conclusion, in the current study the sensitivity of urine microscopic analysis is significantly high in urine strip LE test positive patients, compared to the urine culture results. According to this, empirical treatment can be started in symptomatic patients with positive urine microscopic analysis without waiting for the results of

urine culture. For patients with negative findings, urine culture is recommended.

Conflict of Interest

The authors declare no conflicts of interest.

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