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Evaluation of Leukocyte Esterase Dipstick Test in the Diagnosis of Urinary tract Infection in Children

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Summary

Wammanda RD, Aikhionbare HA and Ogala WN. Evaluation of Leukocyte Esterase Dipstick Test in the Diagnosis of Urinary tract Infection in children. *Nigerian Journal of Paediatrics* **1999; 26: 21.** In a prospective study of urinary tract infection (UTI) in 85 children (51 males and 34 females), urine specimens were evaluated by culture, microscopy and leukocyte esterase dipstick test. Positive urine cultures with significant bacteriuria were found in 21 samples (24.7 percent). Urine microscopy for leukocyturia correctly identified positive urine cultures in 9 of 21 samples, giving a sensitivity of 42.9 percent. Leukocyte esterase dipstick test correctly identified 15 of 21 urine samples with culture proven UTI (71.4 percent sensitivity). The positive and negative predictive values were 36.6 percent and 86.4 percent, respectively. The leukocyte esterase dipstick test was found to be better than significant leukocyturia in detecting UTI. It is concluded that leukocyte esterase is sensitive in detecting UTI, easy to perform, requires less time and does not require highly trained personnel for its performance

Introduction

URINARY tract infection (UTI) is a common childhood infection,[1-4] the presentation of which is often non-specific in infants and young children. Its early recognition and treatment may therefore, be a problem especially in environments where malaria and other childhood infections commonly present with non-specific symptoms. The diagnosis of UTI is usually confirmed by microscopy and culture of properly collected urine samples. However, due to scarce resources and other handicaps, this is often not practicable in many parts of the developing world. Reliable screening tests for UTI will facilitate early diagnosis and treatment, and if negative may avoid unnecessary laboratory urinalysis

Leukocyte esterase is an enzyme from neutrophils not normally found in the urine and is a marker of pyuria.[5] Recently, a dipstick has become available that tests for this marker.[6,7] Since, as far as we are aware, the use of a dipstick method in the quick detection of UTI in our environment has not been evaluated, this study was undertaken to evaluate the use of the test strip of leukocyte esterase as a rapid screening method in the diagnosis of urinary tract infection.

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Patients and Methods

The subjects consisted of 85 consecutive children presenting with features suggestive of urinary infection among the patients attending the paediatric units of the Ahmadu Bello University Hospital, Zaria. Midstream urine specimens were collected into sterile containers by the clean-catch method in the older children, while collection in infants was by means of sterile urine bag attached to the perineum after cleaning with 1:100 dilution of Savlon.

An aliquot of the sample of urine was taken to the laboratory within one hour of specimen collection and processed immediately. Urine culture was carried out by the simultaneous platings of two culture media namely, blood agar (for total colony count) and MacConkey agar (for differential count). Urine was delivered by urine loop 0.02mm in diameter, according

to the method of Hoeprick.[6] The culture media were incubated at 37°C for 18-24 hours. A colony count of $\geq 10^5$ organisms/ml of voided urine was taken as significant. Ten millilitres of the urine was centrifuged in a test tube at 300rpm for five minutes; the supernatant fluid was then decanted and the remaining contents were shaken to mix, and a drop or two was placed on a slide covered with a cover slip and examined under light microscopy for leukocytes, using a high power objective. Significant leukocyturia was defined as $\geq$ 10 cells per high power field (phpf).

Screening urine for leukocyte esterase was done by using Multistix 10SG (Bayer) test strip according to the manufacturer's instructions. The performance characteristics of leukocyte esterase in detecting the presence or otherwise, of UTI, was statistically expressed in terms of sensitivity, specificity, positive predictive and negative predictive values.[7] The chi-square (X^2) test was used to compare the results of leukocyte esterase tests with significant leukocyturia in patients with culture proven UTI. A p-value of <0.05 was regarded as being significant.

Table I

Age and Sex Distribution of the 85 Children studied

Age(mons)	*Males*	*Females*	*Total*	*Percentage*
<1	5	0	5	5.9
1-12	8	3	11	12.9
13-24	19	4	23	27.1
25-36	6	5	11	12.9
37-48	0	6	6	7.1
49-60	3	2	5	5.9
≥61	10	14	24	28.2
Total	51	34	85	100.0

Results

Eighty five consecutive children (51 males and 34 females) aged 2 days – 12 years (Table I) presenting with features of probable UTI were recruited for the study. Thirty nine (45.9 percent) of the 85 were aged two years and below; 38 (74.5 percent) of the 51 males were uncircumcised. Fever, dysuria and lower abdominal pain were the commonest symptoms.

Positive urine culture with significant bacteriuria was found in 21 samples, giving a 24.7 percent positivity rate. *Escherichia coli* was the predominant organism isolated (Table II). Urine microscopy for leukocyturia was significant in 22 urine samples. Significant leukocyturia correctly identified positive urine culture with significant bacteriuria in nine of 21 urine samples, giving a sensitivity of 42.9 percent; the specificity was 79.7 percent while the positive predictive value was 40.9 percent. The leukocyte esterase dipstick test was positive in 41 (48.2 percent) of the urine samples. The performance characteristics of leukocyte esterase

Table II

Microorganisms isolated from 21 Urine Samples

Microorganism	*No of Urine Samples*	*Percent of Total*
Escherichia coli	12	57.1
Enterobacter species	4	19.1
Beta haemolytic streptococcus	2	9.5
Seratia species	2	9.5
Klebsiella species	1	4.8
Total	21	100.0

dipstick test in detecting urinary tract infection is presented in Table III. The test was found to have a high sensitivity of 71.4 percent but low specificity (59.4 percent). The positive and negative predictive values were 36.6 percent and 86.4 percent, respectively. False-positive leukocyte esterase dipstick test was observed to be more common among the female subjects in whom 11 (32.4 percent) of 34 had a false-positive leukocyte esterase dipstick test, compared to 21.6 percent among the males. Further analysis of the results in the males revealed that false-positive leukocyte esterase dipstick test was higher in the uncircumcised (81 percent) than the circumcised (19 percent).

The performance of leukocyte esterase dipstick test was compared to that of significant leukocyturia among patients with culture proven UTI. The results showed that leukocyte esterase dipstick test was positive in 15 (71.4 percent) of 21 with culture proven UTI in contrast to only nine (42.9 percent) of 21 who had significant leukocyturia in association with culture proven UTI. This difference was significant ($X^2 = 63$, 1df, $p<0.02$) Leukocyte esterase dipstick

test was therefore, better than significant leukocyturia in detecting UTI (Table III).

Table III

Leukocyte esterase Dipstick Test compared to Urine Culture

Leukocyte esterase Test	Colony Count $\geq 10^5$/ml	Colony Count $< 10^5$/ml	Total
Positive	15	26	41
Negative	6	38	44
Total	21	64	85

Discussion

The sensitivity of leukocyte esterase dipstick test for detecting UTI with signifieant bacteriuria in symptomatic patients in this study was 71.4 percent. This finding is similar to those reported by others who used similar criteria for significant bacteriuria.[8 9] However, the specificities ranging from 78 to 96 percent reported by those workers[8 9] were higher than the 59.4 percent obtained in the present study. This may probably be due to the differences between the number of patients studied. There were 85 patients in this study while the number of patients studied by the workers cited above ranged from 700 to over one thousand.

The low positive predictive value of 36.6 percent and a high negative predictive value of 86.4 percent obtained in this study, are similar to reported values elsewhere.[5 10] Wiggelinkhuizen *et al*[5] from South Africa, reported positive and negative predictive values of 36.6 percent and 98.2 percent, respectively, while Lejeune *et al*[10] in France reported figures of 42.3 percent and 97.6 percent, respectively. This high negative predictive value is an essential requirement of leukocyte esterase dipstick as a screening test for urinary tract infection. This is because a negative predictive value is the likelihood that a subject with a negative test does not have the disease condition tested for.[12]

In the present series, a false positive leukocyte esterase test was more common in female patients than in the males, an observation which had earlier been reported by other workers.[5 9] It has been speculated that this difference in false-positive rates between the sexes could be due to the increased likelihood of contamination of urine samples in the females by vaginal secretions.[5 11]

The present study has also revealed that leukocyte dipstick test is more sensitive than significant leukocyturia in detecting culture proven urinary tract infections. Although our experience is limited to the small number of patients evaluated in the present study, it is our view that the dipstick test of leukocyte esterase is a reasonable and rapid screening test which does not require highly trained personnel, for the diagnosis of urinary tract infection.

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