Original Article

Prevalence of Urinary Tract Infections (UTIs) Among School - Going Children in Dhaka, Bangladesh: A Dipstick Test Study

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Abstract

Though some studies have evaluated dipstick urinalysis (DUA) for children, it is not commonly done in Bangladesh. However, DUA is an easy, quick and reliable test for predicting urinary tract infection (UTI) within a short period of time. The aim of this cross sectional study was to examine the prevalence of urinary tract infection among school-going children. Urine specimens were collected from 2239 children from six different schools in Dhaka city and sub-urban area. Dipstick urinalysis for nitrite and leukocyte were performed for this study. Sensitivity and specificity with 95% confidence intervals(CI) were calculated. Visual readings were compared to readings with the findings of a urine chemistry analyzer. There were only leukocytes present in urine of 5.95% children 6.50% boys and 5.21% had girls. Age group 8 to <12 years have more of leukocytes and nitrites in urine than other age groups. 26 (1.16%) children have both leukocytes and nitrites and 132(5.9%) having only leukocytes and 83(3.7%) children were having nitrites in urine. When investigating for UTI in children, we suggest nitrite and leukocyte esterase dipstick be combined.

Key words: Dipstick, Infection, Leukocytes, Nitrites.

Introduction

Dipstick urinalysis is often the first measure for detecting bacteriuria.[1] The diagnostic value of dipstick urinalysis is most often used for children and adults, though it may provide different results depending on age group and patient criteria. Thus, the clinical value of dipstick urinalysis could be quite different for elderly patients at nursing homes compared to younger ones, even though elderly patients have a higher prevalence of bacteriuria.[2,3,4]

Dipstick testing of urine sample is a method designed to allow early detection of infection and an early initiation of the treatment.[5] Dipstick have been designed to test markers of infection. Leukocyte esterase and nitrite have been combined on one dipstick to screen urine samples for urinary tract infections.[6]

Leukocyte esterase is an enzyme from neutrophils not normally found in urine and is a marker of pyuria. Nitrites are produced by the bacterial breakdown of dietary nitrates. Most urinary pathogens reduce nitrates to nitrites like E.Coli, Klebsiella, Proteus.[7] Dipsticks use as a routine screening test for UTIs both in children and adults. Among children, the method of urine collection is often varying, and UTIs have far reaching implications.[8]

The accuracy of the dipstick for nitrites was affected by the cut-off point for the nitrites and the population tested. The difference between the studies with regard to

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implicit cut-off points may be influenced by human, instrumental or environmental factors. The test for nitrites might perform better in asymptomatic patients and in patients who are not on antibiotics.[9]

A positive urine culture may confirm the diagnosis and is considered the gold standard in scientific studies. Moreover, susceptibility testing may be performed on cultured bacteria and may guide antibiotic therapy. Considering these facts, it is no surprise that urine samples are the most frequently received specimens in many microbiology laboratories. Nevertheless, a high number of these urine cultures will not yield any bacteria at all, and percentages for negative urine cultures up to 80% have been reported.[10,11] In Dipstick test, where only nitrites and leukocyte esterase show fair accuracy, compared with a quantitative culture.[12]

This dipstick test has a limited use in screening for asymptomatic bacteriuria. The leukocytes test component of the dipstick test appears to have the highest reliability and validity. Rapid diagnostic tests can rule out urine infection, which is inexpensive, less time-consuming and less expensive and are useful in communities having no culture facility.[13] The urine dipstick test will also be useful in follow-up of patient after treatment of urinary tract infection. This is useful in a developing country like Bangladesh, where people are very much unaware about their diseases as well as their children.

Material and Methods:

Study design and setting: Cross sectional study. Data were collected from selected schools in Dhaka and its downtown between April 2012 and February 2018.

Sample size: The total number of children included our study was 2239. Permission and consent was taken from the school authorities as well as parents of students. Age of the students were between 06 to 16 years.

Data collection process: In this study, we use dipstick (urine quick test; Combur-10-Test™, Roche, Mannheim, Germany) for biochemical analysis which consists of 10 reagents such as pH, specific gravity, protein, RBC, glucose, leukocytes, nitrites, urobilinogen, bilirubin and ketones. We considered nitrites and leukocytes for our study. The students and their parents were instructed how to obtain a clean mid-stream urine specimen. Each strip reacted with the substance present in urine and quickly changes color (60-120 seconds). The color of the strip was compared to the color chart present in the dipstick container.

Data analysis: Statistical analysis was done by using statistical package of social science SPSS version 16. Qualitative data were expressed in the form of numbers and percentages to describe comparisons of proportions.

Results:

Table 1 shows boys have more in percentage of leukocytes in urine. Their were 132 children (5.95%) who had only leukocytes present in urine, among them 87(6.50%) boys and 45(5.11%) girls and presence of Nitrites in urine was more in boys than girls. Total 83 children (3.73%) had presence of nitrites in urine, among them 60(4.46%) boys and 23 (3.73%) girls

Table-1 Leukocytes (>5/hpf) and Nitrites present in urine

	Numbers		Percentage	
	Leukocytes (>5/hpf)	Nitrites	Leukocytes (>5/hpf)	Nitrites
Boys (1343)	87	60	6.50	4.46
Girls (896)	45	23	5.11	2.65
Total- 2239	132	83	5.95	3.73

Table 2 shows age group 08 - <12 years have more of leukocytes and nitrites in urine than other age groups. here 26 (1.16%) have both leukocytes and nitrites in their urine, whereas 132(5.9%) having only leukocytes and 83(3.7%) children having nitrites in urine.

Table 2: Leukocytes (>5/hpf) and Nitrites present in urine according to age group

Age	n (%)	Leukocytes + Nitrites	Leukocytes	Nitrites
6 - 8 years	328 (14.65)	02	15	08
8- <12 years	1263 (56.43)	18	72	55
12-16 years	648 (28.92)	06	45	20
	2239 (100)	26(1.16%)	132(5.9%)	83(3.7%)

Table 3 shows Sensitivity and Specificity of dipstick tests of nitrites (Sensitivity 25% and Specificity 75%) and leucocytes (Sensitivity 55% and Specificity 70%) to predict Urinary Tract Infections (UTI) at 95% CI.

Table 3: Sensitivity and Specificity of dipstick tests of nitrites and leucocytes to predict Urinary Tract Infections (UTI)

	Sensitivity (95% CI)	Specificity (95% CI)	Likelihood ratios (LR+,LR-)	P-value
Nitrites +	25(16.1-38.2)	75(53-90.2)	5.5, 0.73	< 0.001
Leucocytes+	55(45.3-70.2)	70(64.4-74.3)	1.8, 0.62	0.02
Nitrites and Leucocytes both +	16.8(8.45-40.6)	87(83-91.1)	26, 0.83	--

Discussion:

UTI is a common cause of fever in young children, often accompanied by subtle and non-specific clinical findings.[14.] In a small percentage of children this may lead to kidney scarring, and at a later age to hypertension, and even renal failure.[15.]

The leucocyte-esterase test had a much higher accuracy in urology patients, consequently also in tertiary care, and when using a catheter for urine-collection. Sensitivity is highest in primary care, but requires further diagnostic work-up because of the high rates of false positives. In primary care negative results do not exclude the presence of infection.

Our study found, boys have more in percentage of leukocytes(>5/hpf) in urine. There were 132 children who had only leukocytes (>5/hpf) present in urine, among them 87 (6.50%) boys and 45 (5.11%) girls.

Dipstick is relatively effective at diagnosing patients as negative who are truly negative than diagnosing patients as positive who are truly positive. This is because the observed specificity values were relatively higher than the observed sensitivity values. Performance of nitrite alone showed relatively low sensitivity 25 at 95% CI, which is similar to previous studies.[9,16]

In our study, we have found presence of Nitrites in urine were more in boys compared to girls. In 3.73% urine had nitrites were present in urine 4.46% boys and 3.73% girls. Evidently, "nitrite-positive or leucocyte-positive" results appeared to be the best index for distinguishing between positive and negative results for quantitative urine culture, which is similar to an earlier report.[17] Nitrite alone recorded a relatively higher +LR 5.5, which suggests it may be useful in ruling in UTI. Conversely, it has relatively low – LR 0.73, indicating that it may not be a good indicator for ruling out UTI. Leucocyte alone appeared to be poor at both ruling in and ruling out UTI [+LR 1.8, – LR 0.62]. Combination of "nitrite-positive and leucocyte-positive" results produced the highest +LR 26, suggesting that it may be the most useful index for ruling in UTI infection. This finding resembles with a recent systematic review study that targeted children under the age of five years.[18]

Conclusion:

Overall, this study demonstrates that the urine dipstick test alone seems to be useful in children to exclude the presence of infection if the results for nitrites or leukocyte-esterase are negative. Although culture of urine is the gold standard test for diagnosis of UTI. In a community set up where culture is not available, dipstick test for nitrites and leukocytes could be a indicator for diagnosis of UTI. When investigating for UTI in school children at we suggest nitrite and leukocyte dipstick should be used combinedly.

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