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Prevalence of Urinary Tract Infection in Children (3-6 years); with Emphasis on Efficacy of Urine Leukocyte Esterase and Nitrite Test

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Abstract

Background & Objectives; Urinary tract infection (UTI) is among the most common childhood disease. The early intervention is prudent to reduce various renal complications. Our study determines the prevalence of UTI in anganwadi children(3-6 years) along with efficacy of dipstick tests in diagnosing UTI. **Method:** Urine leukocyte esterase (LT) and nitrite (NT) tests with urine culture were done and their usefulness was calculated by diagnostic odd ratio and chi square test. **Results :**It revealed prevalence to be 4.6 % with sensitivity and specificity of LT, NT as 85.7%, 85.7% and 95.5%, 94.8% respectively. The positive and negative predictive value of LT, NT was 48%, 44.4% and 99.3%, 99.3% respectively. **Interpretation & Conclusion:** Hence Dipstick tests appears to be a rational and cost effective approach especially in a mass population or in communities to diagnose UTI without adequate laboratory facilities.

Keywords: *Uti, Dipstick, Urine Culture, Urinalaysis*

Introduction

Urinary tract infection (UTI) is among the most common disease in childhood. The prevalence of UTI varies between 0.4 and 7.5% in different childhood populations (Brican 2002)[1]

Screening for asymptomatic bacteriuria if undertaken in order to detect infection and identification of structural abnormalities coupled with appropriate management will lead to prevention of pyelonephritis and renal damage [2].

This would be a tedious task unless a simple and economic screening methods which would be acceptable to the children, parents, school health authorities and bacteriologist.

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There are several rapid diagnostic tests like dipstick method & urine microscopy. Rapid diagnostic tests can rule out negative samples, are economical, save valuable time and thus useful.

The use of leukocyte esterase and nitrate as a screening test for UTI has not been recently evaluated in our environment. This study was therefore undertaken to evaluate dipstick leukocyte esterase and nitrate method in the diagnosis of UTI in this community with a view to recommend its use in screening, as well as in diagnosis of UTIs in resource poor communities so as to avert the long term complications of UTI in children [3,4].

Methodology

A cross sectional study of 300 children was conducted in Dr. D. Y. Patil Hospital, after taking clearance from Dr. D. Y. Patil Medical College ethical committee. Children between the age group of 3-6 years in Anganwadi's of Kolhapur city were included in the study, Whereas Children below 3 years and above 6 years and Children on antibiotics at the time of collection of the urine sample were excluded from the study.

The aim of our study was to know the prevalence of urinary tract infection in Anganwadi children (3-6years) and to evaluate the efficacy of Leukocyte esterase and Nitrite test in diagnosis of urinary tract infection.

The enrolment was made after taking permission from Anganwadi authorities, and written consent from the parents. The age of the children was obtained from the school records and weight was recorded using spring balance (bathroom scale) calibrated to 0.5kg accuracy.

The clean catch midstream 15 ml urine sample was collected in autoclaved bulb in Anganwadi itself after giving instructions to the guardian/helper. All specimens for urinalysis and culture were recorded & labelled including the patient's name, age, sex, and the time. Further it was transferred to the hospital as early as possible (within 2 hours).

In hospital urine sample were divided in to three parts, on one part dipstick tests were done immediately, and two parts were sent to the laboratory for urine microscopy and urine culture.

DIPSTICK SCREENING TECHNIQUE: Urine samples were tested by using the dipstick technique for leukocyte esterase and nitrite using Multisticks of Qickcheak® and by comparing with given colour code results were obtained.

MICROSCOPY: Microscopic examination of a centrifuged sample for White blood cells and bacteria was done. The presence of more than 5 WBC/HPF indicated pyuria and was considered as positive.

CULTURE AND SENSITIVITY: All samples were inoculated on chromogenic media and incubated at 37^{o} C for 24 hours in an incubator. Growth of more than 105 colony forming units (CFU) /ml was considered as positive.

STATISTICAL ANALYSIS: All results were recorded accordingly. Results of NT, LE, combined NT and LE along with microscopy were compared with the culture results.

The specificity, sensitivity, of LE alone, NT alone and combined LE and NT, and the significance of the study results in general was computed with the help of a statistician.

The software used was Statistical Package for Social Sciences (SPSS) Version 11.5The test used for statistical analysis were Chi square test and Diagnostic odds ratio. The P value <0.05 was considered as significant.

Results

300 children were taken into study out of which 164 were boys and 136 were girls. Out of total children, 6 boys(3.66%) and 8 girls(5.88%) were culture positive accounting to 14(4.6%) of total study population.

Table 1: Results Of microscopy and strip leukocyte esterase and nitrite tests in 300 clinical samples

		Culture		
		+ ve	- ve	P-value
Microscopic Pyuria	+ ve	14	7	0.001
	- ve	0	279	
Leukocyte esterase (LT)	+ ve	12	13	0.001
	- ve	2	273	
Nitrite test (NT)	+ ve	12	15	0.001
	- ve	2	271	
LT or NT	+ ve	12	15	0.001
	- ve	2	271	
LT or NT or Microscopy	+ ve	14	15	0.001
	- ve	0	271	

*P-values by Chi-Square test. P-value<0.05 is considered to be statistically significant association.

Table 2. Usefulness of microscopy and strip leukocyte esterase and nitrite tests in 300 clinical samples

	Leukocyte esterase (LT)	Nitrite test (NT)	LT or NT
Positives (n=14)	12	12	12
Sensitivity (%)	85.7	85.7	85.7
Specificity (%)	95.5	94.8	94.8
PPV (%)	48.0	44.4	44.4
NPV (%)	99.3	99.3	99.3
Diagnostic odds ratio	1.02	1.02	1.02

*Positives among the culture positives only (n=14).

Discussion

Urinary tract infection occurs frequently in pediatric population. Pediatrician must maintain a high index of suspicion because of its nonspecific clinical features for which urine culture is considered as diagnostic standard.

In our study of 300 Anganwadi children (3-6years) in Kolhapur city, the overall prevalence of UTI was 4.6 %, with 5.88 % in girls and 3.66 % in boys.

Result of our study approximately matches with the studies of Fallahzadeh MH et al [5]and Schlager TA [6] in which the prevalence is found to be 4.44% and 4.11%. The variation in prevalence in different studies is likely due to geographical variations, different age groups included in the studies and many factors like inclusion criteria, education and socioeconomic status.

Table 3.shows the prevalence of UTI in children in various studies:

Study	Year	Age group	Prevalence
Bauchner et al [7]	1987	<5yrs	1.7 %
Fallahzadeh MH et al [5]	1999	0-5 yrs.	4.4 %
Schlager TA [6]	2001	<5yrs.	4.1 %
Present Study	2016	3-6	4.66 %

Second part of our study includes efficacy of dipstick test in diagnosis of UTI in Anganwadi children (3-6 yrs.). In present study the sensitivity and specificity of Microscopy, LE, NT was 100%, 85.7%, 85.7% and 97.6%, 95.5%, 94.8% respectively.

The positive and negative predictive values of Microscopy, LE, NT is 66.7%, 48%, 44.4% and 100%, 99.3%, 99.3% respectively.

Table 4. Shows the result of nitrate in various studies including present study:

Study	Year	Sensitivity	Specificity	PPV	NNV
Yuen SF[8] et al	2001	72%	85.8%	55.4	92.6%
CHON CH[9] et al	2001	83%	78%	--	--
Zorc JJ[10] et al	2005	83%	84%	--	--
Present study	2016	85.7%	95.5%	48%	99.3%

In present study sensitivity and specificity of dipstick leukocyte esterase was 85.7% and 95.5%.The positive and negative predictive value was 48%, 99.3% respectively. Yuen SF et al[8] stated PPV and NPV to be 55.4% and 92.6% which matches with the present study. Zorc JJ et al[10] reported sensitivity and specificity 83% and 84% respectively. CHON CH et al [9] coated sensitivity and specificity of 83% and 78% respectively.

Table 5. Shows the result of leukocyte esterase in various studies including present study:

Study	Year	Sensitivity	Specificity	PPV	NNV
CHON CH[9] et al	2001	53%	98%	--	--
Zorc JJ[10] et al	2005	50%	98%	--	--
Williams GJ[11] et al	2010	83-95.2%	49.9-100%	--	--
Present study	2016	85.7%	94.8%	44.4%	99.3%

The result of our study and above studies are almost similar.

In present study the sensitivity and specificity of dipstick nitrite test was 85.7% and 94.8% respectively. PPV and NPV was 44.4% and 99.3%. CHON CH et al[9] stated sensitivity and specificity 53% and 98%, Zorc JJ et al[10] stated 50% and 98%. Our results almost match with these study result. Our results are also similar to another study by Williams GJ et al [11] which shows 83-95.2% sensitivity and 49.9-100% specificity.

Conclusion

The Dipstick tests for diagnosis of UTI have high Sensitivity, Specificity and high Negative Predictive value but low Positive Predictive value.

Using Dipstick tests appears to be a rational and cost effective approach towards ruling out UTI, especially in mass population or in communities without an adequate laboratory facilities.

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Conflict of Interest- There is no conflict of interest

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