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Research Article

### COMPARISON OF URINE DIPSTICK AND URINE CULTURE IN DIAGNOSIS OF UTI IN CHILDREN

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**Abstract:**

*For children below age of five urinary tract infection (UTI) is the foremost common sources of infection. To lessen the danger of renal scarring it is critical to have immediate diagnosis and treatment. Quick, cost-effective, methods for the analysis of UTI are needed as an substitute to culture.*

***Objective:** To determine the diagnostic accuracy of urine dipstick in detection of UTI in children keeping urine culture as a gold standard*

***Study Design:** Cross sectional validation study.*

***Setting:** Outpatient department, Benazir Bhutto Hospital, Rawalpindi*

***Duration Of Study:** 6 months after approval of synopsis From: 01-2018 to 07-2018.*

***Methodology:** After taking permission from the hospital ethical committee all female patients with urinary tract infection were included. A rapid dipstick analysis for leukocyte esterase and nitrite was done by a staff nurse using MeditestCombi 10 SGL. The reaction of dipstick strip was read visually by a trained nurse who has five year experience working in the Outpatient department, Benazir Bhutto Hospital, Rawalpindi. All dipstick positive and dipstick negative samples underwent cultures by sending samples in a clean container to the pathology lab via a sanitary attendant within one hour of the urine collection.*

***Results:** In our study, 69.21%(n=281) were between 2 months to 3 years of age while 30.79%(n=125) were between 4-5 years of age, mean±sd was calculated as 2.63±1.36 years, frequency of UTI in children on urine culture as a gold standard was recorded in 20.69%(n=84), the diagnostic accuracy of urine dipstick in detection of UTI in children keeping urine culture as a gold standard was recorded as 80.95%, 62.42%, 35.98%, 92.63% and 66.26% for sensitivity, specificity, positive predictive value, negative predictive value and accuracy rate.*

**Conclusion:**

*We conclude that the diagnostic accuracy of urine dipstick in detection of UTI in children keeping urine culture as a gold standard is higher and this cost effective and easy technique may be used in our routine practice for prediction of UTI in children.*

**Keywords:** Urinary tract infection, children, diagnostic accuracy, urine dipstick.

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**INTRODUCTION:**

The presence of Bacteria within the proximity of symptoms in urine can be characterized as UTI. [1]; around 10% of girls and 30% of boys will have had a UTI by 16 years of age. The symptoms can be classical symptoms such as dysuria, urgency and abdominal pain [2]. The prevalence of UTIs ranges from 1-73% worldwide. In Pakistan UTI is one of the common problems for hospital visits in pediatric ages and girls are the most affected [3]. A recent study from Karachi reported 18% prevalence of UTI in pediatric population [5].

Clinical highlights recommend UTI incorporate a background history of earlier UTI, temperature more noteworthy than 39°C or 40°C, duration of temperature for over 24 hours, suprapubic tenderness, and absence of circumcision [3,4]. Moreover, the likelihood of a UTI decreases by just a little degree in the proximity of another source of fever. Abdominal ache, back ache, dysuria, recurrence and incontinence are present in older children due to UTI. nonetheless, because of the absence of reliable clinical features any child with fever without a restricting source ought to experience workup for a UTI. In children it is always preferable that these infections are diagnosed early and managed accordingly.

Urine culture is the gold standard for diagnosing UTIs [3], however, the time span for results is a serious issue. There are other diagnostic options available and a urine dipstick for a lab analysis may be less time consuming. The urine analysis is the most commonly used test for evaluating UTI, but it is time consuming. The diagnostic precision of dipsticks for UTIs has been studied; these examinations have demonstrated that analytic exactness of rapid dipstick tests is questionable. These studies demonstrate that dipsticks can improve indicative exactness yet ineffectively precludes infection [5].

A recent study done in 2010 has shown that urine dipsticks are moderately sensitive (75%) and less specific (66%) in predicting UTI [5]. In 2007, American Academy of Pediatrics has discouraged the use of dipstick in detecting UTI as it has low diagnostic yield [6].

In a recent randomized controlled trial done in 2010, it was concluded that starting antibiotics after the early detection of UTI is the most cost effective strategy but there are insufficient local data available [7].

The aim of my study was to detect UTI early by the use of urine dipstick as it is an easy modality, an inexpensive test and we can start early treatment with antibiotics and hence can decrease the complications associated with late detection of UTI. It is not routinely performed in our hospital setting and I want to do it as an effective modality that would guide us towards the early treatment and hence prevention of complications.

**MATERIALS AND METHODS:**

This cross sectional validation research was conducted at Outpatient department, Benazir Bhutto Hospital, Rawalpindi. The purpose of research was to decide the demonstrative precision of urine dipstick in detection of UTI in children keeping urine culture as a gold standard. Operational definitions used in this study were: Urine Dipstick: A urine test strip or dipstick was detected qualitatively whether leucocyte esterase or nitrate is present or not. Urine Culture: Growth of gram negative organism as tiny pink glistening colonies on CLED medium within 24 hour on a midstream clean catch sample or suprapubic catheterization. **DIAGNOSTIC ACCURACY:** Sensitivity: measures the ability of a urine dipstick to detect UTI when UTI is present. Specificity: measures the capability of a urine dipstick to correctly exclude UTI when UTI is nonexistent. True Positive: Urine dipstick test result is one that detects the condition when UTI is present also in culture.

False Negative: Urine dipstick test result is one that does not detect UTI when the condition is present in urine culture report. True Negative: Urine dipstick test result is one that does not detect UTI when the condition is absent IN culture also. False Positive: Urine dipstick test result is one that detects UTI when the UTI is absent in urine culture. Positive Predictive value: is the proportion of positives that correspond to the presence of UTI by urine dipstick. Negative Predictive value: is the proportion of negative that correspond to the absence of UTI by urine dipstick. Duration of study was 6 months after approval of synopsis from: 01-2018 to 07-2018. Sample size of 406 was calculated by using sensitivity and specificity sample size calculator with following statistical assumptions: Confidence level: 95%, Sensitivity:75% [5] Specificity: 66% [5] Prevalence of UTI in our population18% [5] Sample technique used was non-probability consecutive sampling.

All females' children of age from 2 months to 5 years with fever upto101°F with presenting complaints (lower /suprapubic/crampy abdominal pain), burning micturition and frequency of micturition ten to fifteen time per day were included within the research. All Patients who have taken antibiotics in the earlier 48 hours.; those with underlying congenital renal anomalies i.e. cystic kidney, obstruction in renal tract, and those with Renal Tumors, Renal Syndromes, Acute Renal failure and CKD were excluded from the study.

Every female patient age 2 months to 5 years present in the inpatient or outpatient division with signs and

manifestations of urinary tract infection were incorporated after approval from the hospital ethical committee. Urine was collected using a midstream clean catch sample or supra pubic aspiration by staff nurse.

A rapid dipstick analysis for leukocyte esterase and nitrite was done by a staff nurse using Meditest Combi 10 SGL. The reaction of dipstick strip was read visually by a trained nurse who has five year experience working in the Outpatient department, Benazir Bhutto Hospital, Rawalpindi. All dipstick positive and dipstick negative samples underwent cultures by sending samples in a clean container to the pathology lab via a sanitary attendant within one hour of the urine collection. In the lab, the urine sample was incubated in a CLED medium at 37°C. Next day after 24 hour the lab assistance was visualized the medium to look for the growth of pink glistening colonies which was indicative of the gram negative organisms. A study proformawas used to record the information regarding patient age, gender and the results of urine dipstick and urine culture tests.

SPSS version 10 was used for the analysis. Mean and standard deviation was calculated for all quantitative variables i.e. age.By keeping urine culture as gold standard, frequency and percentage was presented for all qualitative variables i.e., true positive, false positive, false negative and true negative. Sensitivity, specificity, positive and negative predictive value was calculated using 2x2 table as follows,

Urine Dipstick	Urine Culture		
	Test Result	Positive	Negative
	Positive	TP	FP
Negative	FN	TN	

Sensitivity =  $TP / (TP + FN) * 100$

Specificity =  $TN / (TN + FP) * 100$

Positive Predictive Value =  $TP / (TP + FP) * 100$

Negative Predictive Value =  $TN / (TN + FN) * 100$

Diagnostic accuracy:  $(TP + TN) / (TP + TN + FP + FN) * 100$

## RESULTS:

To decide the diagnostic precision of urine dipstick in discovery of UTI in children by keeping urine culture as gold standard an aggregate of 406 cases satisfying the inclusion/exclusion criteria were selected..

Patients were distributed according to age of the patients, it shows that 69.21% (n=281) were between 2 months to 3 years of age while 30.79% (n=125)

were between 4-5 years of age, mean±sd was calculated as 2.63±1.36 years. (Table No. 1)

Frequency of UTI in children on urine culture as a gold standard was recorded in 20.69% (n=84) while 79.31% (n=322) were not positive with the morbidity. (Table No. 2)

Diagnostic accuracy of urine dipstick in detection of UTI in children keeping urine culture as a gold

standard was recorded as 80.95%, 62.42%, 35.98%, 92.63% and 66.26% for sensitivity, specificity,

positive predictive value, negative predictive value and accuracy rate. (Table No. 3)

**TABLE No. 1 AGE DISTRIBUTION (n=406)**

Age(in years)	No. of patients	%
2m-3 years	281	69.21
4-5 years	125	30.79
<b>Total</b>	<b>406</b>	<b>100</b>
<b>Mean+SD</b>	<b>2.63+1.36</b>	

**TABLE No. 2 FREQUENCY OF UTI IN CHILDREN ON URINE CULTURE AS A GOLD STANDARD (n=406)**

UTI	No. of patients	%
Yes	84	20.69
No	322	79.31
<b>Total</b>	<b>406</b>	<b>100</b>

**TABLE No. 3 DIAGNOSTIC ACCURACY OF URINE DIPSTICK IN DETECTION OF UTI IN CHILDREN KEEPING URINE CULTURE AS A GOLD STANDARD (n=406)**

Urine Dipstick	Urine culture		Total
	Malignant (Positive)	Malignant (Negative)	
Positive	True positive(a) 68 (16.75%)	False positive (b) 121 (29.80%)	a + b 189(46.55%)
Negative	False negative(c) 16 (3.94%)	True negative (d) 201 (49.51%)	c + d 217(53.45%)
<b>Total</b>	<b>a + c</b> <b>84 (20.69%)</b>	<b>b + d</b> <b>322 (79.31%)</b>	<b>406(100%)</b>

Sensitivity =  $a / (a + c) \times 100 = 80.95\%$

Specificity =  $d / (d + b) \times 100 = 62.42\%$

Positive predictive value =  $a / (a + b) \times 100 = 35.98\%$

Negative predictive value =  $d / (d + c) \times 100 = 92.63\%$

Accuracy rate =  $(a + d) / (a + d + b + c) \times 100 = 66.26\%$

### DISCUSSION:

For children below age of five urinary tract infection (UTI) is the foremost common sources of infection. To lessen the danger of renal scarring it is critical to have immediate diagnosis and treatment. Quick, cost-effective, methods for the analysis of UTI are needed as an substitute to culture.

The current study was planned to detect UTI early by the use of urine dipstick as it is an easy modality, an inexpensive test and we can start early treatment with antibiotics and hence can decrease the complications associated with late detection of UTI. It is not routinely performed in our hospital setting so we wanted to do it as an effective modality that may guide us towards the early treatment and hence prevention of complications.

In our study, 69.21% (n=281) were between 2 months to 3 years of age while 30.79% (n=125) were between 4-5 years of age, mean±sd was calculated as 2.63±1.36 years, frequency of UTI in children on urine culture as a gold standard was recorded in 20.69% (n=84), the diagnostic accuracy of urine dipstick in detection of UTI in children keeping urine culture as a gold standard was recorded as 80.95%, 62.42%, 35.98%, 92.63% and 66.26% for sensitivity, specificity, positive predictive value, negative predictive value and accuracy rate.

A recent study done in 2010 has shown that urine dipsticks are moderately sensitive (75%) and less specific (66%) in predicting UTI [5], our study findings are in agreement with the above study,

contrary to above, in 2007, American Academy of Pediatrics has discouraged the use of dipstick in detecting UTI as it has low diagnostic yield. [6]

In a recent randomized controlled trial done in 2010, it was concluded that starting antibiotics after the early detection of UTI is the most cost effective strategy but there are insufficient local data available. [7]

Smith P and others [8] evaluated the sensitivity, specificity, positive and negative predictive values of Negative microscopy and negative dipstick to predict culture results: absence of a reportable pathogen and recorded sensitivity 83%, specificity 76%, PPV 94%, NPV 76%, which is supporting to the current study.

Another study [9] included paper for children (aged 3 weeks-21 years) with suspected UTI and recorded that sensitivity 92%, specificity 62%, PPV 22%, NPV 99%. Microscopy: Sensitivity 92%, specificity 49%, PPV 17%, NPV 98%.

The latest research done by Whiting et al [10] exploring the diagnostic accurateness of dipstick analysis and microscopy for UTI in kids is an all around directed efficient review. The overall conclusion is that negative dipstick analysis for leukocyte esterase and nitrite, or microscopy negative for bacteriuria and pyuria can be used to rule out UTI, without the need for confirmatory culture. Positive dipstick examination and microscopy can likewise be utilized to prompt further examination, by sending for urine culture to affirm UTI. To clinical practice the value of these conclusions is that use of such quick diagnostic tests would result in saving clinic charges by not having to send for culture in case tests are negative, conjointly result in less children getting improper antibiotic treatment whereas anticipating tests results of culture.

In summary, the results of our study support the use of urine dipstick to detect UTI early as it is an easy modality, an inexpensive test and we can start early treatment with antibiotics and hence can decrease the complications associated with late detection of UTI. Though, it is not routinely performed in our hospital setting however, considering the outcome of our research in accordance with other studies, the use of this effective modality may guide us towards the early treatment and hence prevention of complications.

### CONCLUSION:

We conclude that the analytic precision of urine dipstick in detection of UTI in children keeping urine culture as a gold standard is higher and this cost effective and easy technique may be used in our routine practice for prediction of UTI in children.

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