

**CORRELATION BETWEEN DIPSTICK, MICROSCOPY AND CULTURE & SENSITIVITY AMONG CHILDREN SUFFERED FROM URINARY TRACT INFECTION**Ankaj Sharma<sup>1</sup>, Poonam Chouhan<sup>2\*</sup>, Ranbir Singh Jaswal<sup>3</sup>, S. C. Jaryal<sup>4</sup>, Ajay Sharma<sup>5</sup> and Gunjan Sharma<sup>6</sup><sup>1</sup>Post Graduate Student Department of Pediatrics, Dr. Rajendra Prasad Government Medical College, Kangra at Tanda.<sup>2</sup>Post Graduate Student Department of OBG, IGMC Shimla.<sup>3</sup>Professor Department of Pediatrics, Dr.R.P.G.M.C., Tanda.<sup>4</sup>Professor & Head Department of Microbiology, Dr. RPGMC, Kangra At Tanda.<sup>5</sup>Assistant Professor, Department of Pediatrics, Dr. RPGMC, Kangra At Tanda.<sup>6</sup>Post Graduate Student Department of Ophthalmology, PGIMER Chandigarh.**\*Corresponding Author: Dr. Poonam Chouhan**

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**ABSTRACT**

**Background:** The diagnosis of urinary tract infection in children is difficult as clinical presentations are vague and non-specific so high index of suspicion is required to diagnosis the urinary tract infection in children 0-5 year. The purpose of this study was to evaluate the correlation between Dipstick, Microscopy and Culture & Sensitivity among Children suffered from Urinary Tract Infection. **Material & Methods:** The present descriptive, cross-sectional, and prospective study was conducted in the Department of Pediatrics, Dr RPGMC Kangra at Tanda for the period of One year. Total 263 Children aged 1 month to 5 years with fever (axillary temp of  $>38^{\circ}\text{C}$  or  $>100.4^{\circ}\text{F}$ ) without any focus reporting to OPD or admitted to the ward of Pediatric Department were included in the study. **Results:** Culture negative patients were in the majority (87.8%) compared to culture positive patients (12.1%). In our study, total Dipstick Positive were 26, total Routine Microscopy Positive were 24 and Total Patients Combined Positive for Dipstick and Routine Microscopy were 30. In the present study dipstick test has sensitivity of 81.25% and specificity 96.97%. Positive Predictive Value and Negative Predictive Value were 78.79% and 97.39% respectively. Routine microscopy has sensitivity of 75.00% and specificity 97.84%. Positive Predictive Value and Negative Predictive Value were 82.76% and 96.58% respectively. Both dipstick and Routine microscopy has sensitivity of 93.75% and specificity 99.57%. Positive Predictive Value and Negative Predictive Value were 96.77% and 99.14% respectively. **Conclusion:** The present study suggests the sensitivity of dipstick about 81.25% and specificity 96.97%. After combining dipstick with routine microscopy the sensitivity increases upto 93.75% and specificity 99.75% so it is reliable to start antibiotic treatment on the basis of dipstick and routine microscopy till culture report is awaited to prevent morbidity and long term sequelae due to UTI.

**KEYWORDS:** Correlation, Dipstick, Microscopy and Culture & Sensitivity Children, Urinary Tract Infection.**INTRODUCTION**

Urinary tract infection (UTI) is one of the most common pediatric infections causing fever without focus. UTI is defined as growth of a significant number of organisms of a single species in the urine, in the presence of symptoms. The gold standard for diagnosis of UTI is positive urine culture. If the culture grows  $10^5$  CFU/ml in midstream sample of normally cultured urine or there is a growth of even single pathogen in suprapubic sample or catheterized sample showing  $>50000$  CFU/ml. Recurrent UTI, defined as the recurrence of symptoms with significant bacteriuria in patients who have recovered clinically following treatment, is common in girls.<sup>[1]</sup>

The culture and sensitivity of properly collected urine

sample is gold standard to diagnose urinary tract infection but as it takes time for culture and sensitivity report to come, empirical therapy for urinary tract infection is recommended on the basis of other tests such as microscopic examination and dipstick method.<sup>[1,2]</sup>

According to the latest guidelines drafted by the Urological Society of India Pediatric Urinary Tract Infection (UTI) Guidelines Panel and address "Pediatric Urinary Tract Infection, the diagnosis of pediatric UTI should be based on the presence of both pyuria and  $>10^5$  CFU/ml in a clean-catch midstream voided urine sample. If urine is obtained by catheterization, 1000–10,000 CFU/ml is considered positive in symptomatic patient. Any number of CFU/ml counts obtained after

suprapubic aspiration should be considered significant.<sup>[2]</sup>

Rapid urine tests (also known as dipsticks or macroscopic urinalysis) remain useful for diagnosis of UTI. The urine dipstick method is useful to diagnose urinary tract infection as it is easily available, affordable and convenient to both physician and patient. The basis of dipstick method to detect urinary tract infection is that it detects the nitrite and leucocyte esterase level in urine sample. The nitrate is converted in to nitrite by nitrate reductase enzymes produced mostly by urea splitting organisms such as *Proteus* species and occasionally by *E. Coli*. In the normal urine nitrite levels are not present. It has a sensitivity and specificity of 22% and 94-100%, respectively. The low sensitivity has been attributed to enzyme-deficient bacteria causing infection or low-grade bacteriuria.<sup>[2]</sup>

The second component of dip stick is that it detects the urine esterase level in the urine sample suggests presence of WBC in urine. Positive leukocyte esterase is 84% sensitive and 78% specific for diagnosing urinary tract infection. If both are combined overall sensitivity and specificity reaches up to 94% and 96% respectively.<sup>[2]</sup>

According to the American Academy of Pediatrics (AAP) clinical practice guidelines, the diagnosis of UTI in children 2 to 24 months requires positive dipstick test (leukocyte esterase and/or nitrite test), microscopy positive for pyuria or bacteriuria, and the presence of  $\geq 50,000$  CFU/ml of a uropathogen in a catheterized or suprapubic aspiration specimen. As the culture and sensitivity method takes 5-7 days to result to come so it is better to start the empirical therapy after the microscopic examination and positive rapid diagnostic test.<sup>[2,3]</sup>

The purpose of this study was to evaluate the correlation between Dipstick, Microscopy and Culture & Sensitivity among Children suffered from Urinary Tract Infection.

#### AIM AND OBJECTIVES

To evaluate the correlation between Dipstick, Microscopy and Culture & Sensitivity among Children suffered from Urinary Tract Infection

#### MATERIALS AND METHODS

**Place of study:** Department of Pediatrics, Dr RPGMC Kangra at Tanda

**Study design:** Descriptive, cross-sectional, and prospective study

**Duration of study:** One year

**Inclusion criteria:** Children aged 1 month to 5 years with fever (axillary temp of  $>38^{\circ}\text{C}$  or  $>100.4^{\circ}\text{F}$ ) without any focus reported to Pediatric OPD or admitted in ward of Pediatric Department were screened for eligibility.

#### Exclusion criteria

- Other known causes of fever.
- Previous history of Urinary tract infection.

- Children received antibiotics prior to presentation.
- Children with other major comorbidities defined as neuromuscular conditions such as spina bifida, previous urologic surgery other than circumcision and immunodeficiency.
- Children on immunosuppressive drugs.
- Children with severe congenital anomalies of urinary tract making it difficult for urine sample collection such as ectopia vesicae and hypospadias.

Urinary tract infection was defined as the growth of a single colony/organism of at least  $10^5$ /mL. Urine samples were obtained by suprapubic aspiration, catheterisation and for infants and children not yet toilet trained. In older children mid-stream urine samples were collected. Dipstick urinalysis were performed using rapid diagnostic dipstick (urocolour strips) for Urinary tract infection.

Microscopy was done using the manually counting chamber. Cut-off value for microscopy was taken as significant if  $>5$  pus cells per HPF. The collected samples were sent for the culture immediately. The cultures were read after 24-48 h of incubation at  $37^{\circ}\text{C}$ .<sup>66</sup> Positive urine culture was defined as at least  $10^5$  colony forming units (CFU) per mL of a single uropathogen. Mixed growths were excluded. The results of dipstick urinalysis, microscopy was compared.

#### Ethical considerations

Before starting the study, permission from institutional ethical committee was taken. Parents were educated regarding possibility of underlying Urinary tract infection and the importance of detecting it. Thereafter, informed written consent was taken and the importance to carry out further investigations in children depending on their age group was explained to the parents.

#### Data Collection and Variables

For urine analysis, sample of urine was collected in a sterile container. The sample was processed within an hour of collection. Sample from container was transferred to centrifuge tube and spun at 1500 revolutions per minute (rpm) for 5 min. Supernatant was discarded and sediment was taken. Slide was first seen with  $\times 10$  objective and then on  $\times 40$  objective microscope piece for detection of leukocytes. More than 5 leukocytes/high power field were considered significant. Urine culture was considered the gold standard test for the diagnosis of Urinary tract infection. Children with urine culture positive were treated with appropriate antibiotics and further radiological evaluation was performed.

#### Data analysis

Data entry was carried out in MS Excel 2013 and all relevant data were analysed using the statistical package for social science version 21.0 (SPSS, Chicago, IL, USA). Continuous variables were expressed as mean  $\pm$  standard deviation (SD) and categorical variables as

count and percentage. Sensitivity, specificity, Positive Predictive Value and Negative Predictive Value were also calculated.

#### Financial disclosure

No financial burden was placed to the study population.

#### RESULTS

A total of 263 Children aged 1 month to 5 years with fever (axillary temp of  $>38^{\circ}\text{C}$  or  $>100.4^{\circ}\text{F}$ ) without any focus reporting to OPD or admitted to the ward of Pediatric Department were included in the study.

**Table 1: Total culture positivity.**

Culture	Number of observed patients (263)	Percentage
Positive	32	12.16%
Negative	231	87.83%

Culture negative patients were in the majority (87.8%) compared to culture positive patients (12.1%).

**Table 2: Comparison of Positivity of Various Investigations Used In Diagnosis of UTI.**

Total Culture Positive	32
Total Dipstick Positive	26
Total Routine Microscopy Positive	24
Positive for Dipstick and Routine Microscopy	30

In our study, total Dipstick Positive were 26, total Routine Microscopy Positive were 24 and Total Patients Combined Positive for Dipstick and Routine Microscopy were 30.

**Table 3: Diagnostic Performance of Dipstick Test by Comparing With Urine Culture as Gold Standard.**

Statistic	Value
Sensitivity	81.25%
Specificity	96.97%
Positive Likelihood Ratio	26.81
Negative Likelihood Ratio	0.19
Disease prevalence	12.17%
Positive Predictive Value	78.79%
Negative Predictive Value	97.39%
Accuracy	95.06%

In the present study dipstick test has sensitivity of 81.25% and specificity 96.97%. Positive Predictive Value and Negative Predictive Value were 78.79% and 97.39% respectively

**Table 4: Diagnostic Performance of Routine Microscopy By Comparing With Urine Culture As Gold Standard.**

Statistic	Value
Sensitivity	75.00%
Specificity	97.84%
Statistic	Value
Positive Likelihood Ratio	34.65
Negative Likelihood Ratio	0.26
Disease prevalence	12.17%
Positive Predictive Value	82.76%
Negative Predictive Value	96.58%
Accuracy	95.06%

Routine microscopy has sensitivity of 75.00% and specificity 97.84%. Positive Predictive Value and Negative Predictive Value were 82.76% and 96.58% respectively

**Table 5: Diagnostic Performance of both Dipstick and Routine Microscopy By Comparing With Urine Culture As Gold Standard.**

Statistic	Value
Sensitivity	93.75%
Specificity	99.57%
Positive Likelihood Ratio	216.56
Negative Likelihood Ratio	0.06

Disease prevalence	12.17%
Positive Predictive Value	96.77%
Negative Predictive Value	99.14%
Accuracy	98.86%

Both dipstick and Routine microscopy has sensitivity of 93.75% and specificity 99.57%. Positive Predictive Value and Negative Predictive Value were 96.77% and 99.14% respectively.

## DISCUSSION

In the present study dipstick test has sensitivity of 81.25% and specificity 96.97%. Positive Predictive Value and Negative Predictive Value were 78.79% and 97.39% respectively. Routine microscopy has sensitivity of 75.00% and specificity 97.84%. Positive Predictive Value and Negative Predictive Value were 82.76% and 96.58% respectively. Both dipstick and Routine microscopy has sensitivity of 93.75% and specificity 99.57%. Positive Predictive Value and Negative Predictive Value were 96.77% and 99.14% respectively.

Katunzi L et al<sup>[4]</sup> found the sensitivity of dipstick tests against culture to be 56% while specificity was 85%; Positive Predictive Value and Negative Predictive Value were 91% and 42% respectively.

Dipsticks reported from a study conducted by Fredrick F et al<sup>[5]</sup> on 382 febrile children below five years who were admitted in the general pediatric. Sensitivity and specificity of leukocyte esterase was 76.6% and 85.9% respectively, and nitrite was 68.8% and 92.4% respectively. Positive predictive value and negative predicting value of leukocyte esterase was 52.1% and 94.8% respectively and nitrite was 64.7% and 93.6%.

Also, study conducted in Duzce University Turkey by Yildirim M et al<sup>[6]</sup> 250 morning urine specimens tested by using dipstick and microscopic and cultured. Sensitivity and specificity of dipstick were 80% and 60% respectively. Positive predictive value (PPV) and Negative predictive value (NPV) for dipstick were 52% and 84% respectively.

A study conducted by Masinde Aet al<sup>[7]</sup> among 370 febrile children. The prevalence of positive urine culture was 39.7% with sensitivity of leukocyte esterase and nitrate was 8.8% and 21.7% with specificity of 99.1% and 97% respectively. Dipstick tests are inexpensive, convenient, readily available, and useful for diagnosis of UTI.

Microscopy should be performed to detect bacteriuria and pyuria. The presence of crystals or a significant number of urothelial cells, vaginal cells, red blood cells or white blood cells can mask the presence of bacteria in the urine. Gram stain of a urine specimen has a sensitivity of 81% and a specificity of 83%.<sup>[8]</sup>

Williams GJ et al<sup>[9]</sup> performed a meta-analysis on 95

studies involving 95,703 children to determine the absolute and relative accuracy of rapid urine tests (microscopy for bacteria) for UTI. Summary estimates for specificity and sensitivity for microscopy for Gram-stained bacteria were 96% and 91%, for unstained bacteria were 92% and 88%.

Microscopy for bacteria with Gram stain had higher accuracy than other laboratory tests. Rapid urine tests have a false negative rate of approximately 10% and therefore cannot replace urine culture in the diagnosis of UTI.<sup>[9,10]</sup> Nevertheless, rapid urine tests are good screening tests which when used in conjunction with urine culture can increase its diagnostic accuracy.<sup>[11]</sup>

Management of UTI in children can be challenging because symptoms can be vague and nonspecific in young children. A high index of suspicion is essential. UTI should be considered in any child < 5 years presenting with fever. On the one hand, over-diagnosis may lead to unnecessary and potentially invasive testing, unnecessary treatment, and the emergence of bacterial resistance to antibiotics. On the other hand, under-diagnosis and delayed treatment may lead to recurrence and risk for renal scarring which may lead to hypertension and chronic renal failure. Timely and accurate diagnosis and appropriate treatment are therefore essential.

## Limitations

The chemical reactions on dipstick are complicated and can be affected by oxidizing, reducing and discoloring substances in the urine. Therefore, false positive and false negative results are common in dipstick testing. High dietary nitrate can lead to falsely positive nitrite in urine dipstick method. The test relies on correct collection of sample by the patient and if this is not done properly the results may be inaccurate. In addition, each of these methods has disadvantages that limit its usefulness as a routine test. So it is important to test the urine promptly, understand the advantages and limitations of each test when using any of the method.

## CONCLUSION

The present study suggests the sensitivity of dipstick about 81.25% and specificity 96.97%. After combining dipstick with routine microscopy the sensitivity increases upto 93.75% and specificity 99.75% so it is reliable to start antibiotic treatment on the basis of dipstick and routine microscopy till culture report is awaited to prevent morbidity and long term sequelae due to UTI.

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