Original Article

Efficacy of Dip Slide in Diagnosis of Urinary Tract Infection among Children

Kalavathy M[1], Earnest Daniel Prasad P[2], Kokiwar PR[3]

[1] Assistant Professor
Department of Pediatrics
[2] Assistant Professor
Department of Surgery
[3] Professor & HOD
Department of Community Medicine
Malla Reddy Institute of
Medical Sciences
Suraram, Hyderabad.

CORRESPONDENCE :

[1] Dr. Kokiwar PR
Professor and HOD
Department of Community Medicine
Malla Reddy Institute of
Medical Sciences
Hyderabad.
E-mail: kokiwar@gmail.com

ABSTRACT

Background: In practices, clinicians await confirmation of urinary tract infection (UTI) with a written report which results in delay in diagnosis and treatment. Moreover if a heavy mixed growth is obtained, a repeat culture is warranted. If antibiotic therapy has been initiated already, a confident diagnosis cannot be made and unnecessary investigations and follow up are considered despite lack of clear evidence of initial infection. Empirical antibiotic therapy is also initiated during the week-ends when laboratory facilities are unavailable.

Aim: To study the applicability of dip slide in diagnosing UTI in children.

Materials and Methods: Subjects of the present study were selected from the hospital admissions of Kasturba Medical College, Manipal for a period of 9 months. Patients were selected employing the suitable selection criteria. Diagnostic methods like bacteria / HPF, urine analysis, dip slide, and bacteruria were used. Data analysis was done using proportions, sensitivity and specificity.

Results: There was a male preponderance. Fever and failure to thrive were the commonest symptoms (68.8%). Of the 21 cases of UTI 12 correlated with leukocytosis and 15 with fever. Hydronephrosis was the commonest abnormality detected in those cases with proven UTI.

Conclusion: The dip slide is an efficient, easy and reliable method of detecting UTI with a high specificity (100%) and sensitivity (90.4%) rate. The p value of dip slide in this study was 0.0000 which is statistically, highly significant.

Keywords: Urinary tract infection, dip slide, antibiotic therapy, diagnosis, efficacy

INTRODUCTION

Although the true incidence of urinary tract infections (UTIs) in children is difficult to estimate, they are one of the most common bacterial infections seen by clinicians who care for young children. [1] The urinary tract is second only to the respiratory system, as the most common site of bacterial infections during childhood. The disease causes much suffering and inconvenience to many patients. It also results in huge costs for the family and society and requires a great deal of the pediatrician's time.

A single attack of UTI may be sufficient to result in chronic pyelonephritic scarring which may go undetected for years, until it may present with one of its complications such as hypertension, impaired growth or chronic renal failure. [2] Chronic recurrent infection interferes with nutrition, normal social, intellectual development and somatic growth, which is partly related to chronic illness and prolonged hospital admissions.

Prompt treatment depends on rapid diagnosis. However UTI is usually confirmed by a culture of a pure growth of a single bacterial pathogen at a viable count of >105 CFU/ml of urine which is a process inherent with delays, as the media has to the incubated. [3] If significant growth is present, it has to be sub cultured for sensitivity testing, during which time many laboratories do not issue an interim report but await final sensitivity tests.

In practices, clinicians await confirmation of UTI with a written report which results in delay in diagnosis and

treatment. Moreover if a heavy mixed growth is obtained, a repeat culture is warranted. If antibiotic therapy has been initiated already, a confident diagnosis cannot be made and unnecessary investigations and follow up are considered despite lack of clear evidence of initial infection. Empirical antibiotic therapy is also initiated during the week-ends when laboratory facilities are unavailable. With the above facts in mind, this study was undertaken, to determine the efficacy of dip slide in the diagnosis of UTI.

MATERIALS AND METHODS

Subjects of the present study were selected from the hospital admissions of Kasturba Medical College, Manipal for a period of 9 months.

Criteria for selection

The following criteria were used for the selection of the patients.

1. Symptoms referring to the urinary tract.
2. Unexplained fever of more than 2 weeks duration.
3. All children up to the age of 15 years who had urine cultures performed for suspected UTI.

Diagnostic Methods

Bacteria / HPF

A drop of un centrifuged freshly voided urine was examined under the high power of the microscope for the presence of bacilli. A total of 5 high power fields were counted and the average number of bacilli/HPF was noted.

Urine Analysis

5 ml of urine was centrifuged for 3 minutes, the supernatant was decanted and the sediment was examined under the high power field of the microscope. The number of WBC/mm3 was noted. More than 5 WBC/mm3 was considered as a high probability of UTI.

Dip Slide

A dip slide was devised using a plain glass slide, IV bottle rubber covers and a plain glass tube. The glass slide was covered with MacConkey agar on one side and Blood agar on the other slide. The agars (MacConkey and Blood) were poured at 600c for a length of 5 cm under UV light with air blower on an autoclaved slide. The dip slide was incubated overnight to rule out any contaminant colonies and then was stored in the refrigerator, the shelf life being 1-2 weeks. The dip slide growth was compared to standard charts and the growth assessed.

Clean catch midstream samples were collected in all patients, by parents, after careful cleansing of the external genitalia. The samples were collected in a sterile wide mouthed screw capped bottle and the dip slide was dipped into the specimen. If the sample obtained was too small then the urine was poured on both the sides of the dip slide. The excess urine was drained and the dip slide replaced in its sterile container. It was transported to the microbiology laboratory on the same day. If specimens were collected after working hours then it was incubated at room temperature and transported to the microbiology laboratory on the next day.

A routine sample of urine for culture was collected by midstream clean catch or supra pubic aspiration, after adequate preparation, in a sterile, wide mouthed screw capped bottle and processed immediately or refrigerated until processed but for no longer than 2 hours after collection. The calibrated loop method was used for plating MacConkey and Blood agar. The disc diffusion method was employed for determination of antibiotic susceptibility.

Bacteruria

Significant bacteruria was defined as a colony count of >105 CFU/ml of urine of a single species of bacteria cultured from a urine specimen. Lower counts with supra pubic aspiration were also considered significant. Patients with documented UTI were treated with the appropriate antibiotic for 10 - 14 days. Repeat urine cultures were performed at the end of the course of treatment, either while the child was on antibiotics or after stopping the antibiotics for 3 days.

RESULTS AND DISCUSSION

The total number of cases included in the study was 52. Of these, 29 were male (55.8%) and 23 were female (44.2%). The maximum number of cases was in the 2-5 years age group (53.8%). The incidence of UTI was found to be 40.38%. Aiyegoro OA et al in their study on UTI in Nigeria among children found that the incidence was 11.96%. [4] Boothman et al reported a prevalence of 13% in children aged between 3 months to 5 years. [5]

Table 1: Age and sex distribution of proven cases of UTI

Age	Male		Female		Total	
	No	%	No	%	No	%
0-1 year	0	0	1	100	1	4.8
2-5 years	9	60	6	40	15	71.4
6-12 years	2	40	3	60	5	23.8
Total	11	52.4	10	47.6	21	100

The number of culture proven cases of UTI was 21, of the 52 cases included in the study. It is a well known fact that the incidence of UTI is higher in females in all age groups except in the neonatal and early infancy period where males have a higher incidence.

In this study, there is a male preponderance which could be explained by the bias in the study. The objective of the study was to detect cases of UTI and as such, population at high risk for UTI's been included in this study. Many of the males included in this study were operated for posterior urethral valve, or for various upper tract anomalies. The preschool age group appears to have a higher incidence of UTI but as the total number of cases is small it would be difficult to draw any definite conclusions.

Table 2: Pattern of symptoms in culture proven cases of UTI

Signs and symptoms	Number of patients	Percentage	P value
Fever	15	68.8	0.602
Failure to thrive	15	68.8	0.010
Dysuria	11	50	0.146
Past history of UTI	10	45.4	0.263
History of instrumentation	10	45.4	0.005
Vomiting	09	40.9	0.494
Enuresis	07	31.8	0.865
Past history of surgery	07	31.8	0.331
Increased frequency	05	22.7	0.428

Above table indicates that fever and failure to thrive were the commonest symptoms (68.8%), but fever was not found to be statistically significant as there were a high number of false positives. It is therefore a non specific symptom. Failure to thrive was also noticed in 68.8% of cases and is found to be statistically significant. Correlation of history of instrumentation and UTI was statistically significant. Smellie et al [9] in their study have indicated that instrumentation of any kind predisposes to infection and prophylaxis for the same, should be instituted for 24 – 48 hours. Similarly "failure to thrive" is a common presentation of UTI, and its complications in children. [10] Sharma A et al also reported that fever was the most common presentation (65.0%) followed by abdominal pain (42.5%), decreased appetite (37.5%) and dysuria (37.5%). [6] Islam MN et al found that fever was the most common clinical presentation (82%). Pyuria was detected in 92% of cases. [11] Brkic S et al also reported in their study that the most common symptom was fever, which was found in 54.9% (90/164) children. [12]

Table 3: Correlation of fever and leukocytosis with UTI (proven)

	Bacteruria				P value
	+ve	-ve	False +ve	False -ve	
Leukocytosis >/ 15,000	12	21	10	9	0.74
Fever	15	11	20	6	0.6025

Of the 21 cases of UTI 12 correlated with Leukocytosis and 15 with fever but neither are statistically significant as the number of false positives and false negatives are high, both being nonspecific indicators of any serious infection.

Table 4: Correlation of urine culture by supra pubic collection with OPD procedures

	Routine Culture						
	+ve	-ve	False +ve	False -ve	P value	Sensitivity	Specificity
(1) Bacteria />/3 HPF	6	10	0	6	0.0000	50%	100%
(2) WBC />/ 5 HPF	12	10	0	0	0.0087	100%	100%
(3) DIP SLIDE	11	10	0	1	0.00002	91.67%	100%

Though the examination of urine microscopically for bacteria has a good predictive value, only the specificity is consistently high. The sensitivity rates are low due to the large number of false negatives noted in this study. A screening procedure requires a high specificity and sensitivity rate to make it ideal for routine use. The yield of bacteria in urine, detected by microscopic examination would probably be increased by performing other procedures such as gram staining or centrifugation of the specimen.

Urine microscopy has a consistently high specificity and sensitivity which indicates its efficacy as a good screening procedure. This has been well established by various authors, but particularly well brought out in the study done by Robin et al. [13] But this procedure remains an indirect indicator of infection. It is demonstration of bacterial growth and not leukocytes which confirm UTI, as leucocytes from the vagina may contaminate the urine specimen. Moreover, when Urine microscopy does not indicate infection (WBC < 5/HPF), the child may have growth of bacteria from the urine culture.

The dip slide culture technique has a high specificity as there are no false positive cases. The sensitivity rate is comparatively lower as there are 2 false negatives. Both of these patients were on antibiotics. Bonadio et al, have demonstrated an increase in false negatives when dipslides were used on patients on antibiotics and have recommend that antibiotics be discontinued for 3 days prior to dipslide culture. [14] The other advantages were, the technique was simple, easy to perform and no problems with storage or transport of urine are encountered. Moreover culture reports are available within 24 hours and confident antimicrobial therapy can be instituted if sensitivity testing is done on the slide itself [15] Whiting P et al also concluded that dipstick negative. for both LE and nitrite or microscopic analysis negative

for both pyuria and bacteriuria of a clean voided urine, bag, or nappy/pad specimen may reasonably be used to rule out UTI. These patients can then reasonably be excluded from further investigation, without the need for confirmatory culture. Similarly, combinations of positive tests could be used to rule in UTI, and trigger further investigation. [16]

Table 5: Incidence of associated urinary tract abnormalities in the proven cases of UTI

Abnormalities	No. of case	%
Hydronephrosis	3	14.28%
PUJ	2	9.52%
Ureteral Abnormalities	2	9.52%
PUV	2	9.52%
VUR	1	4.76%
Hypospadiasis	1	4.76%

This table indicates that hydronephrosis was the commonest abnormality detected in those cases with proven UTI. Through VUR was present in 3 of the cases included in the study only one had proven UTI. Other common abnormalities were of the upper urinary tract and were posterior urethral valve.

CONCLUSION

1. Urine microscopy has a consistently high specificity (87%) and sensitivity (95%). But the number of false positives is high which is not preferable as in UTI even a single episode is considered significant enough to entail investigation.
2. In this study bacteria / HPF has a low sensitivity rate (42.8%) which would seem to preclude its use as a screening procedure for UTI. The p value for bacteria / HPF in this study was 0.00006 which is statistically significant. This is because the specificity rate in this study was 100%, the p value being influenced by sensitivity and specificity rates of the screening procedure and the prevalence of the disease.
3. The dip slide is an efficient, easy and reliable method of detecting UTI with a high specificity (100%) and sensitivity (90.4%) rate. The p value of dip slide in this study was 0.0000 which is statistically, highly significant.
4. The drawback in the dip slide is the decrease in sensitivity when the patient is on antibiotics and culture is performed.

CONFLICT OF INTEREST

The authors declared no conflict of interest.

FUNDING: None.

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