DOI: https://doi.org/10.53350/pjmhs221631126

ORIGINAL ARTICLE

Clinical Utility and Accuracy of UTI Calculator for Estimating the Probability of Urinary Tract Infection in Young Febrile Children

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ABSTRACT

Objective: To investigate the accuracy of the UTI Calculator (UTI Calc) in predicting UTI in children by comparing the results of urine culture sensitivity tests (C/S).

Study Design: Cross-sectional/descriptive study

Place and Duration: The study was conducted at Urology Ward of Saidu Group of Teaching Hospitals, Swat during the period from 1st June 2020 to 31st December 2020.

Methods: A total of eighty five children having ages from 4 to 24-months were presented. Children with fever >38ºC were included. Following informed written agreement from the authorities, the demographics of enrolled cases were documented. Efficacy of UTI calculator was assessed in terms of diagnosing urinary tract infection among children. SPSS 21.0 was used to analyze complete data.

Results: Among 85 cases, majority were male 50 (58.8%) infants and 35 (41.2%) were females. The mean age of the children was 8.44±7.65 years. Frequency of UTI was found among 9 (10.6%) febrile infants. Among 85 patients clinical UTI was high in 45 (52.9%) cases and by urine examination UTI found among 10 (10.6%) cases. Frequency of sensitivity was 100% and specificity 96%. E. coli was the predominant bacterium in 10 (11.8%) and urine cultures positive in (7.1%).

Conclusion: In children, just a few clinical signs and symptoms are helpful in diagnosing or ruling out a urinary tract infection. Clinical prediction rules may be more accurate, but they need be externally verified. Urine collection should not be limited to children who have an unexplained fever or other symptoms that imply a urinary tract infection.

INTRODUCTION

One of the most prevalent reasons for going to the doctor is an acute illness in a youngster. It has been well reported that incidence of urinary tract infection (UTI) in children consulting for any acute disease can range from 2% to 20% [1, 2]. Most of this study has been done in hospitals [1–3]. UTI prevalence was identified in only one investigation that routinely tested urine from consecutively presenting children with acute illness in primary care. [3]. However, that study did not have the power to accurately quantify the predictive value of symptoms and indications.

As many as 50% of young children who attend to primary care may have a urinary tract infection (UTI) [4, 5]. Clinical diagnosis of urinary tract infections (UTI) in young children is difficult because: (1) pre-verbal (predominantly under 3 years) children cannot articulate symptoms and present with the same non-specific symptoms (e.g. fever, irritability, vomiting and poor feeding) when suffering from a wide range of illnesses; (2) identifying dysuria in children wearing nappies (diapers) is difficult; (3) obtaining urine samples is often challenging and time-consuming; and (4) the lack of a urine culture laboratory makes it difficult to distinguish between urinary tract infections and other illnesses. As a result, the diagnosis of a urinary tract infection (UTI) is frequently delayed, ignored, or misdiagnosed (such as otitis media).

Based on the data obtained from urine screening tests, the doctor must recalculate the risk of UTI and decide if empirical antibiotic therapy is necessary before the results of a urine culture test are available. Many times, interpreting screening test findings is not easy (eg, for a child with trace amounts of leukocyte esterase).

One meta-analysis, which included searches back to 2007, and one systematic review were both published in 2011.

[11,12] The purpose of this study was to gather the most recent information on the diagnostic significance of signs and symptoms for paediatric UTI, in order to determine the likelihood of UTI before urine sample..

The authors state that "accurate identification of UTI is critical to minimize the delay in diagnosis and to avoid inappropriate treatment with antimicrobial medicines. Using this method, testing and therapy may be tailored to the specific risk factors of the kid being tested, perhaps improving the result for children with UTI. "

MATERIAL AND METHODS

This cross-sectional/descriptive study was conducted at Urology Ward of Saidu Group of Teaching Hospitals, Swat during the period from 1st June 2020 to 31st December 2020 and study was consisted of 85 patients. Following informed written agreement from the authorities, the demographics of enrolled cases were documented. Excluded patients were those referred from other hospitals after receiving antibiotic therapy, those who took oral antibiotics, those who had convulsions and were suspected of having meningitis, and those who refused to sign an informed consent form. Patients with neurogenic bladder or febrile children with known renal/bladder abnormalities were also excluded from the research.

Aseptic urethral catheterization was used by the doctor or nurse to collect urine; no other approach, such as paediatric bag urine collection, was used. The sample size of 75 was calculated using the Openepi sample size calculator with a prevalence of UTI of 5.3 percent 2 and a 95% confidence interval and a 5% error margin.. Records exist for age, gender, circumcision in male children, the highest temperature ever recorded, and any prior use of antibiotics. Age was given as the mean standard deviation (SD), whereas the qualitative variables were expressed as the frequency and the percentage of the total population.

This calculator (UTI Calc) was used to assess the chance of a UTI in preverbal toddlers by looking at clinical and laboratory risk variables. The calculator has two models (Clinical Model and Laboratory Model). A total of five clinical risk variables (body temperature 390C, brown race, uncircumcised male or female and without any other known cause of pyrexia) were included. The Laboratory model has five sub-models. clinical and nitrite and LE metrics are all incorporated in the dipstick model. The Gram stained urine smear data is also included in the clinical and dipstick model variables. Urine white blood cell (WBC) count (WBC/L) is included in the hemocytometer model.

In addition to clinical and hemocytometer models, the Gram stain data were included in the enhanced urine analysis model. Urine analysis model: bacteria per high-power field (HPF) and

variables from clinical and dipstick models were all included. It is characterised as the presence of at least 50 CFU/ml of uropathogen in the urine, as well as a pyurid cell count of less than 5/HPF or less than 10/L. Clinically, a 2 percent risk cutoff was used, whereas the laboratory model used a 5 percent risk cutoff, indicating that children with a high chance of UTI require antibiotic therapy.

It was evaluated by our free online UTI Calc based on clinical features and classed into high or low risk, depending on the severity of the infection. The dipstick model in UTI Calc was used to calculate the probability of UTI based on nitrites, LE, WBC/mm3, and bacteria in the urine. UTI Calc risk prediction was associated with results from culture and sensitivity tests on urine samples. A urine culture was used to test the accuracy of UTI Calc's sensitivity, specificity, positive and negative predictive values.

RESULTS

Among 85 cases, majority were male 50 (58.8%) infants and 35 (41.2%) were females. The mean age of the children was 8.44±7.65 years.(table 1)

Table 1: Gender and age of enrolled cases

Variables	Frequency	Percentage
Mean Age (years)	8.44±7.65	
Gender		
Male	50	58.8%
Female	35	41.2%

Frequency of UTI was found among 9 (10.6%) febrile infants.(fig 1)

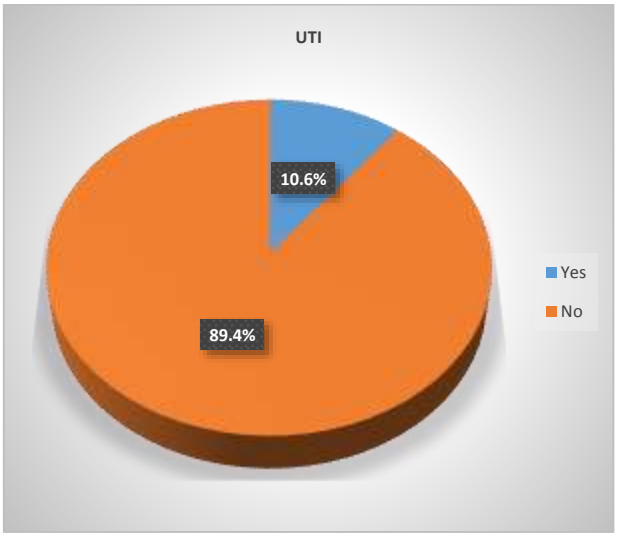

Figure 1: Prevalence of UTI among Febrile Infants

Among 85 patients clinical UTI was high in 45 (52.9%) cases and by urine examination UTI found among 10 (10.6%) cases.(table 2)

Table 2:

UTI	Frequency	Percentage
Clinical		
High	45	52.9%
Low	40	47.1%
Dipstick		
High	10	10.6%
Low	75	89.4%

Frequency of sensitivity was 100% and specificity 96% was assessed by UTI calculator.(table 3)

Table 3: Sensitivity and specificity by UTI calculator

UTI	Specificity	Sensitivity
Laboratory	100%	96%
Clinical	60%	35%

E. coli was the predominant bacterium in 10 (11.8%) and urine cultures positive in (7.1%).(table 4)

Table 4: Laboratory findings

Variables	Frequency	Percentage
E coli		
Yes	10	11.8%
No	75	89.2%
Urine cultures positive		
Yes	6	7.1%
No	79	92.9%

DISCUSSION

Children under the age of three should have a urinalysis and a urine culture conducted due to a dearth of studies. [13] An unexplained fever (>38 o C) in newborns and young children must be evaluated a possible cause of the fever by physicians. [14]

In this study 85 children with ages 4-24months had fever >38ºC were presented. Among 85 cases, majority were male 50 (58.8%) infants and 35 (41.2%) were females. The mean age of the children was 8.44±7.65 years. These were comparable to the previous studies.[15,16] Frequency of UTI was found among 9 (10.6%) febrile infants. Among 85 patients clinical UTI was high in 45 (52.9%) cases and by urine examination UTI found among 10 (10.6%) cases. An estimated 15.5% of febrile infants under the age of two have a urinary tract infection, according to a research published in the journal Pediatrics by Gonzalez. [17] Large sample sizes and multi-center research are to blame for these findings. Using a diaper screening test and LE, researchers in Japan discovered a much greater rate. [18] The sampling technique and sample size might be to blame for the discrepancy in the prevalence of UTI.

Natriuretic acid (NA) and lactic acid (LE) are seen on the urine dipstick, which we employed in our study to identify urinary tract infections in children. Using urine culture as the gold standard, we found that both LE and nitrites were extremely sensitive and specific for UTI diagnosis. Nitrites alone have a very high chance ratio according to a review publication, which supports our findings. There are many factors that contribute to the inability of LE alone to accurately diagnose illness. It is better to use LE and nitrites as a combination for both diagnosis and exclusion of illness. A positive LE and nitrites dipstick test has the greatest positive likelihood ratio, whereas a negative LE and nitrites dipstick test has the highest negative likelihood ratio, indicating that these tests can be used to rule out illness. [19] Microscopy and dipstick testing for LE and nitrites, as well as other screening techniques, are routinely utilised, however they have limited sensitivity. Dipstick alone remains the preferred strategy for infection control, even if a combination of positive test findings is more specific. When it comes to diagnosing and treating patients, precise predictions of culture outcomes are critical for doctors. [20]

E. coli was the predominant bacterium in 10 (11.8%) and urine cultures positive in (7.1%). Frequency of sensitivity was 100% and specificity 96% was assessed by UTI calculator. To rule out a urinary tract infection (UTI), a urine dipstick test that shows no LE or nitrites, as well as microscopic analysis of the urine sample for pyuria or bacteria, can be considered a success. These youngsters can then be securely excused from further evaluation without the requirement for a urine culture. It is also possible to make decisions based on a combination of positive tests. [21] A dipstick and microscopy-based laboratory model outperformed the clinical model in terms of sensitivity and specificity. There is some evidence that clinical diagnosis based on parent-reported symptoms, indicators elicited by the doctor, diagnosis of UTI given by the doctor and the findings of a urine dipstick is useful for diagnosing young children with UTI. [22] According to a

comparable study, children's clinical judgement correctly predicted nearly half of those who had a diagnosed UTI. [23]

CONCLUSION

Using UTI calc, a good online tool for predicting urinary tract infection in preverbal febrile toddlers, is a great idea. In preverbal febrile infants, the clinical model-based UTI diagnosis has low sensitivity and specificity for UTI detection, however urine dipstick and microscopy give an extra diagnostic value for empiric antibiotic treatment.

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