Journal of Neonatal Surgery
ISSN(Online): 2226-0439
Vol. 14, Issue 4s (2025)
https://www.jneonatalsurg.com

OPEN ACCESS

A Study on Urine Analysis Parameters and Antimicrobial Susceptibility of Uropathogens Among Children of Suspected Uti In A Tertiary Care Hospital

Dr. Ganesh Nampelli[1], Dr. Santosh Reddy Gunnala[2], Dr. Rachana Nimmagadda[*3], Dr. Vangala Sateesh Kumar Redy[4]

[1,4] Post Graduate, Department of Paediatrics, Apollo Institute of Medical Sciences and Research, Hyderabad.

[2,*3]Assistant Professor, Department of Paediatrics, Apollo Institute of Medical Sciences and Research, Hyderabad.

***Corresponding Author:**

Department of Paediatrics, Apollo Institute of Medical Sciences and Research, Hyderabad.

Cite this paper as: Dr. Ganesh Nampelli, Dr. Santosh Reddy Gunnala, Dr. Rachana Nimmagadda, Dr. Vangala Sateesh Kumar Redy, (2025) A Study on Urine Analysis Parameters and Antimicrobial Susceptibility of Uropathogens Among Children of Suspected Uti In A Tertiary Care Hospital. *Journal of Neonatal Surgery*, 14 (4s), 1316-1328.

ABSTRACT

Background: Urinary tract infections (UTIs) are the most frequently seen genitourinary condition in children. A urinary tract infection refers to any infection affecting the kidneys, ureters, bladder, or urethra [(1)]. This represents a serious concern that pediatric healthcare providers regularly encounter and is one of the most common bacterial infections encountered in typical clinical settings [(2, 3)].

Objectives:

- To determine the prevalence of UTI among the children of suspected UTI, urinary tract anomalies, and fever without focus.

Material & Methods: Study Design: Hospital-based Cross-sectional study. **Study area:** The study was conducted in the Department of Paediatrics. **Study Period:** 1 year. **Study population:** All children who were admitted in the paediatric department during the study period and fulfilled study criteria were enrolled**. Sample size**: The study consisted of a total of 210subjects.

Results: Among the urine culture positive cases, urinary tract defects are seen in 52.4 % of the population that is 18 out of 34 culture positive cases. The most common urinary tract defect seen in UTI positive patients is hydronephrosis. 7 out of 34 (20.5%) population were having hydronephrosis and 4(11.7%) have hypospadias and the rest were having renal caliculi (8.4%) and PUJ obstruction (4.48%). The prevalence of urinary tract anomalies in children with urinary tract infection was found out to be 52.4%.

Conclusion: While urine culture is considered the definitive method for diagnosing a urinary tract infection (UTI), it can be time-consuming and expensive. Therefore, evaluating additional parameters can aid in the early identification and prompt initiation of antibiotic treatment. This research offers important insights into urine analysis markers such as pus cells, leukocyte esterase, and nitrite.

Keywords: *Urinary tract infections, Klebsiella pneumonia, sensitivity and specificity*

1. INTRODUCTION

Urinary tract infections (UTIs) are the most frequently seen genitourinary condition in children. A urinary tract infection refers to any infection affecting the kidneys, ureters, bladder, or urethra [(1)]. This represents a serious concern that pediatric healthcare providers regularly encounter and is one of the most common bacterial infections encountered in typical clinical settings [(2, 3)]. The infection occurs when uropathogens from the gut contaminate the area around the urethra and/or enter the urethra through blood circulation. Following this, the superficial umbrella cells are colonized and invaded as the pathogens migrate to the bladder and produce various virulence factors [(4)].

Identifying urinary tract infections in children can be challenging because the symptoms are often vague and variable. Symptoms such as dysuria, fever, and poor appetite may occur [(5)]. An upper urinary tract infection can impact the renal

parenchyma, potentially leading to irreversible damage and scarring. This may, in turn, contribute to hypertension and diminished kidney function [6]. Urinary tract infections can be caused by bacteria that are either Gram-positive or Gram-negative. Escherichia coli is responsible for approximately 85% of pediatric UTI cases, followed by Klebsiella pneumoniae, Proteus mirabilis, Enterococcus faecalis, and Staphylococcus saprophyticus [4].

Due to variations in geography, antibiotic usage patterns, and various other factors, the occurrence of pediatric UTIs varies by country [7]. By the age of seven, it is estimated that 2% of boys and 8% of girls will have had at least one UTI episode. Over the course of a year, 12–30% of these children will experience a recurrent episode. For instance, data from Australian hospital admission records indicate that 12 percent of pediatric admissions are related to UTIs [5]. Within one or two years of being diagnosed with a UTI, 3 to 15% of children may show abnormalities in renal tissue [8]. Timely diagnosis of pediatric UTIs is crucial to prevent kidney damage and recurrence. Accurate diagnosis of UTIs is essential to avoid unnecessary antibiotic prescriptions and expensive tests [9].

Due to its vague symptoms and resemblance to other common infections, especially in a time of rising antibiotic resistance, managing UTIs presents difficulties, can lead to significant illness, and is often overlooked [10,11]. To achieve the best possible outcomes without compromising patient safety, it is essential to select the most appropriate antibiotic. To alleviate the patient's discomfort, supportive measures such as pain relief along with non-pharmacological recommendations like adequate hydration, circumcision, genital cleanliness, breastfeeding, and initiating toilet training at an early age are vital [12,13].

The rise in difficult-to-treat urinary tract infections (UTIs) in children can be attributed to the worldwide increase of multidrug-resistant pathogens [14]. Antibiotic resistance among pediatric patients poses a significant challenge for public health on a global scale, including in India. Escherichia coli is responsible for the majority of UTIs, representing approximately 90% of infections reported in community settings and about 50% of those in hospitals [15,16].

Besides Escherichia coli, other identified pathogens include species from Klebsiella, Proteus, Acinetobacter, Pseudomonas, Staphylococcus, Enterococcus, and Streptococcus [17,18]. Common symptoms of urinary tract infections (UTIs) include dysuria, increased frequency of urination, and cystitis [19]. Failing to treat a UTI can lead to severe health complications such as kidney damage, renal scarring, and kidney failure [20]. A significant number of women are affected by this issue, with approximately 40–50% experiencing UTIs [19].

Children younger than two years are also at risk for UTIs, which can happen in both community and hospital environments [21]. Approximately 2% of boys and 5% of girls experience at least one UTI before reaching seven years old [22,23]. Diagnosing UTIs in young children can be challenging because they may struggle to articulate their symptoms. Conversely, older children may report discomfort during urination, which can manifest as burning sensations, loss of bladder control, frequent urination, and urine with a foul odour [24]. It is important to note that men are more prone to complicated UTIs than women, although uncomplicated UTIs typically resolve without needing sensitivity analysis or culture tests [25]. The initial adhesion of bacteria is a primary factor in many infections, leading to the formation of a biofilm that enhances resistance to the immune responses of the host [26]. Numerous studies have shown the presence of various antibiotic resistances in uropathogens, and growing concerns regarding multidrug resistance (MDR) and extended-spectrum beta-lactamases (ESBLs) are becoming increasingly common on a global scale [19,26].

Throughout the years, chemotherapy has demonstrated significant effectiveness as a treatment for urinary tract infections (UTIs). Nevertheless, several factors, such as the accessibility of medications without a prescription and improper dosages and durations of antibiotic courses, have resulted in the rise of antibiotic resistance among frequently encountered infections [28]. Usually, physicians initiate empirical treatment for suspected UTIs prior to receiving urine culture results. Thus, it is essential for doctors to be knowledgeable about the sensitivity patterns of common causative pathogens to commence empirical therapy [29].

It is important to recognize that the agents responsible for UTIs and their susceptibility patterns vary by region, even within the same country. These patterns may also change over time. Therefore, formulating antibiotic guidelines and effectively treating UTIs are vital in combating antibiotic resistance and multidrug resistance. In this context, clinical microbiologists play a crucial role in identifying pathogenic organisms and collaborating with physicians to devise personalized antibiotic treatment plans for each patient, which helps reduce antibiotic overuse, prescription errors, and potential drug interactions.

AIM: To evaluate the urine analysis parameters and to determine prevalence of etiological agents, and antimicrobial sensitivity patterns.

OBJECTIVES:

- • To determine the prevalence of UTI among the children of suspected UTI, urinary tract anomalies, and fever without focus.
- • To evaluate sensitivity and specificity patterns of pus cells, nitrates, leukocyte esterase in detecting UTI.
- • To determine the prevalence of uropathogens, and antimicrobial sensitivity patterns of UTI amongst children admitted.

2. MATERIAL & METHODS:

Study Design: Hospital-based Cross-sectional study.

Study area: The study was conducted in the Department of Paediatrics.

Study Period: 1 year.

Study population: All children who were admitted in the paediatric department during the study period and fulfilled study criteria were enrolled**.**

Sample size: The study consisted of a total of 210subjects.

The estimated sample size was tabulated, Assuming 95% Confidence Interval with prevalence of 16.3% and relative precision of 5% with 5% level of significance.

n = (1.96*1.96*p*q) / (d*d)

P= prevalence, q = (1-p), d= 0.5 N = 210

Sampling Technique: Simple Random technique.

Inclusion Criteria:

• Children with suspected UTI

• Children with urinary tract abnormalities

• Children with fever without focus

Exclusion criteria:

• Children who received antibiotics within two weeks prior to the study.

•Who didn't give consent to the study.

Ethical consideration: Institutional Ethical committee permission was taken before the commencement of the study.

Study tools and Data collection procedure:

Investigations required:

• CUE (which include pus cells, nitrites, leukocyte esterase)

•URINE C/S

Pre tested structured Questionnaire was used to collect data regarding demographic profile, symptoms at the time of admission, vitals of the patients, along with the fever profile, urinanalysis parameters and antimicrobial susceptibility along with the length of hospital stay.

Sample Collection:

BD Urine Collection Kit, Franklin Lakes, NJ, USA, provided 20 mL sterile screw-capped vials for the collection of clean-catch midstream urine (MSU) samples from suspected UTI patients. Samples were moved to a container with 0.2 mg of boric acid added to stop bacterial growth. Patients received instructions on aseptic sample collection to ensure appropriate urethral sample collection.

Dipstick Urinalysis:

Dipstick urinalysis was done using Combur 10-Test M strips with reagent pads for semi quantitative assessment of pH, specific gravity, leukocyte esterase, nitrite, protein, glucose, ketones, urobilinogen, bilirubin, and blood. Leukocyte esterase and nitrite reactions were evaluated as predictive parameters for UTI.

Criteria for positive and negative parameters:

a. Nitrite: clear positive or negative

b. LE: Trace, +1, +2, +3 taken as positive, or negative

Microscopic Sediment Urinalysis:

Manual microscopic sediment inspection was performed as follows: each urine sample (10 mL) was centrifuged at 1,500 rpm for 5 min, and the supernatant was removed. At least 20 random microscopic fields were examined at X40 high power field (HPF) for each sample, and the mean number of cells and particles/HPF were calculated.

a. Bacteria: presence of bacteria is positive and absence of bacteria is negative

b. Pus cells: >5 cells/HPF taken as positive and <5/HPF is taken as negative.

Bacterial Isolation and Identification Procedures:

Isolation of uropathogens was performed by a surface streak procedure on both 5% sheep blood and MacConkey agar (Biomark Laboratories, Pine 411041, India) using 5µL calibrated loops for semi quantitative method and incubated aerobically at 37 °C for 24 hours, and those cultures which becomes negative at the end of 24 hours incubations were further incubated for 48 hours.

A specimen was considered positive for UTI if a single organism (pure colonies) was cultured at a concentration of ≥105cfu/ml. In instances of mixed bacterial growth, the procedure was repeated with fresh samples of patients. These were done to rule out possible contamination. Each colony, representing an isolate was picked and sub- cultured on MacConkey agar to obtain pure culture. Identification of bacteria was done by colonial morphology and standard biochemical tests.

Antimicrobial Susceptibility Testing:

Antimicrobial susceptibility of isolates was performed by the disc diffusion assay on Muller Hinton Agar by Kirby-Bauer method. The antibiotic discs and their concentrations were: Piamoxicillin and clavulinic acid (30 µg), Ciprofloxacin (5µg), Ceftriaxone (30 µg), Gentamicin (10µg), Piperacilin (20µg), Amikacin (30µg), Nitrofurantoin (300µg), Nalidixic Acid (30µg), Ceftadizim (20µg), Norfloxacin (20µg), Tetracycline (30µg), and Levofloxacin (5µg). All the antimicrobials used for the study were obtained from Biomark Laboratories, Pine 411041, India. A standard inoculum adjusted to 0.5 McFarland was swabbed on to Muller-Hinton agar (Biomark Laboratories, Pine 411041, India); antibiotic disc was dispensed after drying the plate for 3–5 minutes. The reference strains used as control were E. coli (ATCC 25922), S. aureus (ATCC25923) and P. aeruginosa (ATTC 27853). Inhibition zone diameters were measured to the nearest millimeter with a slide gauge and interpreted according to the CLSI guidelines [30,31]

Urine samples were inoculated with a 0.01 mL inoculum on Cysteine–lactose electrolyte–deficient (C.L.E.D.) agar medium using a 4 mm nichrome wire inoculating loop. After that, the culture plates were incubated for 24 to 48 hours at 37 °C. Plates were examined for definite, unambiguous bacterial growth after incubation. The incubation period was increased by 24 hours if no colonies could be seen. We relied on colony counts above >104 for catheterized sample and above 105 CFU/mL for midstream urine suggesting severe bacteriuria, to confirm positive urine cultures.

Data Collection:

All the patients that met the inclusion criteria in paediatric department of Apollo Institute of Medical sciences and research, Jubilee hills are followed up till the length of the hospital stay and the lab reports were collected and entered into MS Excel spreadsheet for the analysis.

Statistical Analysis:

The data from the data collection sheet and patient records were entered into a MS Excel spreadsheet. Statistical analysis was performed using SPSS software latest version 24.0. Descriptive analysis was done and is expressed as mean ± SD for quantitative variables and percentages (%) for qualitative variables. The sensitivity, specificity, predictive values (positive and negative) and accuracy for the parameters analyzed as predictors of UTI were calculated using positive urine culture as standard. To investigate any statistically significant association between patients' complaints and culture positivity, chi square test of association was employed. P values, <0.05 were considered significant.

The following formulas were used for statistical analysis.

Sensitivity = True positives / True positives + False negatives

Specificity = True negatives / True negatives + False positives

Positive Predictive Value = True positives / True positives + False positives

Negative Predictive Value = True negatives / True negatives + False negatives

3. OBSERVATIONS & RESULTS

Table no – 1: Age distribution of study participants

Age distribution	Frequency	Percent
<1 year	62	29.5%
1 to 5 years	78	37.1%

5 to 10 years	33	15.7%
>10 years	37	17.6%
Total	210	100%

Among the 210 study group the major proportion 78 (37.1%) of the sample population belongs to the age group of 1 to 5 years followed by 62 (29.5%) belongs to less than one year. The lowest number of sample 33 (15.7%) belongs to the age group of 5 to 10 years.

Majority of the study participants are males comprising 63.8% (134) while females consists of 36.2% (76). Out of 34 culture positives for urinary tract infection, 14 (41.1%) were females and 20 (58.8%) were males.

Table no – 2: Various symptoms of UTI positive cases.

Symptoms	**Culture positive children (N=34)**	**Percentage (%)**
Fever	25	73.5
Vomiting	5	14.7
Dysuria	13	38.2
Pain abdomen	14	41.1
Diarrhoea	5	14.7
Refusal of feeds	2	5.8
Decreased urine output	4	11.6
Burning micturition	5	14.7

Majority of the children from our study presented with chief complaints of fever (70.5%), pain abdomen (69%), and burning micturition (69%). Other symptoms are dysuria (3%), vomitimgs (2.9%) and Very less proportion of population were having symptoms of diarrhoea (2%) and dehydration (1%).

25 out of 34 children with culture positive have Fever and the rest of the children don't have any symptoms at the time of presentation but have urinary tract defects like Hypospadias, Bilateral hydroureteronephrosis, posterior urethral valve, vesicoureteric reflux.

Out of the total population having fever, 89(42%) of them were having a high grade fever, 37(17.6%) of them have moderate grade of fever while the remaining have low grade fever. 62(29.5%) out of 210 study population didn't have any complaints of fever.

Out of the 210 sample population none of them had a history of prior antibiotic use. When asked for Urinary tract defects 139(67%) out of 210 were found to be not having any abnormality related to urinary tract. The percentages of the people having various defects are tabulated.

Table no – 3: Type of urinary defects in sample population

Type of urinary defect	Number of cases	Percentage of sample population
B/L URETEROCELE	1	0.48%
CYSTITIS	2	1%
HYDRONEPHROSIS	22	10.57%
HYPOSPADIAS	23	11%
PUJ OBSTRUCTION	9	4.48%
URETERONEPHROSIS	3	1.5%
POSTERIOR URETHRAL VALVE, B/L HYDROURETERONEPHROSIS	2	1%
RENAL CALCULI, UNILATERAL HYDROURETERONEPHROSIS	2	1%
URETHRAL STRICTURE	3	1.5%
VUR	2	1%

The types of urinary defects ranged from simple renal calculi to bilateral ureterocele. The highest portion of the sample were having hypospadias 11% (23) followed by hydronephrosis 10.57% (22). Renal calculi, VUR, PUJ obstruction, Urethral stricture is seen in 1%, 1%, 4.4%, 1.5 % of the sample respectively.

Among the urine culture positive cases, urinary tract defects are seen in 52.4 % of the population that is 18 out of 34 culture positive cases. The most common urinary tract defect seen in UTI positive patients is hydronephrosis. 7 out of 34 (20.5%) population were having hydronephrosis and 4(11.7%) have hypospadias and the rest were having renal caliculi (8.4%) and PUJ obstruction (4.48%). The prevalence of urinary tract anomalies in children with urinary tract infection was found out to be 52.4%.

Abdominal mass is felt in 1%(2) of the population and tenderness is seen in 5 (2.5%) of the sample. Apart from all these, one patient presented with hematuria and one with sepsis. Tests for typhoid, dengue, malaria were negative in all the patients. All the vitals of the patients were noted time to time. All the other systems like cardiovascular, respiratory, gastrointestinal and central nervous system were seems to be normal.

68% (143) of the total urine samples have pus cells less than 5 and the remaining 32% (67) have pus cells greater than 5. In urinalysis for nitrite and leucocyte esterase, 17(8.1%) samples were tested positive for nitrite while 33(15.7%) were positive for leucocyte esterase.

Table no – 4: Urinalysis of the culture positive patients

	LEUCOCYTE ESTERASE		NITRITE	
	Frequency	Percent	Frequency	Percent
NEGATIVE	23	67.6	12	35.3
POSITIVE	11	32.3	22	64.7
Total	34	100	34	100

In urinalysis of culture positive urine samples, 22 (64.7%) samples were tested positive for nitrite while 11 (32.3%) were positive for leucocyte esterase. 12 of the UTI patients samples were turned out to be negative for nitrite and 23 turned out to negative for leucocyte esterase. 8 (23.5%) samples were found to be positive for both nitrite and leucocyte esterase. 9 (26.4%) of the samples were found to be negative for both leucocyte esterase and nitrite. On urine culture, the growth of microorganisms is seen in 34 samples comprising of about 16.2%of the total samples. While 176(83.8%) have no growth on culture.

Out of the 34 samples having growth of organisms, 26 (76.4%) are E.Coli and 7 (20.5%) are Klebsiella species and 1 (3.1%) is Proteus.

Out of 210 patients who had UTI symptoms, 34 had a positive urine culture test. Out of 34 culture positive patients, 25 (73.5%) were male and 9 (26.5%) were female. Among the 34 patients most commonly isolated organism was E. coli contributing to approximately 26(76.4%) of the culture positive cases out of which 18 were male and 8 females. Second most common isolated organism was Klebsiella pneumoniae with 20.5% cases followed by Proteus with 3.10%.

Table no – 5: Routine blood tests

Test	**Result**	**Number**	**Percentage**
Hb	Anemia	61	29%
	Normal	149	71%
TLC	High TLC	62	29.5%
	Normal	148	70.5%
CRP	Positive	30	14.3%
	Negative	180	85.7%

Anemia was found to be prominent in 61(29%) of the population. Whereas the rest 129 were having normal hemoglobin levels. When looked for total leucocyte count as a suggestive feature for bacterial infection, 148(70.5%) have their leucocyte count in the normal range while the rest 62(29.5%) were having an increased leucocyte count.

C-reactive protein which is a marker of inflammation in the body was found to be positive in 30 (14.3%) of the sample while it was found to be negative in 180(85.7%) of the population. All the other common causes for fever like dengue, malaria and typhoid were tested and none of the sample found out to be positive for any of them.

Table no – 6: Sensitivity pattern of the UTI to different drugs

Sensitive to Drugs	**Yes/No**	**Frequency**	**Percentage(%)**
Sensitive to 3rd generation Cephalosporin	Yes	20	58.8
	No	14	41.1
Sensitive to Aminoglycosides	Yes	31	91.1
	No	3	9.9
Sensitive to Penicillin	Yes	25	73.5

	No	9	26.47
Sensitive to other drugs	Yes	24	70.5
	No	10	29.5
Sensitive to all three group of drugs	Yes	18	52.9
	No	16	47.1
Sensitive to cephalosporin and aminoglycosides	Yes	19	55.8
	No	15	44.1

Out of the sample population having fever, 32 of them were started on an empirical antibiotic as a course of their treatment. Third generation cephalosporin, aminoglycosides and penicillin were main antibiotics used. When a patient is resistant to all these three group of drugs, other higher antibiotics were used like carbapenam antibiotics.

Antibiotic resistance is most common now a day because of their improper use. In our sample population sensitivity is tested for more commonly used antibiotics like Third generation cephalosporin, aminoglycosides and penicillin along with some other drugs. Out of which we found that 14 of the population that is around 41.1% of the sample were found to be resistant to third generation cephalosporins while 3(9.9%) were found to be resistant to aminoglycosides. 25 (73.5%) of the population were found to be sensitive to pencillin and other drugs. 18 (52.9%) of the population were sensitive to all the three groups. While 15 (44.1%) were resistant to both cephalosporins and aminoglycosides together.

These drugs are used as a single antibiotic or in combination. 162 (77.1%) of the population were not treated with any antibiotic. Piperacillin tazobactum alone was used in 15(7.1%) cases. Only amikacin was used in 3 cases while combination of amikacin and piperacillin tazobactum was used in 2(1%) cases. Amoxicillin- clavulinic acid was used in one case while cefoperazone- salbactum was used in 16(7.7%) cases. Higher anitibiotic meropenam was used in 2(1%) cases who were resistant to all other antibiotics. Cefotaxime alone was used in 8(3.8%) of the sample population while in combination with amikcain is used in single person.

Table no – 7: DMSA and MCUG in culture negative patients

Urine Culture	**MCUG**	**DMSA**
Negative	Bilateral vesicoureteric reflux	Bilateral diffuse cortical dysfunction
Negative	Left vesicoureteric reflux	Left diffuse cortical dysfunction
Negative	Bilateral vesicoureteric reflux	Normal
Negative	Right vesicoureteric reflux	Right diffuse cortical dysfunction

Further imaging like DMSA, MCUG were ordered for 20(83%) people having culture positive and 4(17%) culture negative population. Out of the 20 population of urine culture positive who underwent MCUG, 18 (90%) of them showed normal reports. One of the two children has a finding of Bilateral vesicoureteric reflux and the other one has right vesicoureteric reflux.

DMSA was done in 24 (20 in culture positive and 4 in culture negative) of the total sample population. Out of which 17 (70.83%) showed normal reports. The rest 7 of sample that got tested showed right diffuse cortical dysfunction in 4, left diffuse cortical dysfunction in 2 and bilateral diffuse cortical dysfunction in 1 (16.6%). Out of the four in culture negative group the results are as follows, One normal, one with left diffuse cortical dysfunction, one with bilateral diffuse cortical dysfunction and one with right diffuse cortical dysfunction. 3 out of 4 patients who got DMSA done among the culture negative showed positive in DMSA.

Table no – 8: Comparison of urinalysis parameters with urine culture in the detection of UTI

Parameter tested	Sensitivity	Specificity	PPV (Positive predictive va lue)	NPV (Negative predictive value)	Positive likelihood ratio	Negative likelihood ratio
Leucocyte Esterase	86	93.1	75.6	96.1	12.4	0.16
Nitrite	61	99.1	93.2	89.1	54.84	0.49
Bacteria	68	96.9	84.6	92.6	20.62	0.37
Pus cells	80	93.1	74.4	94.9	11.67	0.21
RBC	60	85.7	51.1	48.9	4.19	1.03
LE and nitrite	90	97	95.5	97.4	11.56	0.1
LE, nitrite and bacteria	92.5	92.2	74.2	98	9.28	0.09
LE, nitrite and pus cells	91.3	90	69.8	97.6	9.15	0.07

Bivariate analysis was done using chi square test to find association between urine culture and dipstick method. Regarding the validity of the positive LE dipstick test, sensitivity was 86 %, specificity was 93.1%, negative predictive value was 96.1%, positive predictive value was 75.6%, and overall accuracy was 94%.

Regarding the validity of positive nitrite dipstick test, sensitivity was 61%, specificity was 91.1%, negative predictive value was 89.1%, positive predictive value was

93.2%, and overall accuracy was 94.5%. As regards the validity of combined positive LE and nitrite, sensitivity was 90%, specificity was 97%, negative predictive value was 97.4%, positive predictive value was 95.5%, and overall accuracy was 95.8%.

4. DISCUSSION

In the present study the prevalence of paediatric urinary tract infections was 16.1% (34/210). The percentage of females and males having positive urine culture are 41.1% and 58.8% respectively. This finding is comparable with the previous studies conducted in India, Nepal and Ethiopia at 18.2%, 16% and 15.9% [32-34], respectively. Belete et al. and Fenta et al. had also reported 15.8% and 16.7% proportion of SBU among children at Felege Hiwot hospital in 2013 and 2019, respectively [35,36].

A lower prevalence was reported in Nigeria 3% [37]. In contrast, higher proportion of SBU among the pediatric group was also reported in Nairobi, Kenya, 69.7% [38], Congo, 42.2% [39] and in Ethiopia at (26.5–27.5%) [40,41].

According to a study, 7% of toddlers and kids who visited the paediatric outpatient clinics at Tanta University and Zagazig hospitals had UTI. Consistent with our findings, Mohammed et al. [42] in the Giza governorate of Egypt discovered that among 1000 seemingly healthy school-age children, 552 boys (55.2%) and 448 girls (44.8%), the prevalence of UTI was 6%.

In our study fever was the most common presenting complaint (70.5%) followed by pain abdomen (69%), burning micturition (13.57%), vomiting (2.9%), dysuria (3%) in all the sample population while in culture positive patients the symptoms were fever, burning micturition and pain abdomen. Very less proportion of population were having symptoms of diarrhoea and dehydration.

In a meta-analysis of studies including children with UTI, a history of previous UTI and fever >40 °C were the two most helpful signs in identifying UTI in children below two years of age. Symptoms like fever, chills, symptoms of lower urinary tract – abdominal pain, flank pain are suggestive of pyelonephritis [43]. Abdominal pain, back pain, frequency and/or dysuria, and new-onset urinary incontinence were the most valuable signs in predicting UTIs in verbal children. In acute cystitis, children typically present with the absence of fever and symptoms from the lower urinary tract, including dysuria, frequency, urge, new-onset urinary incontinence, suprapubic /abdominal pain, and/or hematuria [44].

We found the proportion of patients having UTI was significantly higher in the group having more than five pus cells, i.e., five to 10 pus cells (66.67%), >10 pus cells (75%) as compared to less than five pus cells (17.74%). This association was found to be statistically significant in our study with a p value <.0001. Similar significant association was found in most other studies [45]. On the contrary, a study by Ibrahim et al. [46] and Rabasa et al. [47] found poor leucocyte response in children with malnutrition compared to control. So, pyuria cannot be used as a criterion to diagnose UTI as it can be present without bacteriuria in various conditions like infections elsewhere in the body or glomerulonephritis. But presence of pyuria should increase the suspicion of UTI as seen in our study and various other studies as well.

This study's most common isolate was Escherichia coli (76.4%), which is comparable to some studies of Ethiopia [22]. The high rate of E. coli might be due to the high abundance of E. coli in the fecal flora, which ascends through the genitalia to cause UTI, in addition to having a unique structure such as P-fimbriae or pili adherence factors, which promote E. coli attachment to the uroepithelial cells, allowing for multiplication and tissue invasion. But, this finding contradicts a study done in Abakaliki, Nigeria in which Klebsiella spp. (24.5%) were most commonly isolated [48], and in Uganda, Proteus spp. (39.5%) were most frequently isolated [27]. This could be due to variations in specimen collection techniques and the existence of many virulence factors.

Urine analysis plays a crucial role in the diagnosis of urinary tract infections, even if urine culture remains the gold standard for UTI diagnosis. In contrast to cultures, which require at least 48 hours to yield results, this rapid, simple, and reliable procedure using dipsticks can yield results in a matter of minutes. The two primary tests helpful in the laboratory diagnosis of UTIs are the nitrite (NIT) and leukocyte esterase (LE) assays.

Urine does not often include nitrites, although it can when reducing bacteria change nitrates into nitrites. In substantial amounts, nitrates in urine can be reduced to nitrites by a variety of bacteria, both gram positive and gram negative. Leukocyte esterase, which neutrophils produce in urine, is a sign of pyuria. Leukocyte esterase positive has been used in numerous cases to isolate Chlamydia and Uroplasma, however urine cultures have shown negative results. (49)

The sensitivity and specificity of Nitrite and Leucocyte Esterase have been shown in a variety of sensitivity analysis studies throughout the literature; nonetheless, nearly all of the research show that Nitrite is more specific and Leukocyte Esterase is more sensitive when it comes to UTI diagnosis. In our study the sensitivity and specificity of Leucocyte esterase was found out to be 86 and 93.1 respectively while the sensitivity and specificity of Nitrate was found out to be 61 and 91.1 respectively. In the study of Laosu- Angkoon, [23] it was found that the sensitivity of LE test was 63.6% while the combined LE and nitrite test were 66.7%. They concluded that the dipstick test can be used as a rapid diagnostic tool in detecting UTI and to prevent potential sequelae such as hypertension and renal scarring.

The study of Taneja et al [24] found that the combined sensitivity of LE and nitrite was 79.6%, while sensitivity and specificity of LE were 73.5% and 58.5%, respectively, and for nitrite was 57.1% and 78.7%, respectively. He concluded that for the faster diagnosis of UTI, dipstick tests for LE and nitrite tests should be added in routine laboratory practices. The study of Abdelhamid found that LE sensitivity was 85.8%, specificity 54.1%, positive predictive value 45.9%, and negative predictive value was 91.2%. Nitrite sensitivity was 79.3%, specificity was 66.3%, positive predictive value was 73.9%, and negative predictive value was 88.9%. LE and nitrite sensitivity was 71.2%, specificity was 100.00%, positive predictive value was 100% and negative predictive value was 79.4%.

The results of other studies [14, 29] revealed that S. aureus was more resistant to commonly prescribed beta-lactam antibiotics such as ampicillin (83.3%) and tetracycline (83.3%), while the study from Gondar, Ethiopia [36] found that S. aureus was less resistant to tetracycline and chloramphenicol. This discrepancy may result from S. aureus overproducing β-lactamase and developing resistance by insertion of drug- resistant genes, transformation, and plasmid-mediated transduction [50].

In addition, our study's total MDR isolate rate was 61.6% (95% CI: 51–73, N = 53). Together with others from Ethiopia [36, 24, 31], gram-negative bacterial isolates shown a large level of MDR 47/68 (69.1%) compared to gram-positive bacteria 6/18 (33.3%). In the current investigation, 11.6% and 2.3% of the gram-negative species were XDR and PDR, respectively. There were discrepancies in the findings of an Ethiopian investigation for 22% XDR and 4% PDR [5]. The use of broad-spectrum medications, an increase in the irrational use of antibiotics, the ease with which antimicrobials can be obtained in unregulated

pharmacies, the transfer of resistance genes between humans and animals, and overprescription are all factors that contribute to the development of resistance [5, 15]. Furthermore, there is an exceptionally high level of bacterial resistance in the general population, which leads to an overuse of high-potency antibiotics for UTIs and further increases bacterial resistance. Uropathogens are alarmingly becoming more resistant to antibiotics through a variety of resistance mechanisms [42].

5. CONCLUSION

While urine culture is considered the definitive method for diagnosing a urinary tract infection (UTI), it can be time-consuming and expensive. Therefore, evaluating additional parameters can aid in the early identification and prompt initiation of antibiotic treatment. This research offers important insights into urine analysis markers such as pus cells, leukocyte esterase, and nitrite. Utilizing these findings can bolster diagnostic accuracy and lead to better patient outcomes. The urine dipstick test is a straightforward, simple, and affordable screening method for identifying UTIs. The study also points out the fluctuations in antimicrobial susceptibility, highlighting the importance of routinely monitoring local resistance trends to inform effective empirical antibiotic treatment.

REFERENCES

[1] Espinosa C, Bryant K, Pharm KB. Therapeutics of Pediatric Urinary Tract Infections. American Journal. 2015;7(5):4.

[2] Umesh BP, Tamta S. Microbiological Profile in Urinary Tract Infections among Children in a Tertiary Care Center in Kumaun region, India. Intentional Journal of Current Microbial Applied Science. 2016;5(4):101–108.

[3] Gautama G, Regmi S, Magar NT, Subedi B, Sharma T, Regmi SM. Occurrence of urinary tract infection among children attending Gandaki Medical College Teaching Hospital and Research Center, Pokhara, Nepal. International Journal of Infection and Microbiology. 2013;2(3):82–86.

[4] Flores-Mireles AL, Walker JN, Caparon M, Hultgren SJ. Urinary tract infections: epidemiology, mechanisms of infection and treatment options. Nature Reviews Microbiology. 2015;13(5):269–284.

[5] Desai DJ, Gilbert B, McBride CA. Pediatric urinary tract infections: Diagnosis and treatment. Australian Family Physician. 2016;45(8):558.

[6] Nasser H, Farid N, Nasser S. Resistive Index (RI) in Febrile Urinary Tract Infection: New Predictive Value. Journal of Clinical Cases and Reports. 2019; 2:48–56.

[7] White B. Diagnosis and treatment of urinary tract infections in children. American Family Physician. 2011;83(4):409–415.

[8] Yang B, Yang F, Wang S, et al. Analysis of the spectrum and antibiotic resistance of uropathogens in outpatients at a tertiary hospital. Journal of Chemotherapy. 2018;30(3):145–149.

[9] Duicu C, Armean I, Aldea C. New Insights in Treatment Options in Pediatric Urinary Tract Infection. Acta Medica Marisiensis. 2019;65(1):7–11.

[10] Muoneke VU, Ibekwe MU, Ibekwe RC. Childhood urinary tract infection in abakaliki: etiological organisms and antibiotic sensitivity pattern. Annals of Medical and Health Sciences Research. 2012;2(1):29–32.

[11] Rodriguez-Encarnacion A. Pathogens Causing Urinary Tract Infection and Their Resistance Patterns among Pediatric Patients in Chong Huan Hospital (January 2003 to June 2005) PIDSP Journal. 2012;13(1):37–43.

[12] Lee SJ. Clinical guideline for childhood urinary tract infection (second revision) Childhood Kidney Diseases. 2015;19(2):56–64.

[13] Schellack N, Naested C, Sandt N, Padayachee N. Management of urinary tract infections in children. South African Family Practice. 2017;59(6):16–20

[14] Maiti S, Nazmeen A. The emergence and impact of medicinal honey. Journal of Clinical and Molecular Pathology. 2018;2(1):16.

[15] Wang, Y.; Zhao, S.; Han, L.; Guo, X.; Chen, M.; Ni, Y.; Zhang, Y.; Cui, Z.; He, P. Drug resistance and virulence of uropathogenic Escherichia coli from Shanghai, China. J. Antibiot. 2014, 67, 799–805.

[16] Schito, G.C.; Naber, K.G.; Botto, H.; Palou, J.; Mazzei, T.; Gualco, L.; Marchese, A. The ARESC study: An international survey on the antimicrobial resistance of pathogens involved in uncomplicated urinary tract infections. Int. J. Antimicrob. Agents 2009, 34, 407–413.

[17] Al-Naqshbandi, A.A.; Chawsheen, M.A.; Abdulqader, H.H. Prevalence and antimicrobial susceptibility of bacterial pathogens isolated from urine specimens received in rizgary hospital—Erbil. J. Infect. Public Health 2018, 12, 330–336.

[18] Faraz, M.A.A.; Mendem, S.; Swamy, M.V.; Patil, S. Prevalence of urinary tract infections and related

antimicrobial resistance in india: A systematic review and meta- analysis. Int. J. Pharm. Sci. Res. 2021, 12, 4314–4321.

[19] Shaifali, I.; Gupta, U.; Mahmood, S.E.; Ahmed, J. Antibiotic susceptibility patterns of urinary pathogens in female outpa-tients. N. Am. J. Med. Sci. 2012, 4, 163.

[20] Medina-Bombardó, D.; Seguí-Díaz, M.; Roca-Fusalba, C.; Llobera, J. What is the predictive value of urinary symptoms for diagnosing urinary tract infection in women? Fam. Pract. 2003, 20, 103–107.

[21] Tan, C.W.; Chlebicki, M.P. Urinary tract infections in adults. Singap. Med. J. 2016, 57, 485.

[22] Mitiku, E.; Amsalu, A.; Tadesse, B.T. Pediatric urinary tract infection as a cause of outpatient clinic visits in southern Ethiopia: A cross sectional study. Ethiop. J. Health Sci. 2018, 28, 187–196.

[23] Smelov, V.; Naber, K.; Johansen, T.E.B. Improved Classification of Urinary Tract Infection: Future Considerations. Eur. Urol. Suppl. 2016, 15, 71–80.

[24] Freedman, A.L.; Urologic Diseases in America Project. Urologic diseases in north america project: Trends in resource utilizationo for urinary tract infections in children. J. Urol. 2005, 173, 949–954.

[25] Patel, H.; Soni, S.; Bhagyalaxmi, A.; Patel, N. Causative agents of urinary tract infections and their antimicrobial susceptibility patterns at a referral center in Western India: An audit to help clinicians prevent antibiotic misuse. J. Fam. Med. Prim. Care 2019, 8, 154.

[26] Flores-Mireles, A.L.; Walker, J.N.; Caparon, M.; Hultgren, S.J. Urinary tract infections: Epidemiology, mechanisms of infection and treatment options. Nat. Rev. Microbiol. 2015, 13, 269–284.

[27] Faidah HS, Ashshi AM, Abou El-Ella GA, Al-Ghamdi AK, Mohamed AM. Urinary tract infections among pregnant women in Makkah, Saudi Arabia. Biomedical And Pharmacology Journal. 2015;6(1):01–7.

[28] Kerr JR. Antibiotic treatment and susceptibility testing. Journal of Clinical Pathology. 2005;58(8):786–787.

[29] Ashkenazi S, Eventov S, Samra Z, et al. Uropathogens of various childhood populations and their antibiotic susceptibility. PediatrInfec Dis J. 1991;10:742–746.

[30] CLSI, author. Methods for Dilution Antimicrobial Susceptibility Tests for Bacteria that Grow Aerobically. 8th edn. Wayne, PA: Clinical and Laboratory Standards Institute; 2009a. Approved Standard M07-A8. [Google Scholar]

[31] CLSI, author. 20th Informational Supplement M100-S20. Wayne, PA: Clinical and Laboratory Standards Institute; 2009b. Performance Standards for Antimicrobial Susceptibility Testing. [Google Scholar]

[32] Lone MR, Ganie NA, Rashid M, Mohammad SM, Ahmad J, Parray NA. Bacterial Agents and Their Antibiotic Susceptibility in Urinary Tract Infection of Pediatric Age Group. Innovative Journal of Medical and Health Science. 2019;9(4):401–407.

[33] Duffa YM, Kitila KT, Gebretsadik DM, Bitew A. Prevalence and antimicrobial susceptibility of bacterial uropathogens isolated from pediatric patients at Yekatit 12 hospital medical colleges, Addis Ababa, Ethiopia. International Journal of Microbiology. 2018 doi: 10.1155/2018/8492309.

[34] Shrestha LB, Baral R, Poudel P, Khanal B. Clinical, etiological and antimicrobial susceptibility profile of pediatric urinary tract infections in a tertiary care hospital of Nepal. BMC Pediatrics. 2019;19(1):36.

[35] Belete Y, Asrat D, Woldeamanuel Y, Yihenew G, Gize G. Bacterial Profile and Antibiotic Susceptibility Pattern of Urinary Tract Infection Among Children Attending Felege Hiwot Referral Hospital, Bahir Dar, Northwest Ethiopia. Infection and drug resistance. 2019; 12:3575–3583.

[36] Fenta A, Dagnew M, Eshetie S, et al. Bacterial profile, antibiotic susceptibility pattern and associated risk factors of urinary tract infection among clinically suspected children attending at Felege-Hiwot comprehensive and specialized hospital, Northwest Ethiopia. A prospective study. BMC Infect Dis. 202; 20:673.

[37] Muoneke VU, Ibekwe MU, Ibekwe RC. Childhood urinary tract infection in abakaliki: etiological organisms and antibiotic sensitivity pattern. Annals of Medical and Health Sciences Research. 2012;2(1):29–32.

[38] Njagi LN, Odera S, Mutua F. Antimicrobial Susceptibility Patterns of Urinary Bacteria Amongst Pediatrics Patients at The Nairobi Hospital, Kenya. East African Medical Journal. 2015;92(3):104–111.

[39] Many MR, Yvey MK, Celestin NC, Richard BM. Investigation of antimicrobial resistance in urinary tract infection in children at the east party of democratic Republic of Congo. Journal of Bacteriol Mycolgy Open Acces. 2019;7(3):50–53.

[40] Mitiku E, Amsalu A, Tadesse BT. Pediatric urinary tract infection as a cause of outpatient clinic visits in southern Ethiopia. Ethiopian Journal of Health Sciences. 2018;28(2):187–196.

[41] Ayelign B, Abebe B, Shibeshi A, et al. Bacterial isolates and their antimicrobial susceptibility patterns among

pediatric patients with urinary tract infections. Turkish Journal of Urology. 2018;44(1):62.

[42] Mohammed A, Abdelfattah M, Ibraheem A, Younes A. A study of asymptomatic bacteriuria in Egyptian school-going children Afr Health Sci. 2016; 16:69–74

[43] Primack W, Bukowski T, Sutherland R, Gravens-Mueller L, Carpenter M. What urinary colony count indicates a urinary tract infection in children? The Journal of pediatrics. 2017; 191:259–61. e1. pmid:28967387

[44] Zerefaw G, Tadesse S, Derbie A. Bacterial Uropathogens, Antimicrobial Susceptibility Profile and Associated Factors among Pediatric Patients in Bahir Dar, Northwest Ethiopia. Ethiop J Health Sci. 2022 Jan;32(1):81-92.

[45] Mekonnen S, Tesfa T, Shume T, Tebeje F, Urgesa K, Weldegebreal F (2023) Bacterial profile, their antibiotic susceptibility pattern, and associated factors of urinary tract infections in children at Hiwot Fana Specialized University Hospital, Eastern Ethiopia. PLoS ONE 18(4): e0283637.

[46] Alzahrani MA, Sadoma HHM, Mathew S, Alghamdi S, Malik JA, Anwar S. Retrospective Analysis of Antimicrobial Susceptibility of Uropathogens Isolated from Pediatric Patients in Tertiary Hospital at Al-Baha Region, Saudi Arabia. Healthcare. 2021; 9(11):1564.

[47] Shaikh N, Morone NE, Bost JE, Farrell MH. Prevalence of urinary tract infection in childhood: a meta-analysis. Pediatr Infect Dis J. 2008;27(4):302-308.

[48] T., Madhubalan & Chidambaranathan, s.C.Nathan & E., Yazhini. (2020). Study of prevalence of urinary tract infection in febrile children less than 5 years of age. International Journal of Contemporary Pediatrics. 7. 10.18203/2349-3291.ijcp20200488.

[49] Amin, Ezzat K.1; Zaid, Ali M. Abo1; Kotb, Abd El Rahman I.1; El-Gamasy, Mohamed A.2,. Incidence, Risk Factors and Causative Bacteria of Urinary Tract Infections and their Antimicrobial Sensitivity Patterns in Toddlers and Children: A Report from Two Tertiary Care Hospitals. Saudi Journal of Kidney Diseases and Transplantation 31(1):p 200-208, Jan–Feb 2020.

[50] Mitiku E, Amsalu A, Tadesse BT. Pediatric urinary tract infection as a cause of outpatient clinic visits in southern Ethiopia: a cross sectional study. Ethiopian journal of health sciences. 2018;28(2):187–96. pmid:29983516