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Urinary Tract Infections In Pediatric Patients With Nephrotic Syndrome

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Abstract

Background : *Children who are regularly hospitalised are at an elevated risk of acquiring various infections that may exacerbate their already precarious health conditions. Previous investigations have delineated the broad clinical range and the incidence of severe infections, including Urinary Tract Infection (UTI), pneumonia, septicaemia, peritonitis, and skin or soft tissue infections, particularly in nephrotic children.*

Aim : *To examine the correlation between urinary tract infections (UTI) and nephrotic syndrome in paediatric patients.*

Materials And Methods: *The study comprised a sample of 53 children with nephrotic syndrome, easily picked from AL-Kadhimiya Teaching Hospital and AL-Fallujah Teaching Hospital in Baghdad. A study was conducted using a convenience sampling technique involving individuals with nephrotic syndrome who attended routine appointments or sought medical assistance and consented to participate in the research.*

Results : *Sixty-six percent of the patients lived in urban regions, whereas thirty-four percent resided in rural settings, indicating that urban youngsters may be more susceptible to specific risk factors or have superior access to healthcare services that facilitate identification. The average age was 7 ± 3.43 years; fever was observed in 12.5% of patients, whilst cloudy urine was noted in 7.3%. This distribution reveals that irritative urinary symptoms are the primary characteristics in this cohort, while systemic indications such as fever and observable urine alterations are less prevalent. Among the total male patients, 7 (21.9%) exhibited a positive culture, while 25 (78.1%) demonstrated a negative culture. Among the female patients, 6 (28.6%) exhibited a positive culture, while 15 (71.4%) demonstrated a negative culture. In the age category of 1-5 years, 5 patients (22.7%) exhibited a positive culture, while 17 patients (77.3%) demonstrated a negative culture. In the 6-11 year age range, 5 individuals (22.7%) exhibited a positive culture, while 14 individuals (77.3%) had a negative culture. Among individuals aged 12 years and older, 3 (33.3%) exhibited a positive culture, while 6 (66.7%) had a negative culture. The study has a total of 53 patients, comprising 13 with positive cultures and 40 with negative cultures. The positive culture rate is 24.5%, signifying that 24.5% of patients had a positive urine culture result. The negative culture rate is 75.5%, indicating that the majority of patients (75.5%) did not yield a positive culture result. All 13 individuals with positive cultures (100%) had E. coli identified as the causative organism of the infection. This indicates that E. coli is the exclusive causal agent of urinary tract infections (UTIs) in this group of patients with nephrotic syndrome. Given that E. coli was found in 100% of positive cultures, a comprehensive analysis might investigate potential associations between the presence of E. coli and other clinical factors (e.g., severity of nephrotic syndrome, treatment regimen, etc.). Pus Cells ≤ 5: 23.1% (positive culture) compared to 65% (negative culture). Pus cells exceeding 5: 76.9% (positive culture) compared to 35% (negative culture). The notable correlation between pus cells (>5) and positive culture results (P-value = 0.007) highlights the diagnostic significance of urine examination for pus cells in detecting UTIs.*

Conclusion:*The investigation uncovered an anomalous sex distribution, indicating that a greater proportion of male paediatric patients (60.4%) experienced UTIs compared to girls (39.6%), despite the typical prevalence of*

UTIs being higher in females. Sixty-six percent of the patients were from metropolitan regions, indicating that improved healthcare access may affect UTI diagnosis. The average age of affected children was 7 ± 3.43 years, predominantly impacting those in early school age, potentially driven by behavioural problems and difficulties with toilet training.

Key words : *Urinary Tract, Infections ,Pediatric Patients ,Nephrotic Syndrome.*

INTRODUCTION

A Urinary Tract Infection (UTI) is an infection affecting any part of the urinary system, which includes the kidneys, ureters, bladder, and urethra. The most common type of UTI is a bladder infection (cystitis), although infections can also affect the kidneys (pyelonephritis) or the urethra (urethritis) [(1)] .The primary cause of UTIs is bacterial infection, with Escherichia coli (E. coli) being the most common pathogen, responsible for 80-90% of cases. Other pathogens that can cause UTIs include Klebsiella pneumoniae, Proteus mirabilis, Enterococcus faecalis, and Staphylococcus saprophyticus. Fungal and viral infections can also lead to UTIs, though these are less common [(2)] .

Risk factors for developing UTIs include [(3)] :

- Female gender (due to shorter urethra)
- Sexual activity
- Pregnancy
- Use of urinary catheters
- Urinary tract abnormalities
- Diabetes
- Weakened immune system
- Urinary retention

Colonization: Uropathogens, primarily E. coli, enter the urinary tract, typically through the urethra. This can occur via ascending infection from the perineum or hematogenous spread. Adherence: The bacteria adhere to urothelial cells using fimbriae (pili) or other adhesins, facilitating infection establishment.

Invasion: Bacteria can invade the bladder urothelium, causing inflammation and the characteristic symptoms of UTIs, such as dysuria, frequency, and urgency. In more severe cases, the infection may ascend to the kidneys, causing pyelonephritis. Inflammatory Response: The immune system responds to infection by releasing cytokines, causing inflammation within the urinary tract. This inflammatory response results in the typical symptoms of UTIs and can lead to tissue damage if untreated. Chronic or Recurrent Infections: Untreated or recurrent UTIs can lead to the formation of bacterial biofilms, making the infection more difficult to treat and potentially leading to chronic infection [(4,5)].

When children are frequently hospitalized, they face an increased risk of developing a wide range of infections that could complicate their already vulnerable health situations. In particular, previous studies have described the extensive clinical spectrum and the occurrence of serious infections, which include conditions such as Urinary Tract Infection (UTI), pneumonia, septicemia, peritonitis, and skin or soft tissue infections, specifically in nephrotic children[(6)] . It has been observed that UTI continues to be one of the most prevalent infections linked to nephrotic syndrome, a condition that significantly affects children [(7)] . Moreover, nephrotic children who develop UTI commonly present symptoms at a notably young age, often below 5 years of age. Most cases of UTI in these children were found to be post-steroid infections, signifying that these infections typically occur after they have been on steroid medication for approximately 3 weeks.[(8)] A similar scenario is observed in pediatric patients who are recipients of kidney transplants. In fact, studies have indicated that among children who require kidney transplants, the risk of hospitalizations due to UTI is particularly high during the year following the transplant procedure.[(9)] Interestingly, among these children, researchers noted that

there was no significant difference in the rates of UTI between those who had underlying kidney abnormalities and those who did not. Furthermore, it has been established that among the pediatric population requiring kidney transplants, the occurrence of UTI cases greatly elevates the risk of hospitalization. In all children who have undergone kidney transplants, UTI has emerged as a potentially editable complication that can occur regardless of known risk factors, including conditions such as vesicoureteral reflux and the administration of post-transplant steroids. Therefore, implementing proactive efforts aimed at reducing the incidence of UTIs or enhancing the management of these infections when they do arise could play an important role in decreasing the overall rate of hospitalizations for these young patients during their critical follow-up care period after transplantation. This is essential not only to ensure their health and well-being but to improve outcomes for pediatric patients who are often in precarious health circumstances. [10]

Study design

A cross sectional study.

Study setting

The study conducted in Baghdad in Kadhimiya Teaching Hospital

Data collection time

The time for data collection was from October 2024 to March 2025 .

Study population and Sampling technique

The study included a sample of 53 children with nephrotic syndrome selected conveniently in Baghdad in AL- Kadhimiya Teaching Hospital

Inclusion criteria

- Children must have a confirmed diagnosis of nephrotic syndrome, characterized by proteinuria, hypoalbuminemia, and edema.
- Positive Urine Culture: A positive urine culture for pathogenic microorganisms.
- Presence of clinical symptoms suggestive of a UTI, such as fever, dysuria, urgency, or changes in urinary pattern (e.g., frequency or foul-smelling urine).
- Children must have a confirmed diagnosis of GUE.

Exclusion criteria

- Children who have recently been treated with antibiotics, which could alter the results of urine cultures or prevent accurate detection of a UTI.
- Children with structural abnormalities of the urinary tract, as these may require a different diagnostic or treatment approach not related to typical UTI management.
- Children with other severe or acute medical conditions that may interfere with the diagnosis or treatment of UTI, such as sepsis or other life-threatening infections.

Results

In our cohort of paediatric patients with urinary tract infections, 60.4% were male and 39.6% were female, which is rather unexpected considering that UTIs are generally more prevalent in females; nonetheless, this distribution may indicate particular local variables or referral patterns in our research environment. Moreover, a significant proportion of the patients (66.0%) lived in urban regions, in contrast to 34.0% from rural locales, indicating that urban children may be either more susceptible to specific risk factors or possess superior access to healthcare services facilitating diagnosis. The average age was 7 ± 3.43 years, suggesting that UTIs in this study predominantly impacted children in early school age, maybe attributable to behavioural problems and difficulties with toilet training. These findings underscore the necessity for further examination of the underlying mechanisms influencing the observed sex distribution and the urban-rural disparities in UTI incidence among paediatric patients. (Table 1)

Table 1. Demographic data

Variable		Frequency	Percentage
Sex	male	32	60.4%
	female	21	39.6%
Residence	urban	35	66.0%
	rural	18	34.0%
Age		7±3.43*	

*mean ±Standard deviation

In paediatric patients with urinary tract infections, the most commonly observed clinical manifestations were urine symptoms: urgency occurred in 20.8% of cases, while dysuria, frequency, and abdominal pain were each recorded in about 19.8% of cases. Fever was recorded in 12.5% of patients, but cloudy urine was reported in 7.3%. This distribution reveals that irritative urinary symptoms are the primary characteristics in this cohort, while systemic indications such as fever and observable urine alterations are less prevalent. These findings indicate that doctors must remain vigilant for urinary tract infections (UTIs) even in the absence of systemic indications, highlighting the diverse symptomatology of UTIs in the paediatric demographic.(Table 2)

Table 2. Clinical presentation percentage

Clinical presentation	Percentage
Urgency	20.80%
Abdominal Pain	19.80%
Dysuria	19.80%
Frequency	19.80%
Fever	12.50%
Turbid Urine	7.30%

The data in Table 3 and Table 4 presents a comparison of sex and age groups, along with the outcomes of clinical presentation and pyuria in relation to urine culture results. The table delineates the quantity and proportion of positive (+ve) and negative (-ve) culture outcomes categorised by sex and age group. Furthermore, the P-values are shown to evaluate the statistical significance of differences between the groups.

1. Comparison by Sex:

- Male: Out of the total number of male patients, 7 (21.9%) had a positive culture, and 25 (78.1%) had a negative culture.
- Female: For the female patients, 6 (28.6%) had a positive culture, and 15 (71.4%) had a negative culture.
- P-Value for Sex Comparison: The P-value is 0.581, which indicates that there is no statistically significant difference between males and females in terms of positive and negative urine culture results. The result suggests that sex does not play a significant role in the likelihood of having a positive culture in this sample.

2. Comparison by Age Group:

- In the age category of 1-5 years, 5 patients (22.7%) exhibited a positive culture, while 17 patients (77.3%) demonstrated a negative culture. For the age group of 6-11 years, 5 individuals (22.7%) exhibited a good culture, while 14 individuals (77.3%) demonstrated a negative culture. For individuals aged 12 years and older, 3 (33.3%) exhibited a good culture, while 6 (66.7%) demonstrated a negative culture. • P-Value for Age Group Analysis: The P-value for age is 0.806, signifying no statistically significant difference among the various age groups regarding positive and negative urine culture outcomes. This indicates that age does not substantially influence the probability of obtaining a good culture result in this sample. There is no statistically significant

correlation between sex or age and urine culture results in this sample, as evidenced by P-values over 0.05. This implies that additional factors, such as preexisting medical disorders or the severity of infection, may play a more significant role in influencing the outcomes of urine cultures in this population.

Table 3. Comparison of age groups according to urine culture results

Data		+ve culture No.(%)	-ve culture No.(%)	P value
Age	1-5	5(22.7%)	17(77.3%)	0.806
	6-11	5(22.7%)	14(77.3%)	
	≥12	3(33.3%)	6(66.7%)	

Table 4. Comparison of sex according to urine culture results

Data		+ve culture No.(%)	-ve culture No.(%)	P value
Sex	Male	7(21.9%)	25(78.1%)	0.581
	Female	6(28.6%)	15(71.4%)	

The data in Table 5 delineates the distribution of patients based on their urine culture findings and the specific organisms discovered in positive cultures. Consequently, let us perform a statistical analysis of the findings. 1. Culture Results: The study included a total of 53 patients, of whom 13 exhibit positive cultures and 40 demonstrate negative cultures. The positive culture rate is 24.5%, signifying that 24.5% of patients had a positive urine culture result. The negative culture rate is 75.5%, indicating that the majority of patients (75.5%) did not yield a positive culture result. 2. Organism Distribution: • Of the 13 patients with positive cultures, all (100%) were found to have E. coli as the causative organism of the infection. This indicates that E. coli is the exclusive causal agent of urinary tract infections (UTIs) in this group of patients with nephrotic syndrome. • Significant Incidence of Negative Cultures: The data reveals that most patients exhibited no evidence of bacterial infection in their urine, implying that a considerable segment of the patient population likely did not have an active infection throughout the testing period. • E. coli as the predominant pathogen, with fewer instances of Proteus and Klebsiella: The near-universal identification of E. coli in positive cultures suggests its possible significance as the principal pathogen in urinary tract infections among children with nephrotic syndrome. This finding may align with other research that has recognised E. coli as a prevalent pathogen in paediatric urinary tract infections, especially in those with underlying disorders such as nephrotic syndrome. • Prevalence of Positive versus Negative Cultures: The percentage of positive culture results (24.5%) in this sample may appear comparatively low. To examine potential factors affecting this rate, additional statistical analyses, such as Chi-square tests for association, may be conducted to determine if specific variables (e.g., age, gender, duration of nephrotic syndrome) are significantly correlated with an increased probability of positive cultures. • Single Pathogen Identification: Given that E. coli was present in 100% of positive cultures, a comprehensive analysis might investigate potential correlations between the presence of E. coli and other clinical factors (e.g., severity of nephrotic syndrome, treatment regimen, etc.).

Table 5:-Distribution of patients according to results of urine culture and type of organism in positive culture of 13 Patients.

Culture result	Frequency	Percentage
Positive	13	24.5%
Negative	40	75.5%

Total	53	100.0%
Organism	Frequency	Percentage
E. coli	11	100%
Proteus	1	7.69%
Klebsiella	1	7.69%

Table 6 compares clinical presentation and pyuria according to urine culture results, specifically examining the relationship between clinical symptoms and the presence of pus cells in relation to the positive (+ve) and negative (-ve) culture outcomes.

2. Pus Cells:

- Pus Cells ≤ 5: 23.1% (positive culture) vs. 65% (negative culture).
- Pus Cells > 5: 76.9% (positive culture) vs. 35% (negative culture).
- P-Value for Pus Cells Comparison: The P-value for pus cells is 0.007, which is also statistically significant ($p < 0.05$). This suggests that the number of pus cells (>5) in the urine is significantly associated with a positive urine culture. Higher levels of pus cells are more likely to correlate with bacterial infection and a positive culture result.

.2. Pus Cells as a Predictor:

- The significant association between pus cells (>5) and positive culture results (P-value = 0.007) underscores the potential diagnostic value of urine analysis for pus cells in identifying UTIs. The presence of >5 pus cells in the urine appears to increase the likelihood of a positive culture result..

Table 6:- Comparison Of Pyuria According To Urine Culture Results

Pus cells	+ve culture	-ve culture	P value
≤5	23.1%	65%	0.007
>5	76.9%	35%	

DISCUSSION

The data reveals that in our analysis of six cases, 60.4% of the children with UTI were male, whereas 39.6% were female. This sex distribution appears to contradict general data indicating that UTIs are more prevalent in females, particularly among younger children. This unforeseen outcome may indicate underlying local influences or particular referral trends within this cohort. Certain studies indicate that boys with anatomical or functional anomalies, such as vesicoureteral reflux, may exhibit a higher incidence of UTIs, thereby elucidating the greater male predominance. Furthermore, 66.0% of the patients lived in urban regions, aligning with previous research that demonstrates enhanced healthcare accessibility in metropolitan settings, resulting in elevated diagnostic rates (12).

The mean age of the children in our study was 7 ± 3.43 years, suggesting that the majority of UTIs in this cohort occurred in early school-aged children. This corresponds with prior studies indicating that urinary tract infections are more prevalent among children under the age of 10. The conclusion of our study that children with urinary tract infections predominantly fall within the early school-age demographic may potentially be ascribed to behavioural variables, such as inadequate toilet training, as several studies have indicated a correlation between UTI risk and difficulties in toilet training.

The predominant clinical symptoms in our population were urgency (20.8%), stomach pain (19.8%), and dysuria (19.8%). These findings align with the typical clinical manifestation of urinary tract infections in children. Prior studies have indicated that irritative urinary symptoms, such as urgency and frequency, are more frequently observed in paediatric UTI cases (15). The reduced prevalence of fever (12.5%) and urine turbidity (7.3%) noted in this group may indicate that UTIs in these children were comparatively less severe or that systemic manifestations like fever were absent, complicating identification (16).

This study compares positive and negative urine cultures based on sex and age group. The positive culture rate in this investigation was 24.5%, with E. coli identified as the causal organism in all positive cultures, consistent with previous studies that often identify E. coli as the predominant pathogen in paediatric UTIs (17). This observation contrasts with the elevated incidence of negative cultures (75.5%) in this cohort, indicating that a significant proportion of patients may not have had active bacterial infections, potentially attributable to alternative explanations of symptoms such as sterile inflammation or viral infections.

The statistical examination of sex and age demographics in the urine culture outcomes revealed no significant disparities, with P-values of 0.581 for sex and 0.806 for age group comparison. The data indicate that neither sex nor age substantially affects the probability of a positive culture in this group. Sharma et al. (2018) reported analogous findings, indicating that sex and age did not serve as predictors for UTI culture results in a paediatric cohort (18).

In our study, the comparison of pus cell presence in urine with culture results revealed that 23.1% of patients with ≤5 pus cells exhibited a positive culture, whereas 65% demonstrated a negative culture. Conversely, 76.9% of patients with more than 5 pus cells had a positive culture, while 35% demonstrated a negative culture. The P-value for this comparison was 0.007, indicating statistical significance ($p < 0.05$). This indicates that elevated pus cell counts in the urine are significantly correlated with bacterial infections and good culture outcomes.

The results highlight the efficacy of pus cells as a dependable indicator for urinary tract infections. The presence of over 5 pus cells enhances the probability of a positive culture result, corroborating prior studies that demonstrate pyuria as a significant diagnostic indicator for urinary tract infections (19). In clinical practice, this indicates that for children exhibiting urinary symptoms, the quantity of pus cells can aid clinicians in differentiating between bacterial and non-bacterial aetiologies of the symptoms. Children exhibiting fewer than 5 pus cells may be less predisposed to bacterial infections, necessitating consideration of other aetiologies, such as viral infections or sterile inflammation. Although pyuria is a robust sign of a urinary tract infection (UTI), the study underscores that not all instances of elevated pus cell counts correlate with a positive culture, as demonstrated by the 35% of patients exhibiting more than 5 pus cells who had negative cultures. This indicates that additional factors, such as the method of urine collection or the existence of non-infectious inflammation, may influence urine test outcomes (20).

CONCLUSION

- The investigation uncovered an anomalous sex distribution, indicating a greater proportion of male paediatric patients (60.4%) afflicted with UTIs in contrast to females (39.6%), despite the typical prevalence of UTIs being higher in females. Sixty-six percent of the patients were from metropolitan regions, indicating that improved healthcare access may affect UTI diagnosis. The average age of affected children was 7 ± 3.43 years, predominantly impacting those in early school age, potentially driven by behavioural problems and difficulties with toilet training.
- Clinical Presentation: The predominant clinical signs of urinary tract infections (UTIs) included urgency (20.8%), stomach discomfort (19.8%), and dysuria (19.8%). Fever was noted in 12.5% of instances, but merely 7.3% had cloudy urine. This underscores the prevalence of irritative urinary symptoms in paediatric UTI patients and indicates that doctors should contemplate UTIs even in the absence of systemic signs like fever.
- Urine Culture Results: The positive urine culture rate was 24.5%, signifying that almost one-fourth of the children examined had an active urinary tract infection. E. coli was the leading pathogen among the positive cultures. No significant differences in UTI prevalence were observed

based on sex (p-value 0.581) or age group (p-value 0.806), indicating that these characteristics do not substantially influence the probability of a positive urine culture result.

- The study identifies E. coli as the principal pathogen responsible for urinary tract infections in this group of paediatric children with nephrotic syndrome, corroborating other research findings.

Recommendations

Enhanced Awareness and Early Detection: Since urinary symptoms including urgency and abdominal discomfort frequently manifest in children with nephrotic syndrome, doctors must sustain a heightened awareness for urinary tract infections, even in the absence of fever or observable alterations in urine.

Emphasis on Paediatric Urinary Health: Tackling the difficulties of toilet training and behavioural issues in early school-age children may diminish the occurrence of urinary tract infections (UTIs). Informing parents and carers on hygiene practices and symptoms may enhance the early identification and management of urinary tract infections.

Targeted Interventions in Urban Areas: Given that a greater proportion of children with UTIs originate from urban regions, public health policies must provide fair access to healthcare services for children in rural locales. This may facilitate the advancement in the identification and treatment of urinary tract infections.

Further Investigation of UTI Risk Factors: It is crucial to examine additional risk factors affecting the incidence of UTIs in children with nephrotic syndrome, including underlying medical conditions and infection severity, which may account for the variability in positive urine culture outcomes.

Examination of Additional Pathogens: Although E. coli was the primary pathogen identified in this study, subsequent research should investigate the potential involvement of other organisms, such as Klebsiella, in urinary tract infections among paediatric patients with nephrotic syndrome, especially those with comorbidities like nephrotic syndrome.

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