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Frequency of Urinary Tract Infection in children presenting with Protein Calorie Malnutrition to Hayatabad Medical Complex, Peshawar

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ABSTRACT

Background: Urinary tract infection (UTI) is among the most common bacterial infections in childhood and can lead to serious complications such as renal scarring and chronic kidney disease if not detected early. Children suffering from protein calorie malnutrition (PCM) are at higher risk due to impaired immune defenses, including reduced cell-mediated and humoral immunity. In resource-limited settings like Pakistan, where malnutrition and poor hygiene coexist, the coexistence of PCM and UTI further increases morbidity and mortality. However, local data on the prevalence and bacterial pattern of UTI in malnourished children are limited. This study was conducted to determine the frequency of UTI in children with PCM presenting to Hayatabad Medical Complex, Peshawar. **Methodology:** This cross-sectional descriptive study was conducted in the Department of Pediatrics, Hayatabad Medical Complex, Peshawar, from November 2024 to May 2025. A total of 121 children up to 12 years of age with protein calorie malnutrition were included through non-probability consecutive sampling. Protein calorie malnutrition was defined according to the Wellcome classification as weight less than 80% of the expected for age. Urine samples were collected aseptically by suprapubic aspiration in non–toilet-trained children and by midstream clean-catch in toilet-trained children. Samples were cultured in the hospital laboratory, and a pure growth of a single organism $\geq 10^5$ CFU/mL was considered diagnostic of UTI. Data were analyzed using SPSS version 22. Quantitative variables were described as mean ± standard deviation (SD), and categorical variables as frequencies and percentages. Chi-square test was applied with $p \leq 0.05$ considered statistically significant. **Results:** Out of 121 children, 68 (56.2%) were males and 53 (43.8%) were females, with a mean age of 26.8 ± 14.7 months. Urinary tract infection was confirmed in 14 (11.6%) children. *Escherichia coli* was the most common pathogen, isolated in 8 (57.1%) cases, followed by *Klebsiella* species (21.4%) and others including *Proteus*, *Staphylococcus aureus*, and *Pseudomonas*. A significant association was observed between UTI and poor socioeconomic status ($p = 0.03$) as well as incomplete vaccination ($p = 0.04$). The mean birth weight was significantly lower among children with UTI compared to those without infection ($p = 0.05$). **Conclusion:** Urinary tract infection is a frequent comorbidity among children suffering from protein calorie malnutrition. *Escherichia coli* remains the leading causative organism. Poor socioeconomic conditions, incomplete vaccination, and low birth weight are significant risk factors associated with infection. Routine screening and prompt management of UTI should be incorporated into the care of malnourished children to prevent complications and improve outcomes.

INTRODUCTION

Infectious diseases remain one of the leading causes of morbidity and mortality in childhood, particularly in developing countries where malnutrition and poverty are widespread. During early life, the immune system is still maturing, making children highly vulnerable to bacterial and viral infections [1-3]. Among these, urinary tract infection (UTI) is one of the most frequent bacterial illnesses encountered in pediatric practice. It is recognized as the second most common bacterial infection after respiratory tract infections and often presents with nonspecific symptoms, especially in younger children.

Untreated or recurrent UTI can lead to severe complications such as bacteremia, renal scarring, and chronic kidney disease, underscoring the importance of early detection and treatment [4, 5].

Protein calorie malnutrition (PCM) continues to be a major public health problem in low- and middle-income countries, including Pakistan. Malnutrition adversely affects multiple physiological systems, including the immune response. It reduces both cellular and humoral immunity, impairs mucosal defense mechanisms, and decreases the activity of the complement system. As a result, malnourished children are more susceptible to various infections, including pneumonia, diarrhea, and urinary tract infections [6, 7]. The coexistence of PCM and UTI significantly increases the risk of prolonged illness, hospitalization, and mortality.

Previous research has shown a variable prevalence of UTI in malnourished children, ranging from 10% to 30% in different regions. Rabasa and Shattima (2002) in Nigeria reported a frequency of 11.3% [8], while Uwaezuoke (2016) found a higher rate of 21% among severely malnourished children [9]. More recently, Tiwari et al. (2023) observed a prevalence of 29.5% in Indian children aged six months to five years [10]. Despite these findings, there is limited local data available from Pakistan, particularly from the northwestern region, where socioeconomic conditions and healthcare access differ markedly from other parts of the country.

Given the high burden of malnutrition and the potential for UTI to cause long-term renal damage if undetected, it is important to establish the local frequency and bacterial profile of urinary infections among malnourished children. Understanding these patterns can guide clinicians in early diagnosis, appropriate antibiotic selection, and preventive strategies.

Therefore, the current study was undertaken to determine the frequency of urinary tract infection in children presenting with protein calorie malnutrition at Hayatabad Medical Complex, Peshawar. The findings are expected to provide valuable insight into the burden of UTI in this high-risk group and help in developing effective management protocols tailored to local needs.

METHODOLOGY

This cross-sectional descriptive study was conducted in the Department of Pediatrics, Hayatabad Medical Complex (HMC), Peshawar, with the objective of determining the frequency of urinary tract infection (UTI) in children presenting with protein calorie malnutrition (PCM). The study was carried out over a period of six months, from November 2024 to May 2025, following formal approval by the Institutional Research and Ethical Board (IREB) of Hayatabad Medical Complex

Ethical approval for this research was obtained from the Institutional Review and Ethical Board (IREB) of Hayatabad Medical Complex, Peshawar (Approval No. 1843). Written informed consent was obtained from the parents or guardians of all children before their inclusion in the study. The confidentiality of participants was strictly maintained by assigning each patient a unique identification number, and no personal or identifiable information was disclosed at any stage. The study was conducted in full compliance with the ethical standards outlined in the Declaration of Helsinki (2013).

In addition, the College of Physicians and Surgeons Pakistan (CPSP) Research Evaluation Unit, Karachi, reviewed and approved the synopsis of this study under reference number CPSP/REU/PED-2022-021-7223, dated November 22, 2024. The CPSP approval confirmed that the research met the academic and ethical standards required for postgraduate clinical research and was authorized for execution at Hayatabad Medical Complex, Peshawar.

A total of 121 children were included in the study. The sample size was calculated using the World Health Organization (WHO) sample size calculator, keeping a 95% confidence level, a margin of error of 5%, and using an expected frequency of UTI of 11.3% among malnourished children as reported by Rabasa et al. The sampling technique used was non-probability consecutive sampling, and all patients meeting the inclusion criteria during the study period were enrolled until the desired sample size was reached.

All children up to twelve years of age diagnosed with protein calorie malnutrition according to the Wellcome Classification (weight less than 80% of expected for age) were included in the study. Both male and female children were enrolled. Those children who had received antibiotics within the previous two weeks, those on corticosteroid therapy for any other illness, and those whose parents or guardians did not give consent for participation were excluded from the study.

After obtaining written informed consent from parents or guardians, each child was evaluated through a detailed history and thorough physical examination. Particular attention was given to weight and nutritional status. Weight was recorded using a Bassinet weighing scale for children under two years of age and a bathroom weighing scale for older children. Demographic and clinical information such as age, gender, weight at presentation, birth weight, socioeconomic status, and vaccination status were documented on a predesigned proforma. Socioeconomic status was categorized as good, satisfactory, or poor, based on family income and living standards. Vaccination status was noted as complete, incomplete, or not done according to the national immunization schedule.

Urine samples were collected under strict aseptic conditions. For non–toilet-trained children, specimens were obtained through suprapubic aspiration, while for toilet-trained children, midstream clean-catch urine samples were collected. All specimens were placed in sterile universal containers containing 1.8% boric acid and immediately sent to the hospital's microbiology laboratory for culture and sensitivity testing. Urinary tract infection was diagnosed when a pure growth of a single bacterial organism was identified with a colony count of $\geq 10^5$ CFU/mL. The culture results were retrieved through the Hospital Management Information System (HMIS) and recorded in the proforma.

Data collected from all participants were entered and analyzed using Statistical Package for Social Sciences (SPSS) version 22. Quantitative variables such as age, birth weight, and weight at presentation were expressed as mean ± standard deviation (SD), while categorical

variables such as gender, socioeconomic class, vaccination status, and urine culture results were presented as frequencies and percentages. To assess associations between urinary tract infection and various independent factors, stratification was carried out for gender, age, birth weight, weight at presentation, vaccination status, and socioeconomic class. The chi-square test was applied, and a p-value of ≤0.05 was considered statistically significant. All results were summarized in the form of tables and figures for clarity of presentation.

RESULT

A total of 121 children with protein calorie malnutrition were included in the study. The mean age of participants was 26.8 ± 14.7 months. Out of the total, 68 (56.2%) were males and 53 (43.8%) were females, giving a male-to-female ratio of approximately 1.3:1. The mean weight at presentation was 8.9 ± 2.6 kg, while the mean birth weight was 2.6 ± 0.5 kg. Regarding socioeconomic class, 61 (50.4%) children belonged to the poor class, 42 (34.7%) to the satisfactory group, and 18 (14.9%) to the good class. Vaccination status was complete in 54 (44.6%), incomplete in 47 (38.8%), and not done at all in 20 (16.6%) participants.

Table 1

Demographic and Clinical Characteristics of the Study Population (n = 121)

Variable	Categories	Frequency (n)	Percentage (%)
Gender	Male	68	56.2
	Female	53	43.8
Age (months)	Mean ± SD	26.8 ± 14.7	—
Weight at Presentation (kg)	Mean ± SD	8.9 ± 2.6	—
Birth Weight (kg)	Mean ± SD	2.6 ± 0.5	—
Socioeconomic Class	Good	18	14.9
	Satisfactory	42	34.7
	Poor	61	50.4
Vaccination Status	Complete to-date	54	44.6
	Incomplete	47	38.8
	Not done	20	16.6

Urinary tract infection was detected in 14 (11.6%) children, while 107 (88.4%) were culture-negative. This indicates that approximately one in every nine malnourished children had a UTI.

Table 2

Frequency of Urinary Tract Infection Among Malnourished Children (n = 121)

UTI Status	Frequency (n)	Percentage (%)
Positive UTI	14	11.6
Negative UTI	107	88.4
Total	121	100.0

Among UTI-positive patients, *Escherichia coli* was the most commonly isolated pathogen, accounting for 57.1% of cases. This was followed by *Klebsiella* spp. (21.4%), *Proteus* spp. (7.1%), *Staphylococcus aureus* (7.1%), and *Pseudomonas* spp. (7.1%). This distribution aligns with the typical microbiological profile of pediatric UTIs in malnourished children.

Table 3

Distribution of Bacterial Isolates in UTI-Positive Cases (n=14)

Organism Isolated	Frequency (n)	Percentage (%)
Escherichia coli	8	57.1
Klebsiella spp.	3	21.4
Proteus spp.	1	7.1
Staphylococcus aureus	1	7.1
Pseudomonas spp.	1	7.1
Total	14	100.0

When UTI was stratified according to demographic and clinical factors, it was observed that 13.2% of males and 9.4% of females had positive urine cultures; this difference was not statistically significant (p = 0.42). The prevalence of UTI was significantly higher among children belonging to the poor socioeconomic group (18.0%) compared to those from satisfactory or good backgrounds (p = 0.03). Similarly, unvaccinated children had a higher UTI rate (25.0%) than those with complete vaccination (5.6%) (p=0.04).

Table 4

Stratification of UTI with Respect to Gender, Socioeconomic Class, and Vaccination Status

Variable	Category	UTI Present (n=14)	UTI Absent (n=107)	p-value
Gender	Male	9 (13.2%)	59 (86.8%)	0.42
	Female	5 (9.4%)	48 (90.6%)	
Socioeconomic Class	Good	0 (0%)	18 (100%)	0.03*
	Satisfactory	3 (7.1%)	39 (92.9%)	
	Poor	11 (18.0%)	50 (82.0%)	
Vaccination Status	Complete	3 (5.6%)	51 (94.4%)	0.04*
	Incomplete	6 (12.8%)	41 (87.2%)	
	Not done	5 (25.0%)	15 (75.0%)	

*p-value ≤ 0.05 is considered statistically significant.

Further analysis of quantitative variables showed no significant association between age and presence of UTI (p=0.81). However, children with UTI had a slightly lower mean birth weight (2.4 ± 0.4 kg) compared to those without UTI (2.7 ± 0.6 kg), and this difference was statistically significant (p = 0.05). Weight at presentation was lower among UTI-positive cases but did not reach statistical significance (p = 0.18).

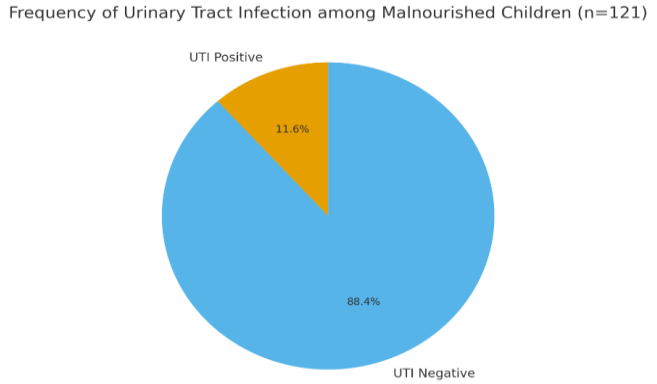
Table 5

Stratification of UTI with Respect to Age and Weight Parameters

Variable	Mean ± SD (UTI Present)	Mean ± SD (UTI Absent)	p-value
Age (months)	27.5 ± 12.9	26.7 ± 15.1	0.81
Birth Weight (kg)	2.4 ± 0.4	2.7 ± 0.6	0.05*
Weight at Presentation (kg)	8.2 ± 2.2	9.0 ± 2.7	0.18

*Statistically significant difference.

Figure 1



Graph illustrating the frequency of urinary tract infection among malnourished children in your study (n = 121). It visually shows that 11.6% of participants were UTI-positive, while 88.4% were UTI-negative.

DISCUSSION

The present study was conducted to determine the frequency of urinary tract infection (UTI) among children suffering from protein calorie malnutrition (PCM) presenting to Hayatabad Medical Complex, Peshawar. The findings revealed that 11.6% of malnourished children had culture-proven UTI. This observation highlights that urinary tract infection is a notable complication in children with compromised nutritional status and emphasizes the need for early screening and management in this vulnerable population [11, 12].

The observed frequency in this study closely aligns with the results reported by studies whom documented a UTI prevalence of 11.3% among children with severe malnutrition. A similar prevalence was noted by Ibrahim et al. in Kano, Nigeria, where 10.8% of malnourished children were found to have urinary infections [13, 14]. These consistent findings across different populations suggest that malnutrition substantially impairs host immunity, predisposing children to bacterial infections of the urinary tract.

In contrast, studies from other regions have reported variable frequencies. Studies found a higher prevalence of 21% among children with severe acute malnutrition [15], while other study observed an even greater rate of 29.5% in children aged six months to five years [16]. Such differences may reflect regional variations in hygiene, access to healthcare, sample collection methods, and diagnostic criteria. Additionally, climatic factors and differences in the severity of malnutrition could also influence infection rates. Nevertheless, even at the lower end of this range, the burden remains clinically significant, warranting attention in pediatric practice.

In the present study, Escherichia coli was identified as the predominant causative organism, accounting for 57.1% of positive cultures, followed by Klebsiella species (21.4%), while Proteus, Staphylococcus aureus, and Pseudomonas were less frequently encountered. This bacterial pattern is in concordance with reports from studies who also found *E. coli* to be the most frequent pathogen isolated from malnourished children with UTI [17]. The predominance of *E. coli* likely results from its natural presence in the gastrointestinal tract and its ability to ascend the urinary tract, especially in children with poor hygiene and impaired immune defenses.

Analysis of the relationship between urinary infection and various demographic and clinical factors in this study showed that UTI occurred more often in males (13.2%) than in females (9.4%), although the difference was statistically insignificant. This pattern may reflect the inclusion of a younger age group where uncircumcised male infants are more prone to urinary infections. However, other studies, reported a higher prevalence among female children, consistent with the known anatomical predisposition for ascending infections. The difference in gender trends between studies likely depends on the age distribution of the enrolled population and cultural differences influencing hygiene practices [18].

A significant association was observed between poor socioeconomic status and the presence of UTI ($p = 0.03$). Children belonging to lower-income families may have limited access to clean water, proper sanitation, and medical care, all of which contribute to infection risk. The results mirror those reported in similar studies from South Asia and sub-Saharan Africa, where socioeconomic deprivation is a consistent predictor of infection burden [19]. Likewise, incomplete or absent vaccination status was associated with a higher prevalence of UTI ($p = 0.04$), reflecting the general immune compromise in unvaccinated or partially vaccinated children. These findings emphasize the importance of preventive health measures, nutritional rehabilitation, and routine immunization in reducing infection-related morbidity in malnourished populations.

Regarding growth and nutritional parameters, the mean birth weight and weight at presentation were lower in children with UTI compared to those without infection, suggesting that undernourished and low-birth-weight children are more susceptible to infections [20]. A statistically significant association between lower birth weight and UTI ($p = 0.05$) was observed. This finding is consistent with earlier reports indicating that infants with poor intrauterine nutrition have reduced renal concentrating ability and compromised mucosal immunity, which may predispose them to bacterial infections.

The results of this study are consistent with the general consensus in the literature that malnutrition impairs multiple components of the immune system, including reduced complement levels, impaired neutrophil function, and decreased secretory IgA. These alterations collectively lower resistance to infections such as UTI. Rytter et al. (2014) emphasized that both cell-mediated and humoral immunity are depressed in malnourished children, explaining their increased susceptibility to bacterial infections.

The frequency of UTI in this study, though lower than some recent reports, still represents a significant health concern in the pediatric population of this region. Variations in findings between studies likely arise from differences in diagnostic criteria, inclusion of community versus hospital-based populations, and variation in the definition of malnutrition severity. Importantly, the consistent observation across studies that *E. coli* remains the

predominant pathogen suggests that empirical antibiotic therapy in such patients should maintain adequate coverage for this organism until culture sensitivity results are available.

The implications of these findings are clinically important. Early screening for urinary tract infection should be considered in children presenting with protein calorie malnutrition, even in the absence of overt urinary symptoms, as infection may be occult. Prompt detection and appropriate antimicrobial therapy can prevent complications such as bacteremia, renal scarring, and chronic kidney disease, thereby reducing long-term morbidity.

CONCLUSION

This study demonstrates that urinary tract infection is a relatively common comorbidity among children suffering from protein calorie malnutrition, with an overall frequency of 11.6%. *Escherichia coli* was identified as the predominant causative organism. The infection was significantly more frequent among children from lower socioeconomic backgrounds and those with incomplete vaccination status. These findings underscore the importance of routine screening for UTI in malnourished children, particularly in resource-limited settings where delayed diagnosis and treatment may lead to serious complications. Strengthening nutritional programs, improving vaccination coverage, and enhancing awareness regarding hygiene and early medical consultation are vital strategies to reduce the burden of urinary tract infections in this vulnerable group.

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