ORIGINAL ARTICLE

# Prevalence of Urinary Tract Infection (UTI) In Malnourished Children Aged 1 Month to 5 Years: A Study from The Children's Hospital and Institute of Child Health, Multan

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**ABSTRACT**

**Objective:** To identify the prevalence of urinary tract infections in malnourished children and the predominant pathogens and assess their antibiotic sensitivity pattern.

**Study Design: A retrospective observational study.**

**Place and Duration of Study:** Conducted at Nutritional Stabilization Centre of The Children's Hospital and The Institute of Child Health Multan, from 01.01.2023-31.12.2023.

**Materials and Methods:** Children aged 1 month to 5 years with severe acute malnutrition (weight-for-height < –3 SD with or without complications or bilateral pedal edema) based on WHO criteria were included. Urine samples were collected by age-appropriate methods; midstream clean-catch for children >3 years and pediatric urine collection bags for younger children, after proper perineal hygiene and analyzed by the hospital's pathology department through routine examination and culture. Results were analysed by using SPSS version 23.0. with frequency distributions and paired t-tests applied; significance was set at $p < 0.05$.

**Results:** A total of 247 patients were included in study. Of these, 62 children (33%) had culture positive UTI. *Escherichia coli* was the most frequently isolated pathogen (64.5%), followed by *Klebsiella* species (19.3%). Antibiotic sensitivity varied by organism, indicating the need for pathogen-specific treatment protocols.

**Conclusion:** Urinary tract infections (UTIs) are highly prevalent among children with severe acute malnutrition, with *Escherichia coli* identified as the predominant pathogen, followed by *Klebsiella*. Routine screening for UTIs in malnourished children admitted to nutritional stabilization centers is recommended to facilitate timely interventions, improve clinical outcomes, and reduce morbidity.

**Key Words:** *Bacterial Infection, Severe Acute Malnutrition, UTI, Urine Examination.*

## Introduction

Urinary tract infections are very frequent in children with severe acute malnutrition than the children with normal weight for height percentiles. The chances of urinary tract infections increase with the severity of malnutrition.[1] Severe acute malnutrition (SAM) is a serious issue with a broad spectrum of morbidities, and it has been linked with increased risk of mortality especially in children under five years of age. In the third world countries the prevalence of SAM is much higher with up to 41% children suffering from SAM and 230 million children being stunted.[2,3] The National nutritional survey 2018 of Pakistan states that currently 40.2% of under five years children are stunted and 17.7% are struggling with wasting whereas 28.9% children in our country are underweight.[4]

Furthermost researches conducted on children with severe acute malnutrition with complications who were admitted for treatment in in-patient facilities shows that these children frequently suffer from urinary tract infections, the frequencies reported were 11% in Nigeria, 17% in The Gambia, 23% to 42% in South Africa (highest in HIV infected children and in those with marasmic-kwashiorkor) and approximately 30% in Turkey and Uganda.[5-9] In the above-mentioned research, the clinical signs associated with urinary tract infections were quite low or almost unnoticeable however another study conducted in Kenya revealed that a positive dipstick

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test for urine analysis was mostly likely linked to higher mortality rates in under five children with SAM.[10]

In another study conducted on autopsies revealed that 15-71% SAM children suffer from renal infection: abscesses or pyelonephritis.[11] Children with malnutrition are more prone to develop Urinary tract infections (UTI) with prevalence of about 8 to 35% as compared to normal healthy children.[12] Its occurrence depends on several predisposing factors and immune competency of individual. Children with severe malnutrition have low resistance to bacteria due to impaired immune function. Thus, it is essential that SAM children should be screened and treated for urinary tract infections as earliest as possible to avoid further morbidities and mortality.[1,13]

There is a strong relation between severe acute malnutrition and frequent infections. Infections can lead to malnutrition and vice versa. Malnourished children may not present with typical symptoms and signs of UTI. The typical triad of fever, vomiting and abdominal pain is usually absent. It is therefore necessary to investigate all children with malnutrition for UTI. Swift and proper management and treatment will prevent malnourished children from recurrent UtI infections and complications.[14]

Dependable urine culture testing facilities are typically absent in the majority of health units where children with severe acute malnutrition are treated so the diagnosis is highly dependent on dipstick test and microscopy. Another study reported that testing for UTI with microscopy, Gram stain to visualize bacteria is 96% accurate and urine microscopy for leucocytes is 91% accurate as compared to dipstick testing which is only 88% accurate for UTI.[15] In Pakistan, there is shortage of data available on urinary tract infection in malnourished children.

Despite urinary tract infection (UTI) being a declared comorbidity among malnourished children, current literature on the topic in Pakistan is scarce Majority of the local reports report the prevalence of general pediatric UTI with no stratification according to the nutritional status even though malnutrition is very common and is associated with a known effect of immunocompromising the child. As a result, the reality regarding the burden of UTI in malnourished Pakistani children is not well-documented. This absence of context-specific information restricts the capability of clinicians to come up with specific screening and management approaches for this marginalized group. Malnourished children require timely diagnosis and proper management of UTI because poor diagnosis can increase morbidity and result in chronic infections and kidney damage. Malnutrition is not only a predisposing factor to infections, but it also distorts typical clinical manifestations and UTIs are more difficult to identify in this population. The aim of this study was to find UTI Prevalence and to screen UTI in malnourished children for empirical therapy and hospital infection control policies.

## Materials and Methods

It was retrospective observational study done at Nutrition Stabilization Centre of CH & ICH, Multan dated 1st January 2023 to 31st December 2023. Ethical approval was obtained from institutional ethical committee (2462, dated: 25.11.2022).

Patients with severe acute malnutrition (Weight/Height less than -3SD for that age and sex with some complications like hypoglycaemia, anaemia, hypothermia or other co-morbid conditions and or bilateral pedal edema) of age 1 month to 5 years who fulfilled the inclusion criteria were included in this study. Children with congenital anomalies of kidneys and urinary tract like hydronephrosis, dysplastic kidneys, vesicoureteral reflux, neuropathic bladder, children with chronic diseases like tuberculosis and AIDS and children taking antibiotics prior to admission in hospital were excluded from our study. All particulars were added in a predesigned structured Performa. Informed written consent was taken from guardians of minors. History was taken and detailed physical examination including genital area examination was done. Genital and perineum were washed with soap and water. For children more than 3 years of age a freshly voided clean mid-stream urine was collected in sterile containers and for children who were aged less than 36 months, their urine sample was collected in paediatric urine collection bag. Urine sample was then shifted to laboratory within half an hour for examination. In all children with evidence of UTI on complete urine examination, such as the presence of pus cells, bacteria, red blood cells, albuminuria (++), nitrite positivity, and leukocyte esterase, a urine

culture and sensitivity test was performed. Abdominal ultrasonography of the kidneys, bladder, and ureters were conducted in all patients showing signs of UTI on urine analysis.

The data was collected and entered in SPSS version 23.0. The frequency distribution of qualitative variables is presented into tabulated form. The mean ± SD of quantitative variables are distributed. The paired t test was used to analyse the correlation among UTI and non-UTI patients, and level of significance was determined at p-value <0.05.

## Results

A total of 260 children were analyzed at nutrition stabilization center of Ch & ICH, Multan. Out of 260, 13 patients were excluded who did not fulfil the inclusion criteria. Remaining 247 patients were included in study. Male to female ratio were 1.35:1. The male 142(57.5%) was predominant to the female 105(42.5%), 21.2% children belonged to less than 12 months of age. Most of the patients 108 (43.7%) belonged to 13-36 months of age. Out of 247 patients, 144 (58%) belonged to rural areas (Table: I).

**Table I: Gender and Age Distribution of Malnourished Children (n=247)**

| Characteristics | Frequency (n) | Percentage (%) |
|---|---|---|
| **Gender** | | |
| **Male** | 142 | 57.5 |
| **Female** | 105 | 42.5 |
| **Age groups** | | |
| **Less than 12 months** | 52 | 21.2 |
| **12-36 months** | 108 | 43.7 |
| **36 months -59 months** | 87 | 35.2 |
| **Residential status** | | |
| **Urban** | 103 | 42 |
| **Rural** | 144 | 58 |

Urine samples were collected using the clean-catch midstream method and by applying a sterile urine collection bag. Total 62 urine samples were positive out of total 247 representing presence of UTI 33%. (Table II).

Fever was most common presentation 34(89.47%) in children with UTI followed by diarrhea 29 (76.31%) and vomiting 26(68.42%) (Table II).

Blood investigations were also performed in admitted children. Out of total 62 patients with UTI, anemia was present in 40(88.89%) children, leucocytosis in 23(51.11%) children, elevated renal function was detected in 12(26.67%) children and positive blood culture was found in 21(46.67%) children.

**Table II: Common Symptoms in Children with Urinary Tract Infection (UTI)**

| Common symptoms | Non-UTI Patients (n=185) | UTI Patients (n=62) |
|---|---|---|
| Fever | 125 (52.3%) | 55 (89.47%) |
| Vomiting | 72 (19.90%) | 42 (68.42%) |
| Diarrhea | 95 (25%) | 47 (76.31%) |
| Cough | 48 (19.90%) | 12 (18.4%) |
| Convulsions | 22 (13.63%) | 06 (10.5%) |
| Abdominal pain | 35 (3.97%) | 20 (26.31%) |
| Urinary bladder tenderness | 0 (0%) | 10 (7.89%) |
| Urinary symptoms | 27 (1.7%) | 23 (28.9%) |

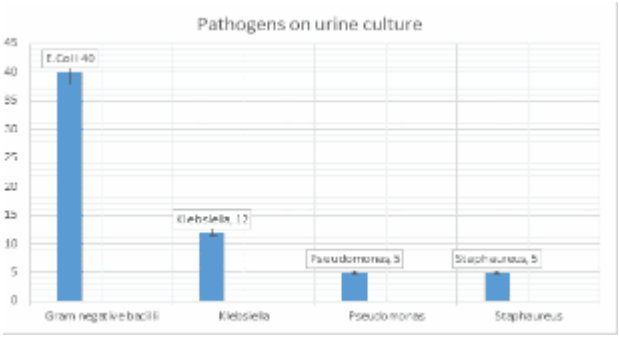


**Figure 1. Pathogens Identified on Urine Culture Reports of the Children of Severe Acute Malnutrition**

In the current study, urine examination revealed albuminuria in 22 children (48.89%), pyuria in 26 children (57.78%), and a positive urine culture in all 62 children (100%) as shown in Table III.

## Discussion

UTIs cause a significant burden of childhood morbidity in children under five years of age , second only to respiratory tract infections. UTIs can present with both symptomatic and asymptomatic forms, with the latter being more frequent in SAM children.

In the current study, 274 cases of malnourished children were investigated and most of them were under the age of three years (mean age 16.7 ± 11.1 months). Similar findings were also reported by Kumar et. al.,[16] and Choudary et. al.,[17] who also found higher percentage of UTIs in children under 20 months of age. Male dominance was observed in our study (57.5) with the male to female ratio 1.35:1. This is in line with the findings reported by Gopal et. al.,[14] and Rehman et al but Sharma et. al.,[19] reported a higher percentage of female cases.[13,18] Those discrepancies might represent gender differences in biological vulnerability, cultural beliefs, and health seeking behavior in different regions.[14,16]


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**Table III: Urine and Blood Reports of Children with Urinary Tract Infection (UTI)**

| Examination type | Findings | Total number (n=62) | Percentage (%) |
|---|---|---|---|
| Urine protein + | Positive | 30 | 48.89 |
| | Negative | 32 | 51.11 |
| Pyuria | Positive | 35 | 57.78 |
| | Negative | 20 | 42.22 |
| Urea culture | Positive | 20 | 33.33 |
| | Negative | 42 | 66.67 |
| Blood examination | Anemic | 55 | 88.89 |
| | Non-anemic | 7 | 11.11 |
| Leukocytosis | Yes | 32 | 51.11 |
| | No | 30 | 48.89 |
| RFT | Elevated | 17 | 26.67 |
| | Normal | 45 | 73.33 |
| Blood culture | Positive | 29 | 46.67 |
| | Negative | 33 | 53.33 |

The prevalence of UTI in this study was 18.2%, lower than that reported by Sharma et. al.,[16] and higher than the prevalence described by Kumar et. al.,[18] in their cohort.

The differences in prevalence could be explained by the variability in the study design, diagnostic criteria and nutritional status of enrolled children. Urine examination shows that pyuria was present in majority of samples. Similar study was conducted by Kumar et. al.,[16] where pyuria presence was significantly lower than our findings. There were clinical characteristics, including fever (75.6%), vomiting (48.9%), and diarrhea (42.2%), which are consistent with Robino et. al.,[17] and Choudary et. al.,[20] who also reported the gastrointestinal symptoms among the frequent presenting complaints.

The laboratory tests showed that there were high rates of anemia (88.9%) and leukocytosis (51.1%) and high levels of renal functions (26.7%) and positive blood cultures (46.7%) children respectively. These were significantly more than the results of Kumar et. al.,[16] this could indicate the significant effect of severe acute malnutrition on the study population whereby they are prone to systemic infections and hematological abnormalities.

*Escherichia coli* was identified as the most common organism with a rate of 64.5%, then *Klebsiella* (19.3%), *Pseudomonas* and *Staphylococcus aureus* (8%) each in terms of pathogen profile. Such results are in line with other studies such as those conducted by Bhuiyan et. al.,[21] and Sharma et. al.,[18] that also reported *E. coli* as the most common pathogen in pediatric UTIs. This fact is underscored by the fact that gram-negative organisms are predominant in nature, and thus they require specific empirical therapy, especially in resource-limited environments, where culture facilities might be limited.[15,20,21]

Altogether, the results of the current research support the idea that UTIs are a severe under-diagnosed issue in children with severe acute malnutrition. Morbidity and the possibility of developing long-term renal complications can be minimized through the early diagnosis and regular check-ups at nutritional rehabilitation facilities.[20] Enhancing diagnostic capacity in the lab, prompting antimicrobial coverage, and incorporating malnutrition management protocols with the UTI screening could help to decrease the outcome in this highly susceptible group. UTI screening in nutritional rehabilitation centers should thus be given priority in order to timely detect and intervene. Malnutrition management protocols should incorporate urine cultures testing and reinforcement of antimicrobial stewardship that can possibly lead to morbidity and long-term complications. The results of this research necessitate an aggressive strategy in pediatrics in resource-constrained areas such as Multan where key diagnosis and the limited treatment of UTIs can make a significant impact on the health outcomes of malnourished children.

## Conclusion

Urinary tract infections (UTIs) are highly prevalent among children with severe acute malnutrition, with *Escherichia coli* identified as the predominant pathogen, followed by *Klebsiella*. Routine screening of UTIs in malnourished children admitted to nutritional stabilization centers is recommended to facilitate timely interventions, improve clinical outcomes, and reduce morbidity.

## Limitation of the Study and Recommendations

There are certain limitations to the current study, it was done in one tertiary care unit only, a multi-centre study will validate the results and support the findings, also follow-ups of the enrolled children can provide insights into reoccurrences of UTI and other infections in malnourished children.

**Disclaimer:** The views and opinions expressed in this study are those of the author.

**Conflict of Interest:** There is no conflict of interest in the current study.

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**CONFLICT OF INTEREST**

Authors declared no conflicts of Interest.

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**DATA SHARING STATEMENT**

The data that support the findings of this study are available from the corresponding author upon request.