FREQUENCY OF URINARY TRACT INFECTION AND UROPATHOGEN SENSITIVITY IN PATIENTS WITH MALNUTRITION

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ABSTRACT:

Introduction: Children who are malnourished are more vulnerable to both clinical and

subclinical UTIs because they have weakened immune systems. A UTI is a dangerous illness that can cause sepsis and other potentially fatal outcomes in kids. This study will give us up-to-date data on the prevalence of UTIs in undernourished children, as no research has been conducted on this topic in the last five years. The results of the study will also be disseminated to other researchers and medical professionals.

Materials and Procedures: Total 212 patients aged 4 to 12 with malnutrition were included. Children with a history of antibiotic use within the previous two weeks, a history of urinary tract infections, and congenital or acquired urinary tract anatomical anomalies were not included. Within 30 minutes of the patient's mid-urination sample being taken, it was delivered to the hospital lab for urinalysis in an aseptic, airtight jar. A urinalysis revealing more than 10 white cells/hpf in a mid-urinary sample taken in an aseptic airtight jar and a patient's core body temperature exceeding 38° C on a thermometer indicated the presence of a urinary tract infection.

Results: I discovered that 38 (17.92%) of the malnourished patients in our study had urinary tract infections. E. coli was found in 16 (42.11%), Klebsiella pneumoniae in 12 (31.58%), Pseudomonas aeruginosa in 07 (18.42%), and Staphylococcus aureus in 03 (7.89%) of the malnourished patients who had UTIs. Amikacin, amoxacillin-clavulanate, erythromycin, ceftriaxone, ciprofloxacin, Meropenem, and pipercallin-tazobactam all had antimicrobial susceptibility patterns of 84.21%, 68.42%, 71.05%, 76.32%, 73.68%, 94.74%, and 89.47%, respectively.

Conclusion: According to our research, children who are malnourished have a significant prevalence of UTIs. Gram-negative organisms were the most often isolated, with E. coli being the most prevalent.

Keywords: malnourished, urinary tract infection, E. coli, antibiotics, sensitivity.

INTRODUCTION:

With recurrence rates ranging from 10% to 30%, urinary tract infections (UTIs) are

common in infants and young children. The Canadian Pediatric Society's updated UTI diagnosis criteria should be examined in relation to testing, sample collection, and treatment approaches.[1] Urine sample collection is challenging when a small newborn develops a urinary tract infection (UTI) since the symptoms are typically hazy. Up to half of primary care children with UTIs might not be identified at first contact due to a lower than advised sampling rate. According to the study, basic care physicians fail to diagnose up to 80% of UTIs. It is advised that primary care physicians collect a urine sample from ill children for culture.[2]

A child's immune system, as well as their physical and mental development, depend heavily on their early nutrition. Malnutrition among children continues, particularly in Sub-Saharan Africa and South-East Asia. The two main causes of malnutrition in children under five are poverty and illiteracy.[3] Child nutrition has been evaluated using a variety of anthropometric metrics. Underweight (weight for age), stunting (age-related height), and wasting (weight-related height). On the other hand, MUAC measurement provides a quick, easy, and precise method of diagnosing malnutrition in children under five.[4]

Compared to their classmates who are well-nourished, children who are malnourished are more likely to get UTIs, and the risk increases as malnutrition increases. Immunological weakness is linked to severe acute malnutrition, which increases the risk of deadly infections in affected newborns. Hospitalized children with SAM had a significant incidence of UTI, according to the majority of research conducted in developing countries. Physicians may be able to diagnose and treat these children more effectively if they are aware of this risk.[5] One study found that 16.5% of undernourished children had UTIs.[6]

Children who are malnourished are more vulnerable to both clinical and subclinical UTIs because they have weakened immune systems. A UTI is a dangerous illness that can cause sepsis and other potentially fatal outcomes in kids. This study will give us up-to-date data on the prevalence of UTIs in undernourished children, as no research has been conducted on this topic in the last five years. The results of the study will also be disseminated to other researchers and medical professionals.

MATERIALS AND METHODS:

This cross-sectional validation study was carried out by the pediatric department of Khyber Teaching Hospital in Peshawar between June 2024 and December 2024. The following presumptions are made while calculating the sample size using the WHO sample size formula: The expected percentage of UTIs in malnourished individuals is 16.5%[6], the margin of error is 5%, the confidence level is 95%, and the sample size is 212. Both genders of patients aged 4 to 12 were diagnosed with malnutrition, which was verified by the STAMP nutritional screening tool (annexure 1). Individuals whose STAMP score is greater than 4. Children with a history of antibiotic use within the previous two weeks, a history of urinary tract infections, and congenital or acquired urinary tract anatomical anomalies were not included.

Patients who met the selection criteria were enrolled from the hospital's outdoor pediatric department after receiving approval from the study review board. After being informed of the study's goals, risks, and advantages, the parents or other blood relatives who were able to provide their consent gave their informed consent. Age (years), gender, height (cm), weight (kg), BMI (kg/m2), domicile, parental education, parental occupation, and socioeconomic position were among the baseline data and demographics that were documented.

After a thorough history was obtained, a medical examination was conducted. A digital thermometer was used to record the temperature using the axillary approach. The child's armpit was tucked tightly against their body, and the thermometer's tip was positioned in the middle of

the armpit. After a minute, it was removed from the spot. The temperature that was thus shown on the digital display was recorded. Within 30 minutes of the patient's mid-urination sample being taken, it was delivered to the hospital lab for urinalysis in an aseptic, airtight jar. A urinalysis revealing more than 10 white cells/hpf in a mid-urinary sample taken in an aseptic airtight jar and a patient's core body temperature exceeding 38° C on a thermometer indicated the presence of a urinary tract infection. The researcher personally recorded the data on a specifically created proforma.

IBM SPSS version 25, a statistical analysis application, was used to analyze the data. After confirming that the data was normal using the Shapiro-Wilk test, means ± SD or median IQR were calculated for continuous data such as age, weight, height, BMI, and length of malnutrition. For categorical variables, such as gender, domicile, mother's education, father's occupation, socioeconomic position, and the presence or absence of a urinary tract infection, frequencies and percentages were noted. To account for effect modifiers, urinary tract infections were categorized by age, gender, place of residence, and socioeconomic level. At the 5% level of significance, the Fisher exact test or post-stratification chi square test was used. A P value of less than 0.05 was deemed statistically significant.

RESULTS:

It was 8.68 ± 2.76 years old on average. With a male to female ratio of 1:1.5%, 86 (40.57%) of the 212 patients were men and 126 (59.43%) were women. A mean height of 106.55 ± 13.43 cm was recorded. A mean weight of 29.07 ± 4.92 kg was recorded. A BMI of 18.865 ± 6.54 kg/m2 was the mean. Table I displays descriptive data for several factors. Table II displays the distribution of patients with additional confounding variables. The most frequent presenting complaint in our study was fever 121 (57.07%), which was followed by loose stool in 76 (35.85%), coughing in 54 (25.47%), pallor in 49 (23.11%), vomiting in 39 (18.40%), not gaining weight in 25 (11.79%), lethargy or

decreased oral acceptance in 19 (8.96%) and abdominal discomfort in 11 (5.19%).

I discovered that 38 (17.92%) of the malnourished patients in our study had urinary tract infections (Figure I). E. coli was found in 16 (42.11%), Klebsiella pneumoniae in 12 (31.58%), Pseudomonas aeruginosa in 07 (18.42%), and Staphylococcus aureus in 03 (7.89%) of the malnourished patients who had UTIs (Table III). Amikacin, amoxacillin-clavulanate, erythromycin, ceftriaxone, ciprofloxacin, Meropenem, and pipercallin-tazobactam all had antimicrobial susceptibility patterns of 84.21%, 68.42%, 71.05%, 76.32%, 73.68%, 94.74%, and 89.47%, respectively, according to Table IV. Table V displays the stratification of UTI according to covariates.

Table-I: Descriptive statistics of different variables (n=212).

Variables	Mean ± SD
Age (years)	8.68 ± 2.76
Height (cm)	106.55 ± 13.43
Weight (kg)	29.07 ± 4.92
BMI (kg/m^2)	18.865 ± 6.54

Table II: Distribution of patients with other confounding variables (n=212)

Confounding variables		N (%)
Age (years)	4-7	67 (31.60%)
	8-12	145 (68.40%)
Gender	Male	86 (40.57%)
	Female	126 (59.43%)
BMI (kg/m^2)	≤20	96 (45.28%)
	>20	116 (54.72%)
Residence	Rural	110 (51.89%)
	Urban	102 (48.11%)
Socioeconomic status	Poor	65 (30.66%)
	Middle	89 (41.98%)
	Upper	58 (27.36%)
Mother's education	Uneducated	77 (36.32%)
	Educated	135 (63.68%)
Father's profession	Unemployed	53 (25.0%)
	Employed	159 (75.0%)

Figure I: Frequency of urinary tract infection in patients with malnutrition (n=212).

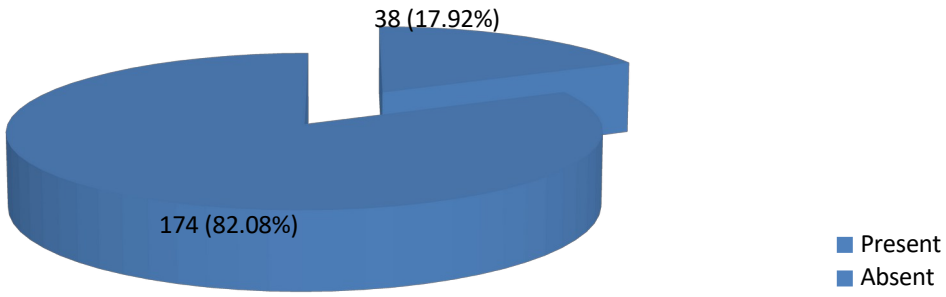

Table-III: Frequency of different causative organisms for UTI in diabetic ketoacidosis patients.

Organisms	No. of Patients	%age
E. coli	16	42.11
Klebsiella pneumoniae	12	31.58
Pseudomonas aeruginosa	07	18.42
Staphylococcus aureus	03	7.89

Table IV: Antibiotic susceptibility pattern (n=38)

Antibiotic	Sensitive	Resistant

Amikacin	32 (84.21%)	06 (17.79%)
Amoxacillin-clavulanate	26 (68.42%)	12 (31.58%)
Erythromycin	27 (71.05%)	11 (28.95%)
Ceftriaxone	29 (76.32%)	09 (23.68%)
Ciprofloxacin	28 (73.68%)	10 (26.32%)
Meropenem	36 (94.74%)	02 (5.26%)
Pipercallin-tazobactam	34 (89.47%)	04 (10.53%)

Table V: Stratification of UTI with respect to confounders.

		Present (n=38)	**Absent (n=174)**	**P-value**
Age (years)	4-7	14 (20.90%)	53 (79.10%)	**0.443**

	8-12	24 (16.55%)	121 (83.45%)	
Gender	Male	17 (19.77%)	69 (80.23%)	**0.563**
	Female	21 (16.67%)	105 (83.33%)	
BMI (kg/m^2)	≤20	12 (12.50%)	84 (87.50%)	**0.061**
	>20	26 (22.41%)	90 (77.59%)	
Residence	Rural	25 (22.73%)	85 (77.27%)	**0.058**
	Urban	13 (12.75%)	89 (87.25%)	
Socioeconomic status	Poor	11 (16.92%)	54 (83.08%)	**0.568**
	Middle	14 (15.73%)	75 (84.27%)	
	Upper	13 (22.41%)	45 (77.59%)	
Mother's education	Uneducated	16 (20.78%)	61 (79.22%)	**0.413**
	Educated	22 (16.30%)	113 (83.70%)	
Father's profession	Unemployed	13 (24.53%)	40 (75.47%)	**0.148**
	Employed	25 (15.72%)	134 (84.28%)	

DISCUSSION:

In our study, 38 out of 212 children with malnutrition had an overall UTI rate of 17.92%. The majority of UTI cases (20.90%) were observed in the 4–7 age group, while the majority of the study population (68.40%) was in the 8–12 age range. There were 126 (59.43%) females and 86 (40.57%) males in our study. The prevalence of UTI was

observed to be higher in females (16.67%) than in males (19.77%). Nevertheless, the p-value of 0.563 indicated that this connection was not statistically significant. This was comparable to earlier research[7-9] that found a strong correlation between UTI and feminine gender. The prevalence of UTI in malnourished children is higher among women, which is consistent with the overall female preponderance of UTI. This could be because females tend to have shorter urethras, which increases the risk of ascending infections.

The most frequent presenting complaint in our study was fever 121 (57.07%), which was followed by loose stool in 76 (35.85%), coughing in 54 (25.47%), pallor in 49 (23.11%), vomiting in 39 (18.40%), not gaining weight in 25 (11.79%), lethargy or decreased oral acceptance in 19 (8.96%) and abdominal discomfort in 11 (5.19%). Other research by Sharma et al.[10] (84.7%), Kumar et al.[11] (59.3%), and Dangayach et al.[8] (33.84%) indicated that fever was the most prevalent presenting complaint, whereas investigations by Dey et al.[9] and Banapurmath et al.[12] found that respiratory symptoms were the most common. Our investigation indicated that the only clinical manifestation that had a statistically significant correlation with UTI was loose stool. It was comparable to the research conducted by Bagga et al[13], which found that UTIs were present in 23.3% of children who had diarrhea and 10.1% of those who did not. The increased colonization of periurethral flora in patients with diarrhea may be the cause of the greater prevalence of UTI in these patients. There was just one patient (0.71%) with urinary symptoms, making them an uncommon finding. However, both our study and earlier studies[11,13] demonstrated a 100% correlation with UTI.

We discovered that the group with more than five pus cells had a considerably higher percentage of patients with UTIs. Our analysis indicated that this link was statistically significant (p value <.0001). Most additional research reported a similar significant

correlation.[14-16] In contrast, a research by Rabasa et al.[17] and Ibrahim et al[7] discovered that children who were malnourished had a lower leucocyte response than those who were not. Because pyuria can occur without bacteriuria in a number of illnesses, such as glomerulonephritis or infections elsewhere in the body, it cannot be used as a criterion to diagnose UTI. However, as our study and several other investigations have shown, the presence of pyuria should raise the suspicion of a UTI.

In our study, 38 out of 212 children, or 17.92%, had a UTI. This study was similar to a few others.[8,10] E. coli was shown to be the most common cause of UTI in 16 (42.11%) malnourished patients, followed by Klebsiella pneumoniae in 12 (31.58%), Pseudomonas aeruginosa in 07 (18.42%), and Staphylococcus aureus in 03 (7.89%). Amikacin, amoxacillin-clavulanate, erythromycin, ceftriaxone, ciprofloxacin, Meropenem, and pipercallin-tazobactam all had antimicrobial susceptibility patterns of 84.21%, 68.42%, 71.05%, 76.32%, 73.68%, 94.74%, and 89.47%, respectively, according to our study.

On the other hand, prior research demonstrated good sensitivity to ciprofloxacin and amikacin. The organisms in the study by Kumar et al.[11] were 7% sensitive to cefotaxime, 100% sensitive to amikacin, and 81.4% sensitive to ciprofloxacin. Good sensitivity to co-trimoxazole, amoxicillin, ciprofloxacin, and ceftriaxone was observed by Bagga et al.[13] 100% sensitivity to ciprofloxacin and gentamycin was seen in the Ibrahim et al. investigation.[7] In studies by Dangayach et al.[8] and Sharma et al[10], E. coli shown 90–100% sensitivity to gentamicin, imipenem, amikacin, and nitrofurantoin. Comparing our work to earlier research, we discovered that organisms were more resistant to certain drugs. Therefore, we advise that antibiotics be chosen in accordance with the information on the sensitivity pattern of that hospital or area.

Meropenem, imipenem, amikacin, ciprofloxacin, and piperacillin-tazobactam were determined to be the most effective antibiotics based on the antimicrobial susceptibility pattern of Enterobacterales, whereas ceftriaxone, cefixime, and amoxicillin-clavulanate were shown to be comparatively less effective. This trend is consistent with several investigations carried out in Pakistan over the last ten years that demonstrated Enterobacterales' growing resistance to the antibiotic classes cephalosporin and penicillin.[18-21]

Our study's strength was that, in comparison to the majority of earlier research, it featured a sizable sample size. All patients had ultrasounds to rule out those with kidney or urinary tract structural abnormalities. The population's demographics and the relationship between UTI and clinical presentation were also investigated. This study's primary drawback was that it was a hospital-based study that only included hospitalized patients; as a result, it was unable to determine the prevalence of UTI in both the general community and asymptomatic SAM patients. Additionally, controls weren't enlisted.

CONCLUSION:

According to our research, children who are malnourished have a significant prevalence of UTIs. Gram-negative organisms were the most often isolated, with E. coli being the most prevalent. The majority of them shown resistance to cefotaxime, cefuroxime, and ciprofloxacin, as well as good sensitivity to antibiotics like amikacin and nitrofurantoin. We can infer from this study that children who are malnourished are susceptible to urinary tract infections. Before beginning antibiotics, all of these children should have a routine urine examination and urine culture. Local sensitivity data should guide the empirical antibiotic selection process. Antibiotics that are effective against gram-negative organisms should be begun until culture reports are obtained if such information is unavailable.

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