Original Research Article

Study to determine the prevalence of urinary tract infection and to identify the causative organism and their antibiotic sensitivity pattern in severe acute malnourished children

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Abstract

Background: Malnutrition generally implies under-nutrition and refers to all deviations from adequate and optimal nutritional status in infants, children and in adults. In children, under-nutrition manifests as underweight and stunting (short stature), while severely undernourished children present with the symptoms and signs that characterize conditions known as kwashiorkor, marasmus or marasmic-kwashiorkor.

Materials and methods: The present study was carried out in the department of pediatrics and microbiology at UP Rural Institute of Medical Sciences and Research, Saifai, Etawah (U.P) during April 2014 to March 2015. Total 85 children were included in study.

Results: Although under reported UTI is common in children with SAM as came out in our study. Prevalence of UTI is common (22.4%) in children with SAM in our study. In our study, Urinary tract infection was more common in females than males in SAM children with maximum prevalence among 37-59 months of age .but there is no significant difference between sex.

Conclusion: Most sensitive first line oral Antibiotic was Nitrofurantoin and parentral antibiotic was Amikacin for UTI in children with SAM, in our study.

Key words

Urinary tract infection, Causative organism, Antibiotic sensitivity, Mal-nourished children.

Introduction

The World Health Organization (WHO) defines Malnutrition as "The cellular imbalance between the supply of nutrients and energy and the body's demand for them to ensure growth, maintenance, and specific functions" [1]. Malnutrition generally implies under-nutrition and refers to all deviations from adequate and optimal nutritional status in infants, children and in adults. In children, under-nutrition manifests as underweight and stunting (short stature), while severely undernourished children present with the symptoms and signs that characterize conditions known as kwashiorkor, marasmus or marasmic-kwashiorkor [1].

Many factors can cause malnutrition, most of which relate to poor diet or severe and repeated infections, particularly in underprivileged populations. Inadequate diet and disease, in turn, are closely linked to the general standard of living, the environmental conditions, and whether a population is able to meet its basic needs such as food, housing and health care. Although it is rarely the direct cause of death (except in extreme situations, such as famine), child malnutrition was associated with 54% of child deaths (10.8 million children) in developing countries in 2001.

It's a serious public-health problem that has been linked to a substantial increase in the risk of mortality and morbidity. In the developing world, prevalence of malnutrition among under-fives is 41% with an estimated 230 million (39%) children being chronically malnourished [2, 3]. Severe acute malnutrition affects nearly 20 million preschool-age children, mostly from the World Health Organization (WHO) African Region and South-East Asia Region. Malnutrition is significant factor in approximately one third of the nearly 8 million deaths in children who are under 5 years of age worldwide [4].

India is home to greatest population of severely malnourished children in the world and accounts for over 20% of under-five childhood death every year and 2.1 million children in India do not survive to celebrate their fifth birthday [5]. National family health survey(NFHS-3) estimates reveal that 45.9% of India's children under 3 years are underweight, 39% are stunted and 23% are wasted and about 8 million (6.4%) children suffer from acute severe malnutrition and these children have high mortality rate ranging from 20% to 30% [6].

In the state of Uttar Pradesh – the most densely populated state of India- NFHS-3 estimated that 14.9% of children between 0-59 months age are wasted and 5.2% (an average 1.2 million children at any point in time) are severely wasted [7]. In children between the ages of 6 and 59 months Severe acute malnutrition SAM is defined as : (*i*) Weight/height or Weight/length < -3 *Z* score, using the WHO Growth Charts; OR (*ii*) Presence of visible severe wasting; OR (*iii*) Presence of bipedal oedema of nutritional origin; OR (*iv*) mid- upper arm circumference (MUAC) < 115 mm [8].

Severely malnourished children have a high mortality rate; almost 56% of childhood death is attributed to malnutrition. It is not only an important cause of childhood morbidity and mortality, but leads to impairment of physical and possibly of mental growth of those who survive. These children are more prone for infections [9, 10]. The judicious use of antibiotics in these children is depended on culture reports.

The response to SAM in Uttar Pradesh is led by the National Rural Health Mission (NRHM). Currently, this response relies on a network of Nutrition Rehabilitation Centers (NRCs), where children with SAM receive therapeutic care following protocols based on the guidelines for the management of SAM by the World Health Organization (WHO) [11] and the Indian Academy of Pediatrics (IAP) [12].

Optimal management of these acutely ill children and a good outcome depends on an evidence based regimen of care. Despite concerted efforts in recent years involving policy makers, health care providers and social organizations morbidity and mortality of malnutrition remains a challenge. Severe acute malnutrition (SAM) continues to be an important cause of mortality. In addition to critical care, a nutritional therapy followed by nutritional rehabilitation is a very important aspect for these children [13].

It is well known that there is synergistic interaction between malnutrition and infection; any kind of infection can worsen the nutritional status. On the other hand, malnutrition, even mild, may affect the immune system and compromise body defense against infections. Severe malnutrition leads to an immunodeficiency state known as NAIDs (Nutritionally Acquired Immune Dysfunctions). The ability of malnourished child to handle infections is lower, hence common infections from Streptococcus pneumoniae, Klebsiella pneumoniae, Escherichia coli and Hemophilus influenza is more common in them [14] leading to pneumonia, septicemia, diarrhea, meningitis, tuberculosis and a higher incidence of urinary tract infections as compared to nonmalnourished has been documented in severely malnourished children [15].

A urinary tract infection (UTI) is an infection in any part of the urinary system, kidneys, ureters, bladder and urethra. Most infections involve the lower urinary tract, the bladder and the urethra. Malnutrition and infections are interrelated [16]. Therefore death amongst children with SAM is almost always as a result of infection. However, when treated with following WHO ten steps of management of severe malnutrition, mortality is expected to be less than 5% [17].

UTI may be asymptomatic, or may present in infants and young children with non-specific symptoms and signs, such as irritability and fever. Hence a close suspicion is required for its correlation in children especially with SAM. Western studies consistently report that UTI accounts for 3-6% of children younger than 2 years of age presenting with fever without a focus (FWF) [18], and collection and examination of urine is recognized as an important part of the investigation of the young febrile child [19-21]. Much less information is available from the tropical world, but studies from Africa suggest that the prevalence of UTI in this group of children may be higher, with rates of 9% and 11.4% reported in two studies [22, 23].

It is widely recognized that urinary infection in infancy and childhood is frequently associated with underlying abnormalities of the renal tract such as vesicoureteric reflux that recurrent urinary tract infection (UTI) may result in renal scarring and chronic pyelonephritis and that early diagnosis of UTI enables preventive measures to be taken with potential benefit to the quality and duration of life for affected children [24-26].

The diagnosis of UTI in children presents problems. In addition to the non-specific presentations, diagnosis depends on obtaining a sample of urine. There is an understandable tendency among clinicians to regard the obtaining of a urine sample from a small child as being either too difficult, when it involves catheterization or Suprapubic aspiration, or relatively easy, when performed by using a urine collection bag. Unfortunately the latter technique produces contaminated urine in a very high proportion of samples and is thus highly inaccurate [27].

It is well known that diagnosis of UTI is made infrequently in our setting and have felt that this is most likely to be due to inadequate diagnosis. It is certainly easy to overlook the possibility of UTI in infants and young children.

The occurrence of infections depends on two factors: predisposing factors and host immunity factors. Predisposing factors of UTI in children include an obstructive defect of urinary tract, chronic constipation, and vesicoureteral reflux. In normal children, proliferation of bacteria in mucosal bladder can be prevented by a strong flow of urine and existence of local mucosal bladder antibody system. Children with protein energy malnutrition (PEM) have impaired immune function including depressed hypersensitivity response, low T lymphocytes, and disturbance of lymphocyte response, decreased phagocytosis secondary to lack of complements and low secretion of immunoglobulin A [28, 29]. The high prevalence of bacteremia, urinary tract infections, diarrhea, and pneumonia among children with severe malnutrition coupled with an atypical clinical presentation of sepsis justifies the routine use of empirical antibiotic treatment in the initial phase of inpatient management as recommended by WHO. However, the choice of antibiotics has to be guided by locally prevalent pathogens and their antibiotic susceptibility patterns [30].

There is a significant association between UTI and the degree of malnutrition [31] or a sub clinical vitamin A deficiency present in the malnourished children may have predisposed them to UTI [32] and it should be routinely investigated. So, regular surveillance of related pathogen and their antibiotic sensitivity test recommended [33].

There is paucity of data on exact prevalence of UTI in SAM. Hence In view of above WHO guideline, this study has been planned to determine the prevalence, to identify causative organisms, and to study the antibiotic sensitivity pattern of the organisms causing urinary tract infection in children suffering from severe acute malnutrition admitted in rural tertiary care teaching hospital in central Uttar Pradesh (UP RIMS&R, SAIFAI).

Aims and objectives

- To determine the prevalence of urinary tract infection in patients with SAM.
- To identify the organisms causing UTI in patient with SAM.
- To study the antibiotic sensitivity pattern of the causative organisms.

Materials and methods

Study design

Hospital based cross sectional study.

Study period

April 2014 to March 2015

Method of Selection

The present study was carried out in the department of pediatrics and microbiology at UP Rural Institute of Medical Sciences and Research, Saifai, Etawah (U.P) during April 2014 to March 2015. Ethical clearance was obtained from the ethical committee of the institute. An informed and written consent was taken from the parents of children. Total 85 children were included in study.

The study group enrolled children from the patients aged between six months to fifty nine months attending the indoor department of pediatrics. Cases were selected on the basis of anthropometry and clinical examination, subjected to fulfillment of the criteria based on IAP definition for SAM.

- Weight for height or Weight for length < -3 *SD*, using the WHO Growth Charts. OR
- Presence of visible severe wasting. OR
- Presence of bipedal oedema of nutritional origin. OR
- Mid upper arm circumference (MUAC) < 115 mm [8].

Inclusion criteria

Children between the ages of 6 months to 59 months who were fulfilling the criteria for SAM (As stated above).

Exclusion criteria

The subjects with following conditions were not being included in the study:

- Children less than 6 months and more than 59 months of age.
- Children who were born either premature or post mature and/or were small for gestational age or large for gestational age.
- Children greater than 70% of the expected weight for age, non-nutritional cause of edema.
- Children having congenital anomalies of the kidney and urinary tract (CAKUT) and anatomical abnormalities that could influence the renal size including hydronephrosis, vesicoureteric reflux, nephrolithiasis.
- Those who routinely take antibiotics/ had taken any antibiotics within the one weeks prior to presentation
- Children with chronic diseases such as AIDS and Tuberculosis.
- Children with known HIV infection and therefore receiving Cotrimoxazole prophylaxis
- Inability to obtain informed consent for participation in study.

All the children included in study underwent through history, physical examination, routine and special investigations, anthropometric measurement.

Routine investigations

- Routine blood examination-CBC.
- Peripheral smear for malaria, serology.
- RBS (random blood sugar)
- Chest X ray.
- Stool- routine, microscopy.
- Sputum/Gastric lavage for AFB.
- Mantoux test.
- Serum electrolytes
- Liver function test(S.albumin, SGOT, SGPT, S.ALP)

Special investigations

- Urine- Routine, microscopy, culture, antibiotic sensitivity, antifungal sensitivity.
- HIV serology
- USG abdomen.
- MCU (Micturating Cystourethrogram)
- DMSA.

  Antifungal sensitivity, MCU & DMSA were not done due to unavailability in the institute.

Subject selection

All the patients with severe acute malnutrition admitted in Pediatric ward were evaluated regarding their eligibility to be included or excluded in the study. First the parents were interviewed and informed, written consent was obtained. All subjects were evaluated on a precoded study proforma which included relevant clinical history, information obtained with the questionnaires included antenatal, natal, postnatal, date of birth/age, sex, family, immunization, nutritional history, history of fever and antibiotic administration in the preceding two weeks, were taken.

A clinical examination was performed on each of the participants with emphasis on anthropometry (height, weight and MUAC), axillary temperature, general physical examination, and features of renal disease such as facial puffiness, oedema, renal angle tenderness and ballotable kidney. Systemic examination, specific investigations were done. Patients were examined for any major congenital malformations, cardiac disease, or renal disease, etc.

The eligible patients were screened for other manifestations of severe acute malnutrition like hypoglycemia, hypothermia, dehydration, dyselectrolytemia, signs of vitamin and micronutrients deficiency and infections like

septicemia, TB, HIV/AIDS, meningitis, worms in stool, malaria etc. A standardized clinical form was used to collect socio-demographic information, clinical symptoms and their duration, immunization history, anthropometric measurements, physical signs, results of laboratory investigations, and the patient's final outcome.

Statistical analysis

Data analysis was carried out using the Statistical Product and Service Solutions (SPSS) 16.0 version (Chicago,inc., USA). The results are presented in Means ±SD and percentage. The univariate binary logistic regression analysis was carried out to find the degree of association between UTI and study parameters. The Relative risk (RR) and its 95% confidence interval (CI) was calculated. P-value <0.05 was considered significant.

Results

In our study, total 85 children were included out of them Male were 48 (56.5%) and female were 37 (43.5%). More than half (56.5%) of the patients were male (**Table – 1**).

Table - 1: Sex distribution of the children.

Sex	No. (n=85)	%
Male	48	56.5
Female	37	43.5

In this study, highest number of children (45.9%) were age between 13 months to 36 months and lowest number (21.2%) were between age of 37 months to 59 months. More than one third of the children between 13-36 (45.9%) month followed by 6-12 (32.9%) and 37-59 (21.2%) as per **Table - 2**.

Table - 2: Age distribution of the children.

Age in months	No. (n=85)	%
6-12	28	32.9
13-36	39	45.9
37-59	18	21.2

The mean height/length was 80.78 (±12.19) cm, average weight 7.56 (±7.56) kg, mean mid-upper arm circumference was 11.74(±1.42) as per **Table - 3**.

Table - 3: Distribution Anthropometric parameters of the children.

Anthropometric parameters	No. (n=85)
Height/Length in cm	80.78±12.19
Weight in kg	7.56±7.56
Mid upper arm circumference	11.74±1.42

In Majority, the weight for height <-3SD was observed among 73 (85.9%) of the patients followed by MUAC<11.5 cm among 40 (47.1%) of the patients, edema positivity seen in 14 (16.5%) of the patients and visible sever wasting was in 28 (32.9%)of the patients (**Table – 4**).

Table - 4: Distribution According to nutritional parameters.

Nutritional parameters	No. (n=85)	%
Weight for height <-3SD	73	85.9
MAUC<11.5 cm	40	47.1
Edema positive	14	16.5
Visible severe wasting	28	32.9

Most common clinical symptom was fever found in 72 patients (84.7%) followed by loose stools in 35 patients (41.2%), convulsions in 28 patients (32.9%), cough in 23 patients (27.1%) and vomiting in 21patients (24.7%) and pain in abdomen in 3 patients (3.5%). The percentage of increased frequency of micturition, urinary bladder tenderness, renal angle tenderness was 1.2% only (**Table – 5**).

Urine sample was collected by Suprapubic, Clean catch mid strem and by Catheterisation out of them the suprapubic method was used in 36 of the patients (42.4%) and clean catch mid trem was used in 28 patients (32.9%). However, catheterisation was used in 21 (24.7%) as per **Table - 6**.

Table - 5: Distribution of clinical symptoms of the children.

Clinical symptoms	No. (n=85)	%
Fever	72	84.7
Cough	23	27.1
Increased Frequency of micturition	1	1.2
Pain in abdomen	3	3.5
Vomiting	21	24.7
Loose stools	35	41.2
Urinary bladder tenderness	1	1.2
Convulsions	28	32.9
Renal angle tenderness	1	1.2

Table - 6: Distribution of method of sampling.

Method	No. (n=85)	%
Suprapubic	36	42.4
Clean catch Mid-stream	28	32.9
Catheterization	21	24.7

Total 19 urine samples (22.4%) were culture positive out of 85 samples so the Prevalence of UTI was 22.4%. Pus cell count ≤4/Hpf was in 77 samples (90.6%), 5-10/Hpf was in 8 samples (9.4%) and Pus cell count >10/Hpf was in none of the sample (**Table – 7**).

Table - 7: Distribution of Microscopic urine examination of the patients.

Urine examination	No. (n=85)	%
Pus cell count/Hpf		
≤4	77	90.6
5-10	08	9.4
>10	0	0.0
Culture positive	19	22.4

Out of the total 19 culture positive cases, E. coli was commonest organism in 13 patients (68.4%) followed by Citrobacter in 2 cases (10.5%), Pseudomonas in 2 cases (10.5.5%) and Acinetobacter and Klebsiella 1-1 each (4.8%) as per **Table – 8**.

Imipenem was sensitive in all sample while Meropenem was sensitive in 94.7% of the samples. Co-amoxiclave was least sensitive among all the drugs while ceftriaxone shows resistant to all the samples (**Table – 9**).

Table - 8: Distribution of organism.

Organism	No. (n=19)	%
Acinetobacter	1	5.3
Citrobacter	2	10.5
E. Coli	13	68.4
Klebsiella	1	5.3
Pseudomonas	2	10.5

E. coli was 100% sensitive with Imipenem and Nitrofurantoin followed by Meropenem (92.3%), Amikacin (92.3%) while E. coli was 7.7% sensitive with Co-Amoxyclav & Cefotaxime. E.coli, showed resistant to Ceftriaxone. Pseudomonas and Klebsiella was 100% sensitive to Meropenem, Imipenem, Gentamicin, Amikacin and resistant to Nitrofurantoin, Cefixime, Ceftriaxone. Acinetobacter and Citrobacter are 100% sensitive to Meropenem, Imipenem, Nitrofurantoin while resistant to Amikacin, Cefixime and Ceftriaxone (**Table – 10**).

The UTI was present in 18.8% of male patients and in 27% of the female patients. The UTI was 31% lower among males than females (RR=0.69, 95%CI=0.31-1.53, p=0.36), however, this trend was statistically not significant (**Table – 11**).

The percentage UTI was observed to be higher among the patients of age between 37-59 months (33.3%) followed by 13-36 months (23.1%) and 6-12 months (14.3%). The UTI was 1.54 times higher in the age group 37-59 month than 6-12 months (RR=1.54, 95%CI=0.42-5.21), p=0.51) as per **Table - 12**.

The UTI was present in 42.9% of Catheterization method followed by Suprapubic (22.2%) and Clean catch mid-stream (7.1%). This trend was statistically not significant (**Table – 13**).

The UTI was observed in 21.4% of the patients whom edema was positive and 23.3% whose

Weight for height was <-3SD. There was no significant association between UTI and Nutritional parameters (**Table – 14**).

Pain in abdomen was significantly (p=0.04) associated with the prevalence of UTI. Renal angle tenderness and urinary bladder tenderness was 100% associated with the UTI. None of the other symptoms were associated (p>0.05) with the prevalence of UTI (**Table – 15**).

Table - 9: Distribution of sensitivity and resistant pattern.

Drugs*	No.	% of sensitivity	% of resistant
Meropenem	18	94.7	5.3
Imipenem	19	100.0	0.0
Nitrofurantoin	16	84.2	15.8
Co-trimoxazole	6	31.6	68.4
Cefotaxime	3	15.8	84.2
Co-Amoxyclav	3	15.8	94.7
Cefixime	2	10.5	89.5
Ceftriaxone	0	00.0	100
Gentamicin	14	73.7	26.3
Amikacin	15	79.0	21.0

Table - 10: Sensitivity pattern in association with organisms.

	No. (%) n=19	Meropenem		Imipenem		Nitrofurantoin		Co-trimoxazole		Cefotaxime		Co-amoxiclave		Cefixime		Ceftriaxone		Gentamicin		Amikacin	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
E. Coli	13 (68.4)	12 (92.3)		13 (100.0)		13 (100.0)		3 (23.0)		1 (7.7)		1 (7.7)		2 (15.4)		0 (0.0)		10 (77.0)		12 (92.3)	
Pseudomonas	2 (10.5)	2 (100.0)		2 (100.0)		0 (0.0)		0 (0.0)		1 (50.0)		0 (0.0)		0 (0.0)		0 (0.0)		2 (100.0)		2 (100.0)	
Citrobactor	2 (10.5)	2 (100.0)		2 (100.0)		2 (100.0)		1 (50.0)		0 (0.0)		0 (0.0)		0 (0.0)		0 (0.0)		1 (50.0)		0.0	
Klebsiella	1 (5.3)	1 (100.0)		1 (100.0)		0 (0.0)		1 (100)		0 (0.0)		0 (0.0)		0 (0.0)		0 (0.0)		1 (100.0)		1 (100.0)	
Acinetobacter	1 (5.3)	1 (100.0)		1 (100.0)		1 (100.0)		1 (100)		1 (100.0)		0 (0.0)		0 (0.0)		0 (0.0)		0 (0.0)		0 (0.0)	

Table - 11: Association between UTI and gender.

Gender	UTI				RR (95%CI), p-value
	Present		Absent		
	No.	%	No.	%	
Male	9	18.8	39	81.2	0.69 (0.31-1.53), 0.36
Female	10	27.0	27	73.0	1.00 (Ref.)

RR-Relative risk, CI-Confidence interval, Ref.-Reference

Table - 12: Association between UTI and age.

Age in months	UTI				RR (95%CI), p-value
	Present		Absent		
	No.	%	No.	%	
6-12	4	14.3	24	85.7	1.00 (Ref.)
13-36	9	23.1	30	76.9	0.61 (0.12-2.71), 0.55
37-59	6	33.3	12	66.7	1.54 (0.42-5.21), 0.51

RR-Relative risk, CI-Confidence interval, Ref.-Reference

Table - 13: Association between UTI and method of sampling.

Method	UTI				RR (95%CI), p-value
	Present		Absent		
	No.	%	No.	%	
Suprapubic	8	22.2	28	77.8	1.00 (Ref.)
Clean catch mid-stream	2	7.1	26	92.9	0.37 (0.09-1.58), 0.14
Catheterization	9	42.9	12	57.1	2.23 (0.72-7.18), 0.15

RR-Relative risk, CI-Confidence interval, Ref.-Reference

Table - 14: Association between UTI and Nutritional parameters.

Nutritional status	UTI				RR (95%CI), p-value
	Present		Absent		
	No.	%	No.	%	
Weight for height <-3SD	17	23.3	56	76.7	1.39 (0.36-5.39), 0.61
MAUC<11.5 cm	8	20.0	32	80.0	0.81 (0.36-1.83), 0.62
Edema positive	3	21.4	11	78.6	0.95 (0.31-2.83), 0.92
Visible severe wasting	4	14.3	24	85.7	0.54 (0.19-1.48), 0.21

RR-Relative risk, CI-Confidence interval,

Table - 15: Association between UTI and clinical symptoms of the patients.

Clinical symptoms	UTI				RR (95%CI), p-value
	Present		Absent		
	No.	%	No.	%	
Fever	16	22.2	56	77.8	0.57 (0.25-1.30), 0.21
Cough	4	17.4	19	82.6	0.63 (0.23-1.68), 0.34
Increased Frequency of micturition	0	0.0	1	100.0	NA
Pain in abdomen	2	66.7	1	33.3	2.87 (1.17-7.02), 0.04*
Vomiting	5	23.8	16	76.2	0.95 (0.39-2.28), 0.91
Loose stools	12	34.3	23	65.7	1.90 (0.90-4.02), 0.08
Urinary bladder tenderness	1	100.0	0	0.0	NA
Convulsions	5	17.9	23	82.1	0.63 (0.26-1.55), 0.30
Renal angle tenderness	1	100.0	0	0.0	NA

RR-Relative risk, CI-Confidence interval, *Significant, NA-Not applicable

Table - 16: Association between UTI and pus cell count.

Pus cell count	UTI				RR (95%CI), p-value
	Present		Absent		
	No.	%	No.	%	
≤4	11	14.3	66	85.7	0.45 (0.04-2.27), 0.09
5-10	08	100	00	00.0	1.0 (Ref.)
>10	00	0.0	0	0.0	

RR-Relative risk, CI-Confidence interval, Ref-Reference

Table - 17: Association between pus cell count and method of sampling.

Pus cells/Hpf (Urine examination)	UTI Positive (n=19)	Suprapubic	Clean catch Mid-Stream	Catheterization
≤4	11	7 (63.6%)	0	4 (36.4%)
5-10	08	1 (12.5%)	2 (25%)	5 (62.5%)
>10	0	0	0	0

In centrifuged urine, Urine culture was positive in 11 samples (14.3%) out of total 77 samples containing pus cells count ≤4/Hpf and urine culture was positive in all samples containing pus call count 5-10/Hpf (**Table – 16**).

There were 11 culture positive urine samples containing pus cells count ≤ 4/Hpf out of them 7 samples (63.6%) were collected by suprapubic method, 4 samples (36.4%) were collected by Catheterization method and 8 culture positive urine samples containing pus cells count 5-10/Hpf out of them 1sample (12.5%) were collected by suprapubic method, 5 samples (62.5%) were collected by Catheterization method, 2 samples were collected by Clean catch mid-stream sampling method (**Table – 17**).

Discussion

UTI is common in children and it is the second highest cause of morbidity in children after respiratory tract infections. There are two types of UTI, symptomatic UTI and asymptomatic UTI. In general, asymptomatic UTI is more common than symptomatic one.

In addition to the non-specific presentations, diagnosis depends on obtaining a sample of urine. There is an understandable tendency among clinicians to regard the obtaining of a urine sample from a small child as being either too difficult, when it involves catheterization or Suprapubic aspiration, or relatively easy, when performed by using a urine collection bag. There is a significant association between UTI and the degree of malnutrition [31] and it should be routinely investigated. So, regular surveillance of related pathogen and their antibiotic sensitivity test recommended [33].

There is paucity of data on exact prevalence of UTI in SAM. To determine the prevalence, to identify causative organisms, and to study the antibiotic sensitivity pattern of the organisms causing urinary tract infection in children suffering from severe acute malnutrition 85 children (aged between six months to fifty nine months were selected on the basis of anthropometric examination, who were fulfilling the criteria of SAM were selected.

Age distribution of the patients

The age group of SAM children involved was 6 months to 59 months. The overall prevalence of UTI was 22.4% (19 out of 85) among the severe acute malnourished children. This is in accordance with the study done by Ahmed shemran M. Alwtaify (2005) [34] on

malnourished children where they found prevalence of UTI 22.2%. Prevalence of UTI in our study is slightly higher than that of a similar study done on severe malnourished children by Anne-Laure Page, et al. (2013) [35], Bagga A, Tripathi P, Jatana V, et al. (2003) [28], where they reported prevalence of UTI 16%, 15.2%, respectively. This difference may be attributed to the fact that our study was conducted in rural population where it might be due to poor hygiene, poor socioeconomic status.

In our study, maximum numbers of cases were children in age group between 13-36 months (45.9%), followed by 6-12 months (32.9%) and 37-59 months (21.2%). The mean age of children was 27.04±15.59 months as compared to 23.8 months found in study of Dholakia PJ, et al. (2013) [36] in which majority of cases were age group 1-5 years. Our study was accordance with the study of Suliman OS, et al. (2011) [37]. In which majority of cases were in age group between 13 to 36 months. Our study is contradictory to study done by Rakesh kumar, et al. (2013) [38] where they found mean age 14.29 months and majority of cases (59.6%) were age group between 6 months to 12 months, also contradictory to study done by Choudhary, et al. (2015) [39] in which mean age of cases were 14.92+7.48 months and majority of the cases (96%) were below 2 years of age.

In our study UTI in SAM children was observed to be higher among the age group of 37-59 (33.3%) months followed by 13-36 months (23.1%), 6-12 months (14.3%). The UTI was 1.54 times higher in the age group 37-59 month than 6-12 month (RR=1.54, 95% CI=0.42-5.21), p=0.51). Our results were contradictory to study done by Ahmed shemran M. Alwtaify (2005) [34], Allah Bux Ghanghro and Arshad Hussain Laghari (2010) [40], Anne-Laure Page, et al. (2013) [35], in which incidence of UTI was higher in age group of below 1 years (26.9%), 2-3 years (16.9%), under 1 year of age (24%), respectively. These differences were mainly due to different sample size and different population group.

Sex distribution of the patients

In our study prevalence of UTI was more in females as compared to male children (27% of the female, 18.8% of male patients). Not many studies of urinary tract infection in severe acute malnourished children have been carried out. In our study total 85 SAM Patients were included out of them Male were 48 (56.5%) and female were 37 (43.5%), Male / Female ratio was 1.3:1. There was male predominance in our study. It was in accordance with the study done by A I Rabasa, MM Gofama (2009) [41], Grish Gopal and R. Premalatha (2014) [42], Anne-Laure Page, et al. (2013) [35] in those male children were more than female children. Present study was contrary with the study done by Dholakai PJ, et al. (2013) [36], Rakesh Kumar, et al. (2013) [38]. Allah Bux Ghanghro and Arshad Hussain Laghari (2010) [40] in those female children were more than male children.

In our study The UTI was present in 27% (10/37) of the female patients and 18.8% (9/39) of male patients. The UTI was 31% lower among males than females (RR=0.69, 95%CI=0.31-1.53, p=0.36), however, this trend was statistically not significant. UTI was predominant in females than males. It was accordance with the study done by Allah Bux Ghanghro and Arshad Hussain Laghari (2010) [40], A I Rabasa, MM Gofama (2009) [41], Grish Gopal and R. Premalatha (2014) [42], where they found UTI predominant in females than males. It was contradictory to study done by Ahmed Sherman M. Alwtaify (2005) [34], Anne-Laure Page, et al. (2013) [35] where they found UTI predominant in males than females.

Distribution According to nutritional parameters

Among the various nutritional parameters included in our study for diagnosis criteria of SAM, 73 children (85.9%) out of 85 children were having weight for height/length <-3SD followed by 40 children (47.1%) having MUAC<11.5 cm, 28 children (32.9%) visible sever wasting and 14 children (16.5%) having edema positivity. These results were somewhat

similar to study done by Rakesh Kumar, et al. (2013) [38] in which 75.8% cases had their weight for height below -3SD, 24.03% cases had severe visible wasting, 27% had bilateral pitting edema. Result were different in study done by K Singh, et al. (2014) [43] they found children 89.7% had a weight-for height/length z-score (WHZ) below -3 SD, 80.7% had a MUAC <115 mm, and 70.7% had both a weight-for-height/length z-score (WHZ) below -3SD and a MUAC <115 mm. These differences were due to different sample size. Our study is in accordance with A study done by Anne-Laure Page, et al. (2013) [35] where they found edema was presented in 15.4% children of SAM children.

Distribution of clinical symptoms of the patients

The children included in our study were presented with cluster of symptoms. Most of the children were presented with fever found in 72 patients (84.7%) followed by loose stools in 35 patients (41.2%), convulsions in 28 patients (32.9%), cough in 23 patients (27.1%) and vomiting in 21patients (24.7%) and pain abdomen in 3 patients (3.5%). The percentage of increased frequency of micturition, urinary bladder tenderness, renal angle tenderness was 1.2% only. Results were comparable to study done by Mukesh Chaudhery, et al. (2015) [39]. Mukesh Chaudhery, et al. (2015) [39] noticed fever as most common presentation. Rakesh kumar, et al. (2013) [38] found diarrhea as a most common symptom in 54% children of SAM. Grish Gopal and R. Premalatha (2014) [42] found vomiting in 69.3% cases as a most common presenting complain.

In our study pain in abdomen was significantly ($p=0.04$) associated with the prevalence of UTI. Renal angle tenderness and urinary bladder tenderness was 100% associated with the UTI. None of the other symptom was significantly associated ($p>0.05$) with the prevalence of UTI. A study done by A I Rabasa, MM Gofama (2009) [41] on 145 children of age 1-60 months found symptoms and signs referable to urinary system such as dysuria, Suprapubic pain ,urethral discharge, and renal angle tenderness were not found to be significant association with UTI.

Lab parameters

Urine was collected as per guideline and sent for routine, microscopic examination and for culture. Centrifuged urine was taken for microscopic examination. Among the urine samples 77 samples (90.6%) were with pus cells count <4/Hpf , 8 samples (9.4%) with pus cells count 5-10/Hpf and none of the sample was associated with the pus cells count >10 / Hpf. Out of the 85samples, 77samples (90.6%) containing pus cells count ≤4 / Hpf, culture was positive in 11 samples (14.3%) and out of 8 samples (9.4%) containing pus cells count 5-10 / Hpf, culture was positive in all 8 samples (100%). Out of 11 urine culture positive samples (Pus cells count containing ≤ 4/Hpf), 7 samples (63.7%) were taken by Suprapubic aspiration, 4 samples (36.3%) by Catheterization sampling method. Out of 8 urine culture positive samples (Pus cells count containing 5-10/Hpf), 1 sample (12.5%) was taken by suprapubic aspiration, 2 samples (25%) taken by Clean catch midstream and 5 samples (62.5%) were taken by Catheterization sampling method.

Organism distribution and sensitivity pattern

In our study, out of 85 SAM children 19(22.3%) urine sample were culture positive.

Out of the total 19 culture positive cases, E. coli was commonest isolated organism in 13 patients (68.4%) followed by Citrobacter in 2 cases (10.5%), Pseudomonas in 2 cases (10.5.5%) and Acinetobacter and Klebsiella 1-1 each (4.8%). This compares favorably with the literature, E.coli was found to be the commonest bacteria causing UTI in children with SAM by Uduak A, Okomo, et al. (2011) [30], Anne-Laure Page, et al. (2013) [35], study in children with PEM or without PEM done by Allah Bux Ghanghro and Arshad Hussain Laghari (2010) [40], by A I Rabasa, MM Gofama (2009) [41], Francis Fredrick, et al. (2013) [44]. In the present study second most common isolated bacteria was pseudomonas and Citrobacter.

When the Antibiotic sensitivity was studied all the isolates were sensitive to Imipenem but were universally resistant to Ceftriaxone and highly resistant to Cefixime and Co-Amoxyclav.

In our study, out of 19 urine culture positive samples, 100% isolates were sensitive to Imipenem, 94.7% sensitive to Meropenem, 84.2% to Nitrofurantoin, 79% to Amikacin, 73.7% to Gentamycin, 31.6% to Cotrimoxazole, 15.8% to Cefotaxime, 10.5% to Cefixime, 5.3% to Co-Amoxyclav, while there was no sensitivity to Ceftriaxone. A study conducted by Aiyegoro O. A, et al. (2007) [45], 301 children`s urine sample was collected (age 5 to 18 year) and UTI was in 11.96% of cases. They found sensitivity pattern, 47% of the isolates were sensitive to amoxicillin, 33.3% to Cotrimoxazole, 50% to Nitrofurantoin, 77.8% to Ofloxacin, 73.5% to Nalidixic acid, 63.9% to gentamycin, 97.1% to ofloxacin, 27.8% to Augmentin, 30.6% to Colistin 61.1% to tetracycline and 100% of *S. faecalis* were sensitive to erythromycin and chloramphenicol while 50% were sensitive Cloxacillin. This difference was due to our small sample size and different study age group.

In present study, E.coli which was the principle bacteria isolated, showed high susceptibility to Imipenem (100%), Nitrofurantoin (100%), Meropenem (92.3%), Amikacin (92.3%), Gentamicin (77%) and low sensitivity to Co-trimoxazole (23%), Cefixime (15.4%), Co-Amoxyclav (7.7%), Cefotaxime (7.7%) and no sensitivity to Ceftriaxone.

In present study E.coli is 92.3% sensitive to Amikacin, in accordance study done by Francis Fredrick, et al. (2013) [44] also found 88% sensitivity to Amikacin. In our study E.coli is 7.7 % sensitive to Co-Amoxyclav in accordance with this are study done by Francis Fredrick, et al. (2013) [44], Maimuna Ahmed, et al. (2015) [46], Aiyegoro O. A., et al. (2007) [45], A I Rabasa, MM Gofama (2009) [46], where they found sensitivity to Co-Amoxyclav, 12%, 14.3%, 31.7% respectively. In our study only 23% sensitivity was for Cotrimoxazole while the study done by Francis Fredrick, et al. (2013) [44], A I Rabasa, MM Gofama (2009) [41] found 100% resistance to Cotrimoxazole. Sensitivity to third generation cephalosporin Ceftriaxone in our study done by Maimuna Ahmed, et al. (2015) [46], Francis Fredrick, et al. (2013) [44], was 65.7%, 64% respectively while in our study we found resistant to ceftriaxone. This contradiction may be due to our study is rural based where there is extensive use of third generation Cephalosporin. In our study all E.coli were sensitive to Nitrofurantoin and a study done by Aiyegoro O. A., et al. (2007) [45] found 63% sensitivity to Nitrofurantoin.

The main limitation of our study was smaller sample size. MCU, DMSA Scan could not be done due to unavailability in institution so results cannot be generalized.

Although most of our results were in accordance with major studies and prevalence of of UTI in SAM children was 22.4%. However few results which differed from the published studies could be due to inclusion of SAM children, rural background. We selected the cases by standard anthropometry and clinical examination; standard guidelines were followed for urine sampling, transportation, culture and microscopic examination.

Hence, we conclude that more studies in severe acute malnourished children with a large sample size in rural background should be done to confirm with results of our study.

Conclusion

The various conclusions drawn from our study were:

1. Although under reported UTI is common in children with SAM as came out in our study. Prevalence of UTI is common (22.4%) in children with SAM in our study.
2. In our study, Urinary tract infection was more common in females than males in SAM children with maximum

prevalence among 37-59 months of age but there is no significant difference between sex.

3. Urinary tract infection is more common in age group 37-59 months in SAM children. But there is no significant difference between age.
4. Fever was the most common presenting symptom with UTI in SAM children.
5. Pain abdomen, urinary bladder tenderness and renal angle tenderness are significantly associated with UTI in children with SAM.
6. Pyuria (pus cells ≥5/Hpf in centrifuged urine) is significantly associated with urine culture positive cases. But in SAM children without pyuria (pus cells <5/Hpf in centrifuged urine) are also positive for urine culture.
7. Most common organism for UTI in children with SAM in our study were mainly Gram negative bacteria. Among them E.coli.is most common bacteria.
8. Most sensitive first line oral Antibiotic was Nitrofurantoin and parentral antibiotic was Amikacin for UTI in children with SAM, in our study.
9. Most sensitive second line Antibiotic is Imipenem followed by Meropenem for UTI in children with SAM.
10. Ceftriaxone showed resistant to all urine cultured organism in our study.
11. In our study E.coli is resistant to third generation cephalosporin ceftriaxone and highly resistant to Cefotaxime, Cefixime, Co-Amoxyclav and Cotrimoxazole.
12. Other gram negative bacteria are most sensitive to Meropenem, Imipenem, Gentamycin, Amikacin but highly resistant to third generation cephalosporin and Co-Amoxyclav.

In the end, we conclude that this was a hospital based study so the results on the isolation of organism and sensitivity pattern cannot be made generalized, it need a large scale study with a large sample size for authentication of the results.

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