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Urinary Tract Infection as a Predictor of Childhood Malnutrition in Southern Sindh, Pakistan

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Abstract: A cross-sectional study to examine the association of urinary tract infection (UTI) with protein-energy malnutrition and microcytic hypochromic anemia (Iron deficiency anemia) was conducted among children in southern sindh Pakistan. A total of 150 children aged up to 5 years were studied. The data were collected using structured questionnaires, anthropometric measurements and laboratory analysis of blood and Urine samples. The results showed that 31.6% of the children were infected with *Escherichia coli*, while 56.5, 41.3 and 15.1% had significant underweight, stunting and wasting, respectively. Urinary tract infection with *Escherichia coli* was statistically identified as a strong predictor of significant wasting in this study population.

Key words: Urinary tract infection, malnutrition, iron deficiency anaemia

INTRODUCTION

Escherichia coli (E. coli) have been recognized as the most common UTI pathogen worldwide. *E. coli* organisms form part of the normal microbial flora of intestinal tract of humans and animal. They can also be found in water, soil and vegetation. In tropical and temperate countries (Jakobsson *et al*., 1999; Coulthard *et al*., 1997), children are more frequently infected than adults, particularly those who are malnourished (Watson, 2003). In the developed countries, *Escherichia coli* has been implicated as a cause of UTI among children (Royal College of Physicians, 1991; Smellie *et al*., 1995) and In developing countries, however, *Escherichia coli* is endemic and *Escherichia coli infection* as a predictor of childhood malnutrition commonly seen in children aged up to 5 years (Goonasekera *et al*., 1996; Jacobsson *et al*., 1989). Most often the infections are asymptomatic. Usually, acute symptomatic individuals present with cystitis, pyelitis, and pyelonephritis (Alexander *et al*., 1990). *E. coli* is the commonest pathogen isolated from patients with cystitis. Chronic *E. coli* infection in children is usually associated with clinical manifestations of Anemia, Weight loss, decreased muscle mass and weakness, Dry scaly skin (Lewis *et al*., 1999). The association of *E. coli* with Proteinenergy Malnutrition (PEM) and recently with Iron Deficiency Anaemia (IDA) has been reported by some researchers. In addition, a positive association between *E. coli* and PEM has been described before (Farhat *et al*., 2004). *E. coli* causes malabsorption and can lead to IDA, although clinical IDA in patients with *E. coli* infection has not been reported (Farhat *et al*., 2004; Wolfish *et al*., 1993).

Children with *E. coli* had anaemia it may be to hemoturia and treatment with antibiotic did not improve the condition (Watson, 2004). The study also suggested that besides antibiotic agent, supplementary with iron should be given to prevent microcytic hypochromic anaemia. However, little is known regarding UTI and its association with malnutrition in southern sindh Pakistan. This study was carried out to examine the association between UTI, PEM, and IDA among children (South Bedfordshire Practitioners' Group, 1990; Pisacane *et al*., 2004).

MATERIALS AND METHODS

Study areas and study population: This is part of a cross-sectional study on the relationship between urinary tract infections and childhood malnutrition in southern sindh Pakistan. The child almost belongs to ruler area of southern sindh. Most of the residents of the area worked as laborers, farmers and some did odd jobs selling forest products. Houses were made of mud or bricks and cements with any cement plaster. Most of them do not had supplies water. The study population was aged upto 5 years. All children who agreed voluntarily through their parents to participate were included in this study. Of 150 children studied, only 136 children delivered urine specimens for examination, and analyses for the association between UTI and malnutrition were based on these children. The study included both males and females. Most of the children's mothers are not completely aware about the washing after pass stool by the children. Most of the children included in this study do not have proper toilet. In addition, their personal hygienic practices were poor. The data were collected using a structured questionnaire, anthropometry and laboratory analysis of blood and urine samples.

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Structured questionnaire: The data were collected over a period of 6 months, beginning in July 2009. During many visits, the parents were read an Informed Consent Form and permission was obtained from parents whose children participated in this study. Each of the children was given a code number accordingly and particulars were entered in the data sheet. The parents were interviewed directly on the personal particulars of the children, as well as socio-economic status, using a standard questionnaire. Date of birth and birth weight were obtained from birth certificates, while immunization status was obtained from each child's health record.

Anthropometry: All children underwent anthropometrics measurement as follows: children were weighed without shoes using Seca scales, which had intervals of 0.5 kg; height was measured to the nearest 0.1 cm using a calibrated scale consisting of a wooden platform with a scale and a sliding head piece. To reduce intra-individual error, weight and height were measured twice and the mean value was used for the analysis.

Blood examination: Approximately 6-7 ml venous blood was collected by disposable syringes through vein puncture technique from cubital vein. An aliquot (3 ml) was transferred in the EDTA tube immediately after collection for heamotological analysts, and remaining blood was transferred into a plain tube, taken to laboratory for biochemical analysis. The blood was collect in plain tube allowed to clot and the tubes were centrifuged at 3000 rpm for 10 min to obtain the serum. Total protein and albumin were determined colorimetrically using the microlab 300 analyzer. Anaemic children (low haemoglobin concentration) with low red blood cells indices (Hct, MCV, MCH, MCHC) were considered to have Anemic. Serum Total protein and albumin was recorded in g/l and children with serum Total protein levels less than 35 g/l and albumin level 2.2 g/l were considered to have hypoal-buminaemia.

Urine culture examination: Urine samples were collected into wide mouth screw-cap sterile 100 ml containers. Mothers of the female children were instructed to cleanse the area around the urethral opening with clean water, dry the area and collect the urine with the labia held apart. Label the container with the date, number of the child. Sample was delivered to the lab as soon as possible. Possible pathogens of UTI in Gram positive are *Enterococci*, *Staphylococcus saprophyticus*, *Haemolytic streptococci* and in Gram negative *E. coli*, *Proteus* species, *Pseudomonas*, *aeruginosa*, *Klebsiella* strain, *Salmonella typhi*, *Salmonella paratyphi*, *Neisseria gonorrhoeae*.

RESULTS

One hundred and thirty six children (61 males; 75 females) aged upto 5 years with a mean age of 3.076±2.02 years. The overall significant underweight was 62.3% with low values of Total protein and albumin. Table 1 shows that 31.6% were positive for *E. coli* infection. Overall, females had a higher prevalence of UTI than males. Prevalence of UTI was slightly higher in children in the age group 2-3 years children but it does not have significant difference, Urine culture analysis identified with *E. coli* infection as a predictor of significant underweight and significant wasting in this study population.

Table 1: Comparison of frequency and % of *E. coli* infection with all others in different age groups

Age (years)	No. of children examined	No. of children infected	No. of *E. coli* infection
Up to 1 years	22 (16.1%)	13 (9.5%)	7 (5.1%)
1-2 years	32 (23.5%)	18 (13.2%)	8 (5.9%)
2-3 years	30 (22.0%)	23 (16.9%)	11 (8.0%)
3-4 years	28 (20.5%)	19 (13.9%)	9 (6.6%)
4-5 years	24 (17.6%)	18 (13.2%)	8 (5.9%)
Total No.	n = 136	91 (66.9%)	43 (31.6%)

Table 2: Frequency and % of males and females children

Gender	No. of children examined	No. of children infected	No. of *E. coli* infection
Males	59 (43.5%)	36 (26.4%)	18 (13.2%)
Females	78 (57.5%)	55 (40.4%)	25 (18.4%)

DISCUSSION

The classical definition of significant bacteriuria (>105 organisms/ml [or >108/l]) is still applied in childhood with the proviso that any bacteriology reports should always be interpreted in the clinical context. The problems of obtaining urine specimens in children have already been alluded to (Watson, 2003; Lambert and Coulthard, 2003).

Anemia, Weight loss, decreased muscle mass and weakness, Dry scaly skin Edema (swelling, due to lack of protein), Hair that has lost its pigment, Brittle and malformed (spooned) nails, Chronic diarrhea, Slow wound healing, Bone and joint pain , Growth retardation (in children), Mental changes such as confusion and irritability, Goiter all are the symptoms of malnutrition (Dohil *et al*., 1994). General malnutrition often develops slowly, over months or years. As the body's store of nutrients is depleted, changes begin to happen at the cellular level, affecting biochemical processes and decreasing the body's ability to fight infections. Over time, a variety of symptoms may begin to emerge (Kontiokari *et al*., 2001).

The present study observed a high prevalence of UTI by the *E. coli* among the children who participated in this study. Alan (2004) reported that *Escherichia coli* are responsible for at least 80% of UTI but other organisms include *Proteus*, *Enterococcus*, *Pseudomonas* and *Klebsiella* species. *Staphylococcal aureus* and *Staphylococcal epidermidis* are urinary pathogens in small children and young women. Any organism may cause sepsis in this young age group with the kidney

Table 3: Biochemical findings of patients

Test	Mean±SD (n = 136)	Reference values
Total protein (g/dl)	3.9±0.9	5.5-8.5 g/dl
Albumin (g/dl)	1.9±0.7	3.5-5.0 g/dl
Blood glucose level (mg/dl)	62.04±23.78	80-180 mg/dl
Urea (mg/dl)	20.48±18.45	10-50 mg/dl
Creatine (mg %)	0.51±0.81	0-1.0 mg %

Table 4: Hematological finding of children

Test	Mean±SD	Reference values
Hb (g/dl)	8.6±2.8	12.0±2.0
RBCs (Cmm)	3.1±1.2	4.7±0.7
Hct (%)	26.7±11.9	41.0±4.0
MCV (fl)	67.8±24.2	84.0±7.0
MCH (dg)	20.8±6.6	29.5±20.5
MCHC (g/dl)	26.4±4.0	33.0±2.0

and urinary tract becoming involved by hematogenous spread from a generalized septicemia (Lambert and Coulthard, 2003; Gorelick and Shaw, 1999).

The prevalence of *E. coli* was slightly higher in children aged 2-3 years. This may indicate that high rate of transmission of the infection occurs in this age group; it spreads poor hygienic condition, within households, perhaps from person to person, as young children usually play in the house and have very close contact with other members of the household (Gorelick and Shaw, 1999).

With positive results of UTI we also observed the significantly low values of Total protein (3.9±0.9 g/dl) and albumin (1.9±0.7 g/dl), Hemoglobin and all the indices include Hct, MCV, MCH, MCHC then the reference normal values, which predicate the protein energy malnutrition and the presence of microcytic hypochromic anemia which is often iron deficiency anemia in the children with positive UTI.

Conclusion: Urinary tract infection with *Escherichia coli* was statistically identified as a strong predictor of childhood malnutrition in this study population.

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