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Relationship between protein energy malnutrition and urinary tract infection in children

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Abstract

Background Urinary tract infections (UTI) is a common health problem in children. Its occurrence depends on several predisposing factors and individual immunocompetence. Children with protein energy malnutrition (PEM) have impaired immune function. Thus early detection and prompt treatment of associated infections in children with PEM are very important.

Objective To determine the relationship between PEM and the occurrence of UTI in children.

Methods This cross sectional study conducted in Dr. Wahidin Sudirohusodo Hospital and Labuang Baji General Hospital, Makassar between March 1, 2007 and June 30, 2007. The target population included PEM patients aged 2 to 5 years. Well-nourished patients matched for age and sex were selected for control group.

Results Out of 220 patients, 25 had UTI consisted of 12 males and 13 females. Eighteen of them had PEM and 7 were well-nourished subjects. There was a statistical significant difference (P=0.019) in the occurrence of UTI between children with PEM and in well- nourished children. The relationship between PEM and UTI as determined by prevalence ratio value (PR) was 2.6 with 95% confidence interval (CI) of 1.1 to 5.9, suggested the risk of getting UTI was 2.6 times higher in children with PEM as compared to normal controls.

Conclusions The frequency of UTI in PEM was 16.4%. Children with PEM have the risk of getting UTI 2.6 times higher as compared to well-nourished children **[Paediatr Indones 2008;48:166-9]**.

Keywords*: protein energy malnutrition, urinary tract infection, children*

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, i. e., symptomatic UTI and asymptomatic UTI. In general, asymptomatic UTI is more common than symptomatic one. In preschool children, the incidence of UTI among male and female patients are 0.2% and 0.8%, respectively, while in school age, about 0.04% of UTI cases were male and 1.2% were female.[1] According to Salekede,[2] the incidence of UTI cases in Dr. Wahidin Sudirohosudo General Hospital was 32%. 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.[3,4] 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.[4] Children with PEM have impaired immune function including depressed hypersensitivity response,

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low T lymphocytes, disturbance of lymphocyte response, decreased phagocytosis secondary to lack of complements and low secretion of immunoglobulin A (IgA).[5,6] In this country, the prevalence of PEM is high in children below five years of age. Based on the Social Economy Survey in 2002, 26% of children under five years old were undernourished and 8% malnourished.[7]

It is well known that there is a synergistic interaction between PEM and infection; any kind of infection can worsen the nutritional status. On the other hand, PEM, even mild, may affect the immune system and compromise body defense against infections. Therefore, early detection and prompt treatment of infection in children with PEM is very important. Ibrahim[8] found that the prevalence of UTI in children with PEM was about 11.3%, and that sex and type of malnutrition were not contributing factors. While in India, Arvind Bagga *et al*[5] found that the prevalence of bacteriuria in malnourished children was 15% and the risk of bacteriuria increased significantly with the severity of malnutrition. This study aimed to determine the relationship between protein energy malnutrition and urinary tract infection in children.

Methods

This was a cross sectional design to compare the occurrence of UTI in children with PEM and in well-nourished children. The study was conducted in Wahidin Sudirohusodo and Labuang Baji General Hospitals Makassar, from March 1, 2007 until June 30, 2007. The target populations were hospitalized patients with PEM aged 2-5 years.

Children with PEM (undernourished and malnourished) aged 2-5 years were included, matched controls for age and sex were also recruited. We excluded patients with constipation, those receiving antibiotics in the previous two weeks, or had congenital anomaly of the external genitals and spine, or those with immunocompromized diseases such as HIV, leukemia, or nephrotic syndrome.

A child was considered undernourished if body weight for height < -2 SD to -3 SD (NCHS reference standard), while malnourished was defined if the body weight for height <-3 SD.9 Weight was measured with standard mechanical personal scale and height was measured in two ways; standing height was used in children taller than 85 cm, and supine length was used in those shorter than 85 cm or those who were unable to stand.

Urine specimens were collected with midstream urine collection and cultured. The standard set up for urine culture was the use of two plates; sheep blood agar (BAP) and Mac Conkey or EMB (eosin methylene blue) plate. According to Kass,10 significant bacteria was defined as 100.000 or greater CFU/ml in a mid stream urine specimens.

Results

Two hundred and twenty children aged 2 to 5 years were enrolled, consisting of 110 children with PEM (55 were undernourished and 55 malnourished) and 110 well- nourished children as controls. Out of the total sample, 25 children had UTI (18 children belonged to undernourished and malnourished children and belonged to 7 well-nourished children) (**Table 1**). It shows that UTI occurred in 16.4% of children with PEM but only 6.4% in well-nourished children. The difference was statistically sighnificant.

The relationship between PEM and UTI can also be assessed based on prevalence ratio value (PR). The PR was 2.6 with 95% confident interval (CI) of 1.1 to 5.9, revealing that children with PEM had a risk of

Table 1. Results of urine culture among PEM and well-nourished children

Nutritional Status	Urine Culture		Total
	UTI (+)	UTI (-)	
PEM	18 (16.4%)	92 (83.6%)	110 (100%)
Well-nourished	7 (6.4%)	103 (93.6%)	110 (100%)
Total	25	195	220

X = 5.461 df = 1 P=0.019

UTI occurrence of 2.6 times higher compared to that of well-nourished children.

Out of the 110 children with PEM 18 had UTI, consisted of four undernourished and 14 malnourished children. The remaining 92 children who did not have UTI, 51 were undernourished and 41 were malnourished children (**Table 2**).

The PR value was 1.7 with 95%CI of 1.2; 2.4, indicating that malnourished children had a chance of getting UTI 1.7 times higher compared to undernourished children.

From the 165 specimens collected, 21 had UTI consisted of 14 malnourished and 7 well-nourished children. The other 144 did not have UTI of which 41 were malnourished and 103 well-nourished (**Table 3**).

A significant difference (P=0,001) of UTI occurrence was found between malnourished (25.4%) and well-nourished children (6.4%). The PR value was 4.0 with 95%CI; 1.7 to 9.3, denoting that UTI occurred 4 times higher in malnourished as compared to well-nourished children.

Out of the 165 specimens, 11 had UTI, of which 4 were in the undernourished group and 7 in well-nourished group (**Table 4**).

Statistical analysis showed a significant difference (P=0.825) of UTI occurrence between undernourished children and well-nourished children. The PR value was 1.1 with 95%CI; 0.3 to 3.7 concluding that undernourished children was not at a higher risk of contracting UTI compared to well-nourished children. Several organism were isolated from urine culture of 25 cases as shown in **Table 5**. The most common organisms causing UTI in the PEM group were E. coli and Acinetobacter sp, whereas in the well-nourished group were Klebsiella sp and Alkaligenes sp.

Discussion

The prevalence of UTI in this study was 11.4% (25 out of 220 subjects), 16.4% of which was in the PEM group. Previous study by Bagga *et al*[5] showed the prevalence of UTI in malnourished children was 15%, while the study by Ibrahim[8] found a prevalence of UTI 11.3% in children with severe PEM.

Statistical analysis showed no significant difference (P=0.985) between male and female distribution on the occurrence of UTI. In another study on preschool children, the incidence of UTI in male was 0.2% whereas in female 0.8%.[1] Studies in Sweden showed the occurrence of UTI in male and

Table 2. Frequency of UTI among undernourished and malnourished subjects

Nutritional Status	Urine Culture		Total
	UTI (+)	UTI (-)	
Undernourished	4 (7.3%)	51 (92.7%)	55 (100%)
Malnourished	14 (25.5%)	41 (74.5%)	55 (100%)
Total	18	92	110

X2 = 6.64 df = 1 P=0.010

Table 3. Frequency of UTI among malnourished and well-nourished children

Nutritional Status	Urine Culture		Total
	UTI (+)	UTI (-)	
Malnourished	14 (25.5%)	41 (74.5%)	55 (100%)
Well-nourished	7 (6.4%)	103 (93.6%)	110 (100%)
Total	21	144	165

X = 12.03 df = 1 P=0.001

Table 4. Frequency of UTI among undernourished and well-nourished subjects

Nutritional Status	Urine Culture		Total
	UTI (+)	UTI (-)	
Undernourished	4 (7.3%)	51 (92.7%)	55 (100%)
Well-nourished	7 (6.4%)	103 (93.6%)	110 (100%)
Total	11	154	165

X = 0.05 df = 1 P=0.825

female subjects were similar i.e., male 2.2% and female 2.1% at the age of 2 years.[11] These differences may be due to our small number of samples.

In our study we found UTI in PEM group was significantly higher than that in well-nourished children (P=0.019). the relationship between PEM and UTI as measured by prevalence ratio (PR) value was 2.6 with 95%CI 1.1; 5.9 denoting that children with PEM had 2.6 times higher risk of having UTI compared to well-nourished children. The frequency of UTI in malnourished and undernourished children was significantly different with PR of 1.7 (95%CI 1.2; 2.4). However, the frequency of UTI between undernourished and well-nourished children was not significantly different, with PR of 1.1(95%CI 0.3; 3.7). Well-nourished condition seemed to have more significant influence as protecting factor than undernourished status.

Analysis between malnourished and well-nourished children showed a high significant difference (P=0.001) in the UTI frequency with a PR of 4.0 (95%CI 1.7; 9.3). The occurrence of UTI in malnourished children was four times higher than that in well-nourished children. Bagga *et al*[5] detected that the risk of bacteriuria increased significantly with the degree of malnutrition.

The results of urine culture showed that the major contributing organisms causing UTI in PEM were E. coli and Acinetobacter, each accounted for five cases (20%). In well-nourished children, the major contributors were Klebsiella and Alkaligenes, each accounted for two cases (8%). Previous study showed that the highest contributing organisms in UTI was E. coli (70%-80%), followed by Klebsiella (3.5%), Proteus (3.5%), Enterococcus (2.6%), Staphylococcus (2.6%) and Pseudomonas (0.5%).[3]

The author realized that this study had some limitations including small number of subjects which might not show significant difference of incidence of UTI according to gender and ignored other diseases which can influence the occurrence of UTI such as diarrhea and fever.[15]

We conclude that the frequency of UTI in PEM is much higher than that in well-nourished children. There is no difference of UTI occurrence between male and female subjects.

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